A COMBINED STATISTICAL AND HYDRODYNAMIC APPROACH FOR EXTREME TIDE PREDICTION

by

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CHAPTER I

Introduction

Hurricanes and associated storm surges have been watched and suffered by men helplessly for centuries. Many accounts of disasters caused by hurricanes may be found in the books by Tannehill (1938) and Dunn and Miller (1960) and the issues of Monthly Weather Review. Gradually enough understanding of the hurricanes have been accumulated, so that tragedies similar to ones in the past can be avoided.

With the recent growth and expansion of coastal communities and industries particularly in the hurricane zones of the south, the importance of hurricane warning and insurance against damage has gained considerable importance. This has been recognized in the "National Flood Insurance Act of 1968." For implementing the act sound actuarial data on flood frequency due to hurricanes are needed. Similar frequency data are needed by the coastal engineer who is called upon to design flood protection structures.

The present research effort has been motivated by the needs of the insurance act as well as the needs of the safe coastal structure design. After outlining the problem, the objectives of the research effort, achievements so far and proposals for future efforts have been summarized. A summary of previous research works relevant to present endeavors has been presented. This is followed by the theoretical consideration of the hydrodynamical models and the statistical methods. A statistical simulation method has been outlined and compared with the other methods (to get the same final result). The method

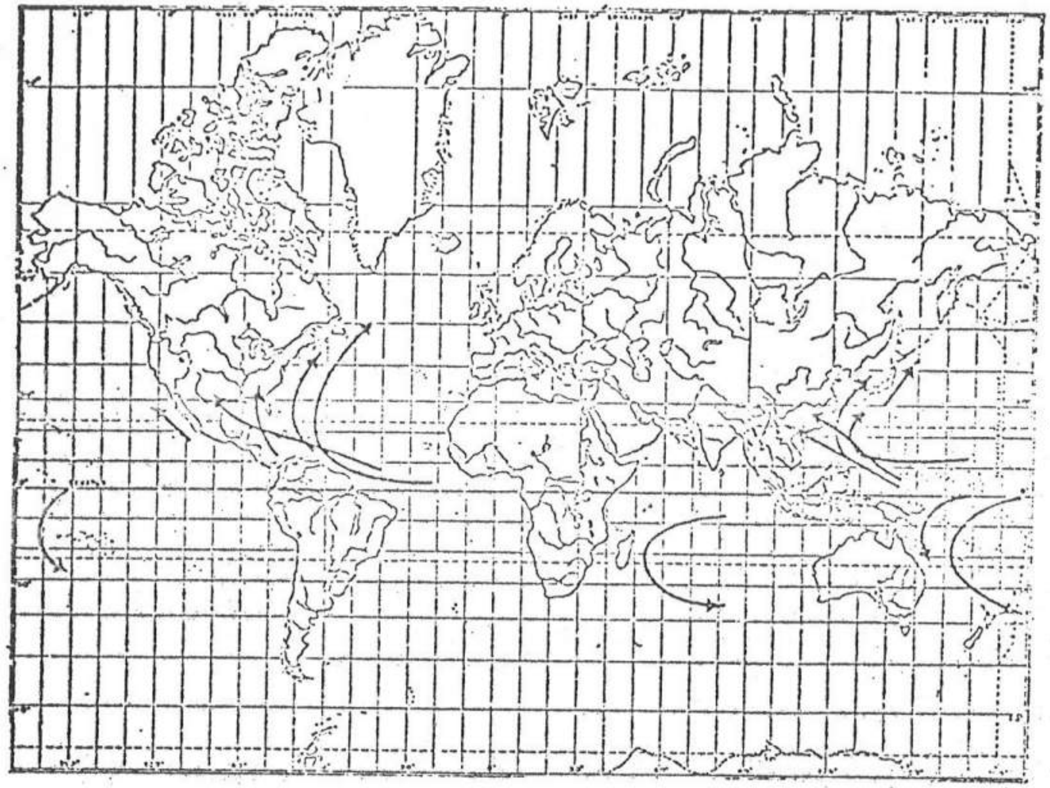

Figure 1 Areas of the earth where tropical cyclones occur

has been applied to the Delaware coast and the results presented and discussed particularly comparing with previous similar works. It has been recognized that the present hydrodynamical models need considerable modification in order to make simulation results more meaningful for bounded bays and curved coastlines. Extreme storm surges could be predicted if the distribution of the storm surge was known. There are two ways in which this can be obtained: (1) Obtain storm surge data for a period sufficiently larger than the time span to which the prediction will apply. That is for 100-year design storm surge at least 100-year data should be available. (2) The way is to find a functional relation between the storm surge and the various hydrodynamic factors causing it. Also needed is the joint probability distribution of the hydrodynamic parameters causing the storm. That is given

$$S = f(Po,\ Poo,\ R,\ V,\ \theta,\ \text{bathymetry},\ \text{tide}) \tag{1}$$

and

$$\text{Prob}(Po \le p_o, Poo \le p_{oo}, R \le r,\ V \le v,\ \theta \le \alpha,\ T \le t) = f(Po,\ Poo,\ r,\ v, \alpha) \tag{2}$$

where S = storm surge

Po = central pressure in the storm

Poo = ambient far field pressure

R = radius of maximum wind

V = translatory motion of the storm

θ = angle of storm motion relative to the coast line

T = tide level

p_o, p_{oo}, r, v, α, t are the corresponding values attained by the surge causing parameters simultaneously. Assuming all parameters have been accounted for, then theoretically it is possible to determine the distribution of storm surge for a given coastal area.

In practice both methods encounter serious difficulties. The first method is entirely empirical and requires data for a length of time which is not available. Therefore, a prediction based on method (1) has limited reliability. Furthermore, the prediction is only valid at the location where data is collected. Any spatial extrapolation is subject to serious doubts in general. Similar difficulty is encountered in method(2)when the joint probability distribution is being estimated. However, now additional information regarding the nature of the distribution of each parameter can be utilized to increase the reliability of the estimated joint probability distribution.

The functional relation (1) between storm surge and the parameters causing it is very complicated. At best only approximate numerical relations are available. Any theoretical attempt to predict the storm surge distribution is full of difficulties and complications and must await the defining of the functional relation (1). In the meantime, statistical simulation can provide some of the answers needed for engineering design.

In view of the importance of the problem, the Ocean Engineering group at the University of Delaware has undertaken a broad program of research into extreme storm tide prediction stressing on the statistical simulation technique. The research program broadly includes (1) estimating the joint probability distribution of the parameters causing the storm surge (2) simulating the parameters causing the storm surge particularly where the parameters are correlated and (3) studying and comparing the existing hydrodynamic models and developing new ones for a bay like the Delaware Bay. Some of the important results obtained so far are summarized below.

(1) By arguments based on the physical interaction among metereological variables, it has been concluded that $(Poo-Po)^{1/2}$, R, V and θ have Gaussian distribution.

(2) The marginal distributions for $(Poo-Po)^{1/2}$, R, V, and θ for hurricanes hitting the Atlantic coast north of Cape Hatteras during the past 75 years are best described by a Gaussian distribution.

(3) No significant correlation has been detected among these variables.

(4) The tide amplitude for the hurricane season has a Rayleigh distribution.

(5) A computer program has been developed to generate Gaussian random variables with zero correlation.

(6) A computer alogrithm has been developed to generate Gaussian random variables with given correlation matrix.

(7) The existing hydrodynamic models have been compared and their strength and weaknesses noted for the future guidance in the development of the model for a bay.

(8) A simulation technique has been developed including the effect of spacial and temporal variation of surge and astronomical tide.

(9) The technique has been applied to the Delaware coast facing the Atlantic Ocean and the results presented.

(10) The result thus obtained has been compared with earlier analysis of a similar nature.

CHAPTER II

Review of Pertinent Literature

Books by Tannehill (1938) and Dunn and Miller (1960) provide historical as well as physical perspective on the hurricanes and damages caused by them. Review articles by Welander (1961) and Bretschneider (1967) deal principally with hurricane surges and the methods of predicting them. Harris (1963), Cry (1962) and Ho et.al. (1975) have documented valuable information regarding past hurricanes and their effect on the coast. These excellent publications provide the background for the present review which is limited to the brief discussion of the approximate analytical and empirical models for surge generation and extreme tide prediction (1) based solely on the past tide records and (2) derived from the statistical distribution of the hurricane parameters and a hydrodynamic model for hurricane generation.

A sound hydrodynamical model, analytical or numerical, of hurricane surge generation is the key to the success of deterministic problems such as surge forecasting and warning. As has been discussed in the last section an exact hydrodynamical model (Eq. 1) is vital to the statistical prediction of extreme tides. Basic hydrodynamic equations governing the storm surge are (Bretschneider, 1967)

$$\frac{dQ_y}{dt} = \underset{(a)}{-fQ_x} - \underset{(b)}{gD\frac{\partial S}{\partial y}} + \underset{(c)}{\frac{\tau_{sy}}{\rho}} - \underset{(d)}{\frac{\tau_{by}}{\rho}} - \underset{(e)}{U_yP} + \underset{(f)}{gD\frac{\partial \eta_o}{\partial y}} \quad (3)$$

$$\frac{dQ_x}{dt} = -fQ_y - gD\frac{\partial S}{\partial x} + \frac{\tau_{sx}}{\rho} - \frac{\tau_{bx}}{\rho} - U_xP + gD\frac{\partial \eta_o}{\partial x} \quad (4)$$

$$\frac{\partial S}{\partial t} + \frac{\partial Q_x}{\partial x} + \frac{\partial Q_y}{\partial y} = P \qquad (5)$$

where S = surge height, ft

θ_x = discharge in the x axis direction, ft^3/sec per foot of width

θ_y = discharge in the y axis direction, ft^3/sec per foot of width

x = distance normal to the shoreline, ft

y = distance along the shoreline, ft

z = time, seconds

f = coriolis parameter $2\omega \sin\theta$, where $\omega = 7.28 \times 10^{-5}$ rad/sec

ϕ = latitude in degrees

g = acceleration due to gravity, 32.2 ft/sec^2

D = water depth in ft

τ_{sy}/ρ = wind stress parallel to coast, per unit volume, ft/sec^2

τ_{by}/ρ = bottom stress parallel to coast per unit volume, ft/sec^2

τ_{sx}/ρ = wind stress perpendicular to coast, per unit volume, ft/sec^2

τ_{bx}/ρ = bottom stress perpendicular to coast

ρ = density water, $ships/ft^3$

U_x = wind speed component perpendicular to coast, ft/sec

U_y = wind speed component parallel to coast, ft/sec

η_o = inverted barometer effect, ft of water

P = precipitation rate, ft/sec

The above equations do not have a closed form solution. Simplified equations have been integrated numerically to get approximate solutions for surge heights.

The earliest and the most direct treatment assumes that the sum of the onshore components of wind and bottom stresses is balanced by a slope of the mean water surface. This treatment neglects unsteady and coriolis effects and usually assumes the bottom stress to be a small fraction (.1 - .3) of the surface stresses. The lateral extent of the wind field is assumed to be large. For simple shelf bathymetries and wind fields analytical solutions are readily obtained. For complicated bathymetries and wind stress fields, a numerical integration of the simplified defining equations can be carried out.

The "bathystrophic storm tide" concept of Freeman, Baer and Jung (1957) incorporates the effect of a time varying wind field in driving the alongshore transport but assumes the time rate of change in the onshore transport to be negligible. Nonlinear bottom friction and the coriolis effect are included. The alongshore equation of motion with the corresponding wind stress component is integrated with respect to time to determine the time-varying alongshore transport. The onshore equation of motion represents a static balance between the slope of the water surface on one side and the onshore wind stress and coriolis effect due to the alongshore transport on the other side.

The method considers the bathymetry to consist of straight and parallel bottom contours and the wind field to be uniform. The bathystrophic storm tide has been utilized extensively by Bretschneider and Collins (1963), Marinos and Woodward (1968) and others for storm tide prediction. Marinos and Woodward "calibrate" the techniques by adjusting the bottom friction coefficient to obtain good agreement between historical and calculated storm tides. The friction coefficient was found to vary with the wind speed and shelf width; undoubtedly this calibration incorporates effects not represented in the formulation, including nonuniform wind fields and irregular bathymetry.

The unsteady problem of storm tides generated by a prescribed wind stress translating directly to shore over straight and parallel contours was investigated by Reid (1956) using an ingenious application of the method of characteristics. The wind stress was assumed to be of unlimited lateral extent. Results were presented as isolines of dimensionless storm tide response as a function of ratios of fetch length to shelf length and storm system speed to the speed of a long free wave. Of particular interest was the presence of a peak in the response (40% above the value for a steady state, infinite fetch wind field) which resulted from a particular combination of the two ratios noted above.

The availability of large high-speed digital computers has provided the means for more realistic representation of detailed offshore topography and storm systems. Generally, finite difference methods are employed to integrate the equations of motion and continuity. The earliest contributions were by Platzman (1958) and Miyazaki (1963). Later notable papers include those by Jelesnianski(1966, 1967, 1974), Reid and Bodine (1968), and Hendrickson and Djou (1974).

Dean and Pearce (1972) solved the linearized problem of a steady state laterally-limited wind stress system for bathymetries of uniform depth and uniform slope. The effects of coriolis force and lateral water stresses were not included in the treatment. The results indicate that if the shelf width is large relative to the breadth of the wind field, the storm tide at the coast is reduced considerably compared to the value resulting from the infinite breadth wind field case.

Jelesnianski's model has been adopted by NOAA for flood forecasting. Shore Protection Manual (1974) nomograms for computing storm surge were based on this model. The model has been recently modified to include storms moving in an arbitrary manner. Since this model has been used and tested extensively, it will be used in the present investigation until a better model is worked out.

While deterministic models are being worked out, the engineer's need for a design storm surge has been filled by two distinct ways. The first method studies the yearly or monthly highest tide recorded for the longest period available and fit the data so gathered to some extreme value distribution. There are two serious objections to this method. First, data for a sufficiently long period of time is not available. Second, the data for any station is biased to an unknown extent. The tide prediction for the stations which have experienced hurricanes in the recent past is biased towards the high side while predictions for the stations only a couple of hundred miles away which did not experience any hurricane tend to be biased towards the low side. Yang, et.al. (1970) have carried out an extreme tide analysis for the Delaware coast. The results of the present study have been compared with that of Yang, et.al., and differences discussed.

Another way by which extreme tides have been obtained for design purposes is by use of what is called the Probable Maximum Hurricane and Standard Project Hurricane. By studying the past hurricanes and the damages done by them, a PMH and SPH has been specified for each region. SPH has a 100-year return period and PMH has a 1,000-year return period. As we know now apart from hurricane parameters there are other factors such as astronomical tides, topography which can seriously affect the high tide values.

Regression analysis methods have been applied to the problem of finding a suitable model for surge generation from the simple parameters of a storm. Conner, et.al. (1957) designed a simple empirical model to forecast storm surges. They plotted observed maximum tides against lowest observed central pressure (p_o) and then found a line of the best fit. A correlation coefficient of .68 has been reported for the observations from 30 stations along the Gulf Coast.

Hoover (1957), arguing that the recording stations rarely experience the true maximum surge, increased some of the observed maximum surge data partly based on the plot of observed high tide distribution along the coast and partly based on the subjective judgment knowing the relative position of the storm with respect to the recording station. He reported a correlation coefficient of 0.81.

Harris (1959) expanded his model to storms making landfall on the east and the Gulf coasts. He removed the seasonal sea level anomaly, wherever possible, from the observed high tides. He also included the other parameters, the peripheral storm pressure (Poo), the size of the storm (R), the vector storm motion (u,θ) and the distance of the 50 fathom line from shore. He has reported correlation coefficient of .75 from data from 52 stations.

Regression models have been rather unsuccessful. But they do throw some light on the nature of the processes involved. The pressure deficit at the center of the storm proves to be the best predictor of the storm surge. This is not surprising because this parameter causes inverse barometric effect and is proportional to the square of the maximum wind velocity in the storm which happens to be the most important surge causing parameter. The radius of a storm seems to have very little effect on the storm surge. The vector storm motion and the angle of approach have limited effect while the bathymetry is an important factor.

Pore, et.al. (1974) found a regression relation between winter storm surge in tenth of feet and pressure in millibar at several points offshore and inshore. The relation is based on past records. The importance of accuracy in the input sea level pressure has been emphasized. For a breakwater harbor the predicting equation is

$$SS(BWH) = 55.93 - .01113\ P(48)_t + .09477\ P(24)_{t\ -6} - .01890\ P(41)_{t\ -6}$$

$$- .07897\ P(47)_{t\ -6} - .04897\ P(42)_{t\ -12}$$

Where SS(BWH) is the storm surge in tenths of feet, at forecast location (BWH) at time t. P is the sea-level pressure in millibars at the indicated grid point (Figure 2). The subscript of pressure is the time in hours.

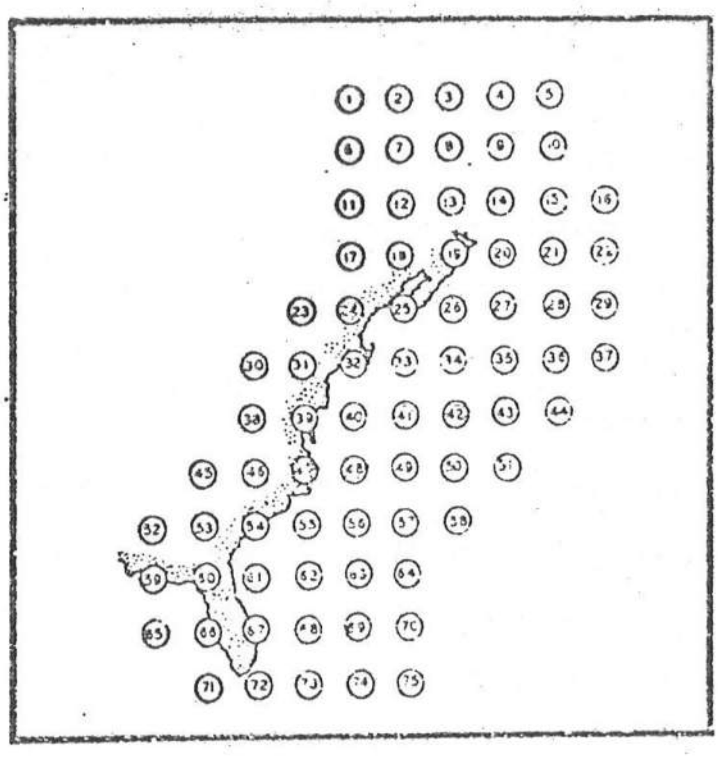

Figure 2 Computation points where predictors of storm surge were considered in the derivation of the forecast equations, by Pore, et.al.

Myers (1970, 1975) used a semi-empirical method in the storm surge analysis for the Atlantic City and South Carolina coast. His method consists of the following steps.

(1) From the past hurricane records pertinent to one area, empirical probability distribution for characteristic parameters of hurricanes such as intensity, radius of maximum wind, forward speed and direction of motion are obtained.

(2) Distribution of each parameter is assumed to be independent of the other parameters.

(3) The distribution is divided into several suitable groups and a fixed value and probability assigned to them.

(4) Storm surges are computed for all possible combinations of the parameters using SPLASH program of Jelesnianski (1974).

(5) The above is carried out separately for landfilling hurricanes and alongshore hurricanes.

(6) The surge heights thus obtained are combined with the astronomical tide with random phase and the maxima of the addition recorded.

(7) Extreme winter tide distribution is obtained from the past records.

(8) Extreme surge distribution due to the landfalling and the alongshore hurricanes is combined with the winter tide distribution to find the extreme tide distribution.

CHAPTER III

Theoretical Considerations

The physical phenomena involved has been briefly described. Based on heuristic arguments the theoretical distributions of the parameters characterizing hurricanes have been derived. The relevant theories of multivariate estimation and simulation have been briefly presented.

The hurricane wind field at the sea surface is best represented by a vortex motion. Studies have shown that the wind velocity on the surface is spiral and bent inwards (Figure 4). Similar studies for currents generated in the ocean water has not been carried out. For slow-moving hurricanes, surface currents are expected to be similar to the one for surface winds. There is considerable radial component in both air and water current. This may be one of the mechanisms by which hurricanes draw their fury from the surrounding hot sea surface and air. A consequence of this is a descending current in the eye of the hurricane. In deep water there is no resistance to flow other than viscosity and the equilibrium water level profile turns out to be inverse barometric effect. But as the hurricane moves into the shallow waters, the boundary resistance affects the equilibrium by reducing the flow away from below the eye of the hurricane. Thus, water accumulates in this region and is observed as high surge. In deep water the horizontal currents are spiral inwards. In shallow water onshore current is converging flow, but the offshore current is divergent flow. Also, the connecting alongshore current is in shallow water. Thus the flow circuit has more resistance in the outflow section. Hence there is a transient pile up of water near the shore (Figure 5).

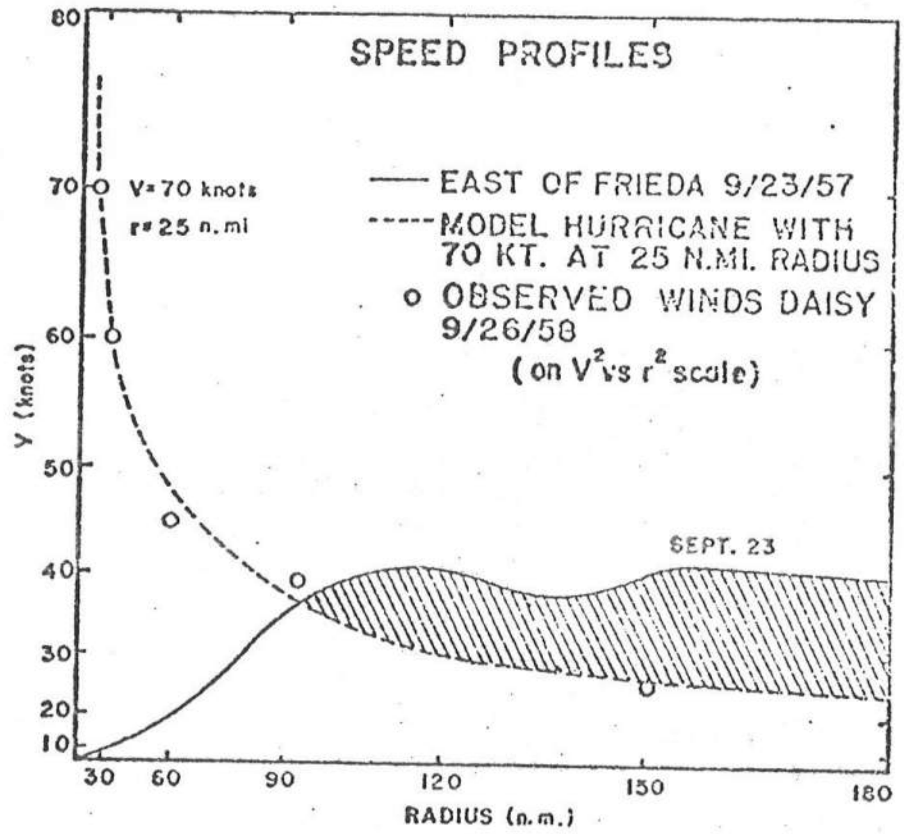

Figure 3 Velocity profiles characteristics of hurricanes and tropical storms.

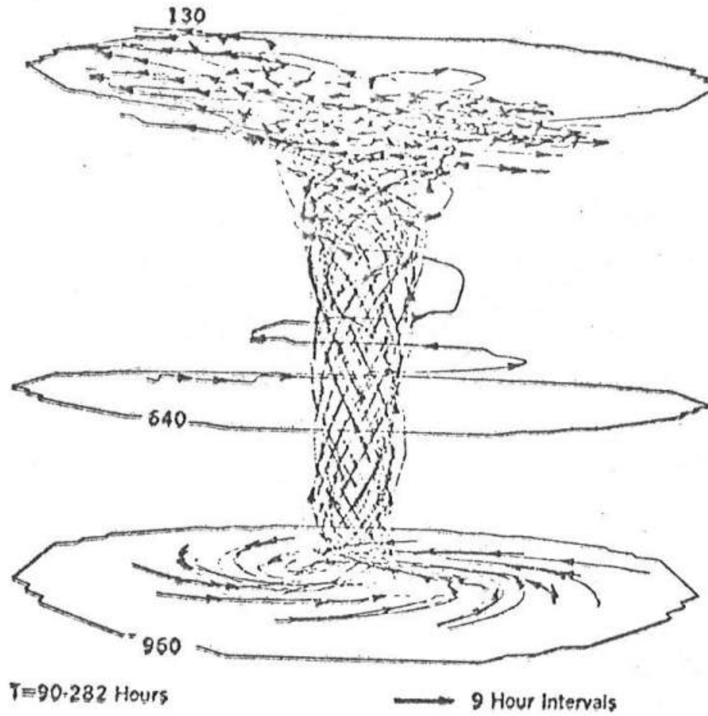

Figure 4 Particle trajectories inside a hurricane over a 9-day period

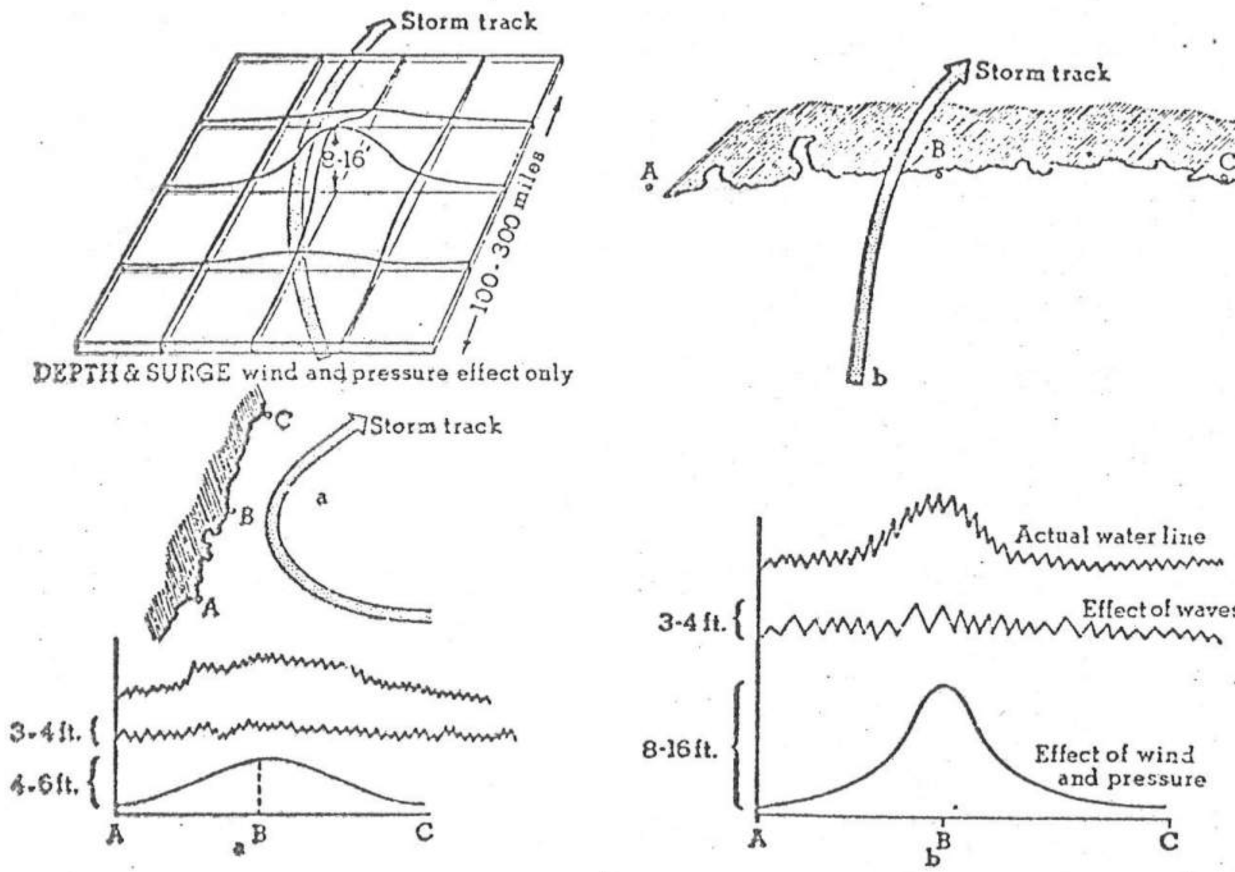

Figure 5 Schematic model for interpreting high-water mark observations in hurricanes.

CHAPTER IV

The Statistical Distribution of Hurricane Parameters

Hurricanes are commonly characterized by ΔP, the intensity (Poo-Po), R, radius of maximum wind, and V, the lateral motion of the storm as a whole. The observed values of each parameter at any instant is a result of complex interaction between the large number of meterological and physical conditions. These interactions either are the sum of individual effects or may be expanded as the sum of these effects. Under these assumptions, by central limit theorem, the distribution of hurricane parameters or a simple transform thereof, should be well described by the Gaussian law. Consider, for example, the maximum wind velocity U in the storm. It may be considered as the manifestation of turbulent velocity on a large scale. Turbulent velocity is very well described by a Gaussian distribution. The relation between U and ΔP is approximately

$$\Delta P = K\,U^2 \quad \text{where K is a constant} \qquad (8)$$

Thus $\sqrt{\Delta P}$ should be distributed close to normal distribution. Similarly the radius of maximum wind is assumed to have Gaussian distribution. The lateral motion of the storm is again representative of large scale turbulent motion and should be well described by Gaussian distribution. The direction of storm motion is dependent on the location of cold or warm fronts which, in turn, are dependent on the location of high and low pressure cells. These, in turn, are caused by random interaction between upper atmosphere and surface circulation. Again, appealing to the central limit theorem it can be concluded that the direction of motion θ has a Gaussian distribution. In order to encompass all possible cases the joint distribution of $\sqrt{\Delta P}$, V, R and θ will be assumed to have multivariate normal distribution given by the joint density

$$\phi(x) = \frac{1}{(2\pi)^2\,|\Sigma|^{1/2}} \quad \text{enp}\ [-1/2(X-\mu)'\ \Sigma^{-1}(X-\mu)] \qquad (9)$$

where $X' = [\sqrt{\Delta P}, V, R, \theta]$ is random variable vector

$\mu' = [\mu_{\Delta P}, \mu_r, \mu_R, \mu_P]$ in a vector of mean values.

$$\sum = \begin{Bmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} & \sigma_{14} \\ \sigma_{12} & \sigma_{22} & \sigma_{23} & \sigma_{24} \\ \sigma_{31} & \sigma_{32} & \sigma_{33} & \sigma_{34} \\ \sigma_{41} & \sigma_{42} & \sigma_{43} & \sigma_{44} \end{Bmatrix}$$

is the covaraniance matrix $E[(X - \mu)(X-\mu)']$

Maximum Likelihood Estimator of ρ, μ and $\sum$

Let

$$X = \begin{bmatrix} X_{11} & \cdot & \cdot & X_{1P} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ X_{N1} & \cdot & \cdot & X_{NP} \end{bmatrix} = \begin{bmatrix} X_1 \\ \cdot \\ \cdot_1 \\ X_N \end{bmatrix} \quad (10)$$

be the realization of P random variables distributed according to the multinormal law with mean vector μ and non-singular covariance matrix $\sum$. The likelihood of the observations are

$$L(\mu,\sum) = \frac{1}{(2\pi)^{Np/2} \, |\sum|^{N/2}} \exp\left[-1/2 \sum_{i=1}^{N} (x_i-\mu)' \sum^{-1}(x_i-\mu)\right] \quad (11)$$

As in the univariate case, the elements of μ and $\sum$ which maximize the above likelihood function are the maximum likelihood estimators. It is more convenient to maximize the logarithm of the above function.

$$\mathrm{Ln}\,(\mu,\sum) = -1/2\ Np\ \mathrm{Ln}\ (2\pi) - 1/2\ N\ \mathrm{Ln}|\sum| - 1/2 \sum_{i=1}^{N} (x_i-\mu)' \sum^{-1}(x_i-\mu)] \quad (12)$$

For the likelihood to be at its maximum value it is necessary that

$$\frac{\partial \mathrm{LnL}(\mu,\sum)}{\partial \mu} = 0 \quad \text{and} \quad \frac{\partial \mathrm{LnL}(\mu,\sum)}{\partial \sum} = 0 \quad (13)$$

where the null matrices have dimensions p x 1 and p x p respectively. The column vector of derivatives with respect to μ is

$$\sum^{-1} \sum_{i=1}^{N} (x_i - \mu)$$

and this is equal to the null vector if we take as the estimate of μ

$$\hat{\mu} = \frac{1}{N} \sum_{i=1}^{N} x_i = \overline{X} \tag{14}$$

or the vector of the sample means of the observations. Similarly by maximizing $Ln(\mu, \sum)$ with respect to $\sum$ and omitting the lengthy derivation we get the estimate for $\sum$

$$\hat{\sum} = \frac{1}{N} \sum_{i=1}^{N} (x_i - \overline{x})(x_i - \overline{x})' \tag{15}$$

It can be shown that $\hat{\sum}$ is a biased estimate of $\sum$. The unbiased estimator is obtained by

$$\hat{\sum} = \frac{1}{N-1} \sum_{i=1}^{N} (x_i - \overline{x})(x_i - \overline{x})' \tag{16}$$

Confidence Interval for Correlations

In the case of a random sample of N observation pairs from the bivariate normal population with $\tau = 0$, the distribution of sample correlation r has this density function:

$$p(r) = \begin{cases} \frac{1}{\sqrt{\pi}} \frac{\Gamma[(N-1)/2]}{\Gamma[(N-2)/2]} (1-r^2)^{1/2(N-4)} & -1 \leq r \leq 1 \\ 0 & \text{elsewhere} \end{cases} \tag{17}$$

The transformed variate

$$t = r\sqrt{\frac{N-2}{1-r^2}} \tag{18}$$

has student's distribution with N-2 degrees of freedom. Given the sample correlation r we accept the hypothesis $\rho = 0$ at significance level α if

$$|r|\sqrt{\frac{N-2}{1-r^2}} \leq t_{\alpha/2\,;N-2}$$

where $t_{\alpha/2\,;\,N-2}$ is the upper 50α % point of the t distribution with N-2 degrees of freedom.

For $\rho \neq 0$, the monotonic transformation

$$Z = 1/2 \ln \frac{1+r}{1-r} = \tanh^{-1} r \tag{19}$$

is a variate with an asymptotic normal distribution with mean

$$\xi \simeq 1/2 \ln \frac{1+\rho}{1-\rho} \tag{20}$$

and variance

$$\mathrm{Var}(z) \simeq \frac{1}{N-3} \tag{21}$$

confidence interval for ρ at significance level α is

$$\tanh\left(z - \frac{z_{\alpha/2}}{\sqrt{N-3}}\right) \leq \rho \leq \tanh\left(z + \frac{z_{\alpha/2}}{\sqrt{N-3}}\right)$$

$z_{\alpha/2}$ is the upper 50α % point of the standard normal distribution function.

We would like to determine whether or not the variables are independent of each other and whether the off-diagonal elements of the covariance matrix are zero or at least if one element is non-zero. It has been derived that the variate

$$K^2 = -\left(N-1 - \frac{2p+5}{6}\right) \ln|R| \tag{22}$$

has X^2 distribution with 1/2 p(p-1) degrees of freedom. In the above

N = sample size

p = number of variables

R = sample correlation matrix.

We accept the hypothesis that all variables are independent of each other if

$$K^2 < X^{2\alpha}\ ;\ 1/2\ p(p-1)$$

where $\chi^2_{\alpha;\ 1/2\ p(p-1)}$ is the upper 100α percentage point of the χ^2 distribution with 1/2 p (p-1) degrees of freedom. For small correlations K^2 can be approximated to

$$K^2 = (N-1 - \frac{2p+5}{6}) \sum_{i} \sum_{< j} r_{ij}^{\ 2} \tag{23}$$

The summation extends over the 1/2 p(p-1) correlations in the upper portion of the matrix.

Principal Axes of the Multinormal Density

The component

$$(x-\mu)' \sum^{-1} (x-\mu)$$

of the multinormal density specifies the equation of an ellipsoid in p-dimensional variate space when it is set equal to some positive constant C. The family of ellipsoids generated by varying c has the common center point μ. The first principal axis of each ellipsoid is that line passing through μ to the surface of an ellipsoid by its coordinates x on the surface, the first principal axis will have coordinates that maximize its squared half length $(x-\mu)'(x-\mu)$ subject to the constraint $(x-\mu)' \sum^{-1} (x-\mu) = C$ (24)

that x be on the surface. For the length to be at its maximum value it is necessary that its derivatives with respect to the elements of x each equal zero. If we introduce the constraint with the aid of the Langrangian multiplier λ, the maximand is

$$f(x) = (x-\mu)' (x-\mu) - \lambda[(x-\mu)' \sum^{-1}(x-\mu) - C] \tag{25}$$

and its vector of first partial derivatives is

$$\frac{\partial f(x)}{\partial x} = 2(x-\mu) - 2\lambda \sum^{-1} (x-\mu) \tag{26}$$

The coordinates of the longest axis must satisfy the equation

$$[I - \lambda \textstyle\sum^{-1}]\ (x-\mu) = 0 \tag{27}$$

or since $\sum$ is non-singular, the equivalent condition

$$[\textstyle\sum - \lambda I](x-\mu) = 0 \tag{28}$$

The coordinates specifying the principal axis are proportional to the elements of a characteristic vector of $\sum$.

Premultiplying Equation(27) by $4(x-\mu)'$ we get

$$4(x-\mu)'\ (x-\mu) = 4\ \lambda(x-\mu)' \textstyle\sum^{-1}\ (x-\mu) = 4\lambda C \tag{29}$$

For a fixed value of C the length of the principal axis is maximized by taking λ as the greatest characteristic root of $\sum$. Therefore, the position of the first principal axis of the concentration ellipsoid is specified by direction cosines which are the elements of the normalized characteristic vector α_1 associated with the greatest characteristic root λ_1, of $\sum$. The other principal axes are similarly found to have orientations given by the elements of the vectors of the characteristic roots

$$\lambda_1 > \lambda_2 > \dots > \lambda_p > 0$$

The new variate vector $Y' = [Y_1, \dots Y_p]$ whose elements have values on the principal axes of the concentration ellipsoids is related to the original variates by the transformation

$$Y = A'\ (x-\mu) \tag{30}$$

where the ith column of A is the normalized characteristic vector α_i. The orthogonality of A implies that the transformation consists of a rigid rotation of the original axes into the principal axes of the ellipsoids, followed by a shift of the origin of the new axes to the center μ of the ellipsoid. The covariance matrix of the elements of Y is

$$A' \sum A$$

The variance of the ith principal-axis variate is

$$\text{Var}\ (Yi) = \alpha_i' \sum \alpha_i = \lambda_i \tag{31}$$

If the characteristic roots are distinct, or if the vectors associated with multiple roots have been constructed to be orthogonal,

$$\text{Cov}\ (Y_i, Y_j) = \alpha_i' \sum \alpha_j = 0 \qquad i \neq j \tag{32}$$

The principal axis transformation has resulted in uncorrelated variates whose variances are proportional to the axis lengths of any specific concentration ellipsoid.

Simulation of Correlated Random Variables

The problem of generating random samples with specified covariance matrix can be broken into two subproblems. The first is the well-known problem of generating independent random numbers. At best on a large scale computer pseudo-random numbers can be generated. Thus on a machine if large samples of several variables are generated it is more than likely that the variables will be correlated amongst themselves. By the orthogonal transformation of the previous section, the values of the uncorrelated samples can be computed. Once the uncorrelated samples have been obtained, by inverse transform correlated sample can easily be computed. The p uncorrelated variates are transformed so that their variances are equal to the characteristic values of the specified covariance matrix $\sum$. Multiplying both sides of equation (3) by $(A')^{-1}$ we get

$$x-\mu = (A')^{-1}Y \tag{33}$$

$$\text{or } x = (A')^{-1} Y + \mu \tag{34}$$

has the desired mean values μ and the covariance matrix $\sum$. Here A is the matrix formed by characteristic vectors associated with $\sum$.

Statistical Simulation Model

The proposed simulation model consists of four stages: (1) estimating the statistical distribution of hurricane and tide parameters, (2) generating random samples with those characteristics, (3) computing the surge heights in each case with a suitable hydrodynamic model and (4) constructing extreme value distribution based on yearly maxima.

It is hazardous to estimate the statistical distribution of hurricane parameters from the observations on a few hurricanes hitting any one point. Moreover, the point in question may experience considerable surge heights due to hurricanes hitting the coast hundreds of miles away. For these two principal reasons a sort of regional simulation has been adopted. A stretch of coast including the point of interest is selected keeping in mind that (1) the stretch should have been crossed by enough hurricanes (10-12) for estimating the statistical distribution, (2) the stretch has fairly straight reaches and fairly similar bathymetry, and (3) the hurricanes visiting the stretch can be reasonably considered samples from a homogeneous population. Within the region the probability of any point being hit by hurricanes is based on historical records. The following are the essential steps in simulating the hurricane surge caused by the landfalling hurricanes.

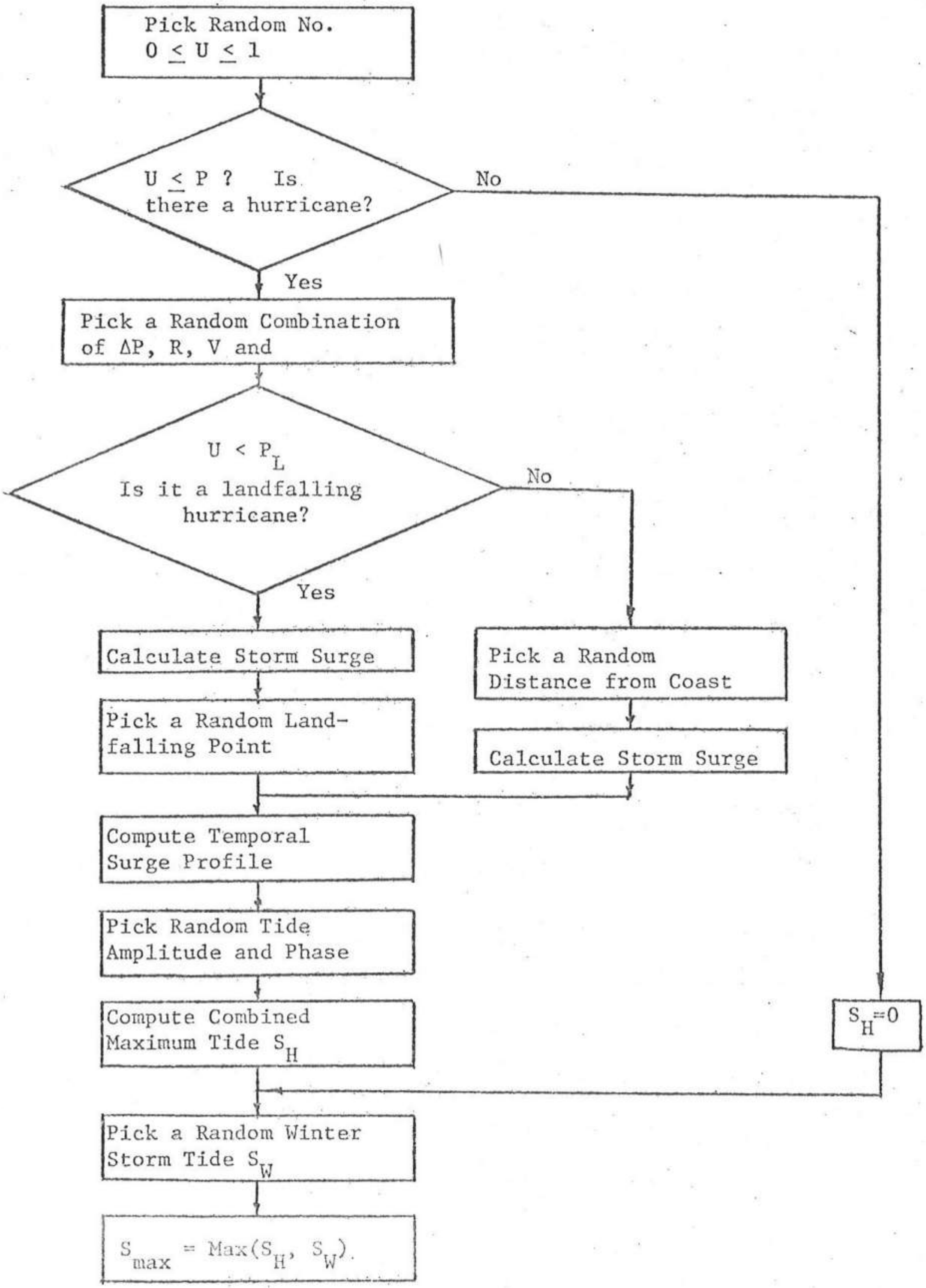

Figure 6 Flow Diagram for Simulation of Maximum Combined Tide in One Year

(1) The joint distribution of ΔP, R, V and θ is estimated from the past observations.

(2) Similarly, the shape of tide and the probability distribution of tidal amplitude is obtained from historical records.

(3) Landfalling point is sampled from the uniform distribution.

(4) The values of ΔP, R, V and θ are sampled according to their observed distributions.

(5) These values of characteristic parameters are fed to a suitable hydrodynamical model which computes the temporal profile of surge at the point of investigation.

(6) Random astronomical tides are generated according to the observed distributions.

(7) Phase lag between peaks of the tide and the hurricane surge is drawn from a population of uniformly distributed numbers.

(8) Temporal profile surge are added to the tide and the maximum water level computed.

(9) Depending on how frequently hurricanes visit a locality, a time span is selected and the water level computed in the last step assigned to this unit time as maximum due to hurricane.

For hurricanes moving parallel to the coast the Step 3 is replaced by

(3a) The distance of hurricane from the coast is sampled from the distribution of such distances based on the past occurrences.

For some areas surge caused by winter storms instead of tropical storms may be significant. It is very difficult to parametrize these storms and a hydrodynamical model of suitable accuracy has not been worked out. Hence winter storm surges will presently be simulated by the statistical distribution of past records.

The overall simulation and combination of the occurrences due to hurricanes and winter storms will be as follows considering a suitable unit period of time (not necessarily a year).

(1) Generate a uniformly distributed random number, U, between 0 and 1.

(2) If $U < P$ (the probability of occurrence of a hurricane in the area during one unit period), a hurricane occurs otherwise it does not.

(3) If hurricane occurs, then another random number is drawn to decide whether the hurricane is landfalling or moving parallel to the coast.

(4) The surge height S_H is computed and retained. If a hurricane does not occur then S_H is set equal to zero.

(5) Denote the computed winter storm surge as S_W.

(6) The larger of the two values S_H and S_W is retained as the extreme event of the year (or some other suitable period).

The simulation must be carried over very large practical periods so that events represented by rare combinations of variables causing exceptionally high surges may have a reasonable chance of occurring.

Comparison with Myers' Method (NOAA)

The storm surge analysis method of Vance Myers (1970) has been adopted by NOAA for the purpose of predicting flood risks of coastal communities for insurance purposes. In the course of the present investigation the following difficulties were encountered in our attempt to use Myers' method.

(1) Myers' grouping of the parameter frequencies causes some errors. Additional errors are introduced by the inadvertent assumption that the maximum values of the parameters have definitely been observed within the limited time for which data is available.

(2) The question of correlations amongst the parameters has been raised by Myers, but the way his method is set up, it is not possible to take into account any correlation amongst variables.

(3) The observed marginal frequencies are biased by any correlation amongst the variables.

In the proposed simulation method all of the above limitations have been overcome by simulating the variables according to the observed covariance structure of the historical data.

Myers' method is similar to simulation method in the following respects.

(1) Both have adopted a regional analysis in the sense that the statistical distributions of the parameters defining a hurricane are obtained from the hurricanes hitting a zone of coast including the point under consideration.

(2) Surge frequencies are computed from the hurricane parameters using a suitable hydrodynamic model.

(3) Both methods use Jelesnianski's hydrodynamic model for surge computations.

(4) Winter storm surge distribution is obtained from the historical records.

Thus both methods share the limitations due to:

(1) The limited length of historical data for deriving frequency distributions of parameters.

(2) Errors in observing and reporting the values of the parameters.

(3) Assumptions such as straight coastline and vertical wall at the coast in the hydrodynamic model.

The proposed method is, however, more general in the sense that:

(1) It can take into account the correlation amongst variables.

(2) It uses the underlying joint distribution of the parameters for further

computations.

(3) It does not put bounds on the values of the parameters based on the limited observations.

Underlying Distribution of the Significant Parameter

In order to implement the proposed simulation method (described in the next chapter) for computing the flood frequencies for the Delaware coast, the underlying distributions of the significant parameters of hurricane and tides have been extracted from the historical data pertinent to the Delaware coast. (The simulation results thus obtained have been compared with the similar results obtained by other methods).

Central Pressure Deficit P

Historical hurricane data has been collected for the Atlantic Ocean East Coast Hurricane Zone 3 and 4 (Bretschneider, 1972). Tables 1 and 2 have been reproduced from Bretschneider (1972). The central pressure index, defined as the difference between the central pressure of the hurricane and the ambient atmospheric pressure, in inches of mercury, and its square root and their relative frequency for a sample of 19 hurricanes during 1913 and 1967 have been presented in Table 3. The probability distribution of square root of intensity of hurricane in inches of mercury has been plotted on normal probability paper (Figure 7). It can be seen that the normal law describes the distribution excellently. The deviation from the normal law at the lower end has been caused by the fact that the reported data does not include storms which have less than hurricane force wind.

Radius of Maximum Wind

The frequency distribution and observations for the radius of maximum wind is listed in Table 4.

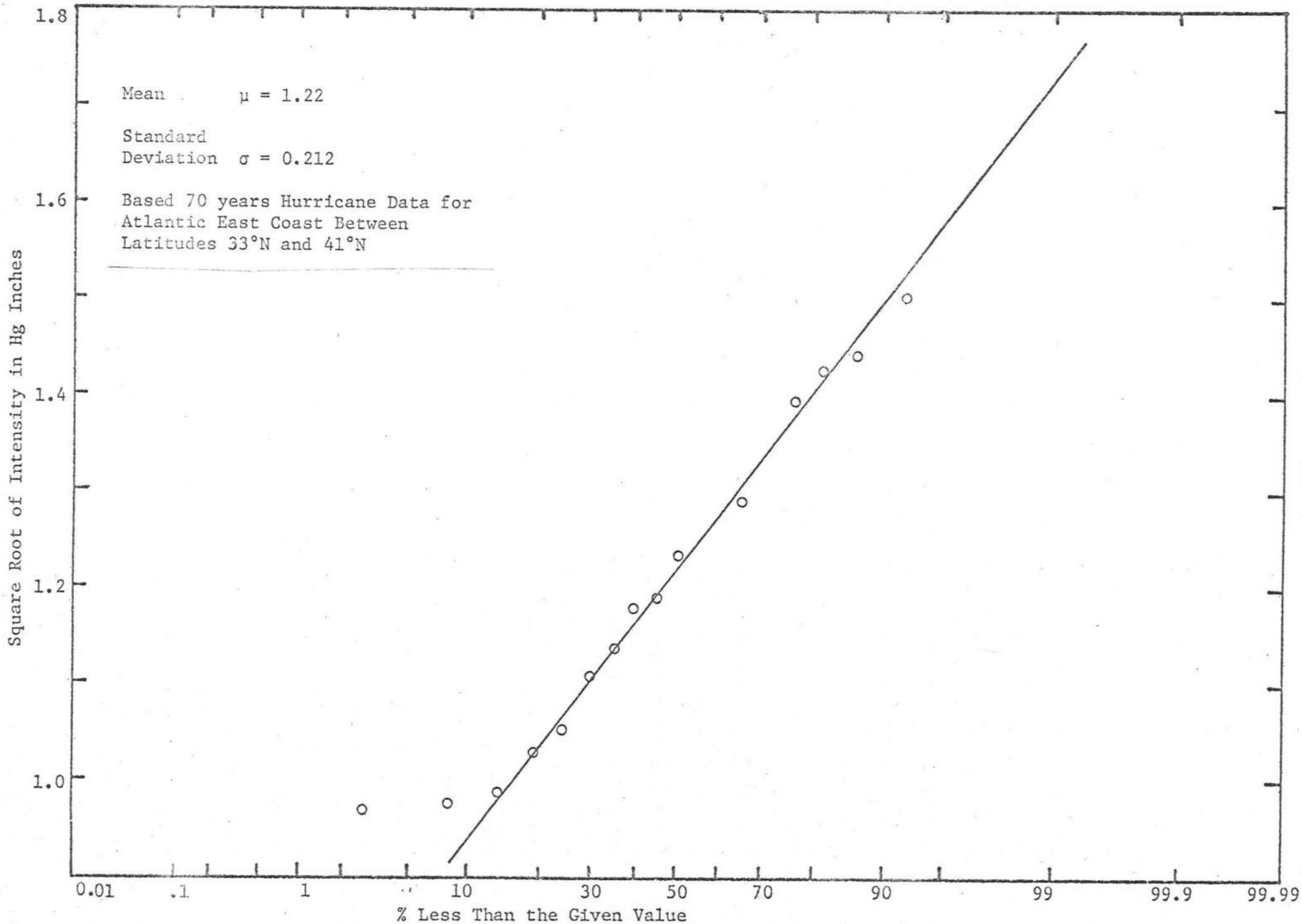

Figure 7 Probability Distribution of Square Root of Intensity in Hg Inches

TABLE 1
U.S. East Coast Zone III Hurricanes

No.	Date	Latitude	R Radius of Maximum Wind in Nautical Miles	P Central Pressure Index in Inches Hg	V Speed of Hurricane Center in Knots
1	9-27-58	34.0	25	2.26	18
2	10-15-54	33.0	36	2.26	26
3	9-21-38	33.7	50	2.06	17
4	9-14-44	35.2	39	2.04	23
5	9-16-33	35.2	42	1.67	9
6	9-11-60	37.4	36	1.57	30
7	8-12-55	34.5	45	1.52	7
8	9-19-55	35.0	50	1.41	9
9	9-18-36	35.2	34	1.39	16
10	8-23-33	36.9	36	1.29	18
11	8-25-24	35.2	34	1.22	22
12	9-9-13	35.8	41	1.11	16
13	8-24-49	33.5	24	1.06	22
14	12-2-25	34.2	54	.97	14
15	9-17-06	34.0	61	.94	16
16	9-10-54	34.8	17	1.95	-
17	8-28-58	34.0	39	1.66	17
18	8-30-54	33.4	39	1.57	17
19	9-16-67	36.6	39	.95	9

TABLE 2
U.S. East Coast Zone IV Hurricanes

No.	Date	Latitude	R Radius of Maximum Wind in Nautical Miles	P Central Pressure Index in Inches Hg	V Speed of Hurricane Center in Knots
1	9-21-38	41.8	50	2.06	47
2	9-14-44	41.4	48	1.61	30
3	8-31-54	41.8	22	1.54	33
4	9-19-36	38.0	34	1.39	33
5	8-26-24	41.3	66	1.22	29
6	9-11-54	34.8	17	1.95	-
7	9-16-33	34.0	39	1.66	17
8	9-11-60	33.4	39	1.57	17
9	8-29-58	36.6	39	.95	9

TABLE 3

Probability Distribution of Hurricane Intensity
for Zone III

Rank	Central Pressure Deficiency in Inches of Mercury	$(\Delta P)^{1/2}$	Cumulative Probability in %
1	.94	.9693	2.6
2	.95	.9749	7.8
3	.97	.9849	13.1
4	1.06	1.029	18.4
5	1.11	1.05	23.6
6	1.22	1.1045	28.9
7	1.29	1.136	34.2
8	1.39	1.179	39.4
9	1.41	1.187	44.7
10	1.52	1.233	50.0
11, 12	1.57	1.2503	60.5
13	1.66	1.288	65.7
14	1.67	1.292	71.0
15	1.95	1.396	76.3
16	2.04	1.4283	81.5
17	2.06	1.4353	86.8
18, 19	2.26	1.503	97.3

TABLE 4
Probability Distribution of Radius of Maximum Wind of Hurricanes in Zone III

Rank	Radius of Maximum Wind (Nautical Miles)	Cumulative Probability in %
1	17	6.67
3	25	20.0
5	34	33.3
8	36	53.3
9	41	60.0
11	45	73.3
13	50	86.6
14	54	93.2
15	61	100.0

The cumulative probability distribution of the radius of maximum wind has been plotted on the normal probability paper (Figure 8). It can be seen that the observed radii of maximum wind are very well represented by the normal distribution. Mean radius of maximum wind is 36.3 nautical miles. The standard deviation is 12.2 nautical miles.

Forward Speed

The historical data for the forward speed of the hurricanes and their frequency distribution is placed in Table 5.

The cumulative frequency distribution for the forward speed has been plotted on the normal probability paper (Figure 9). It can be seen that the normal law describes the distribution very well. Deviation of small forward

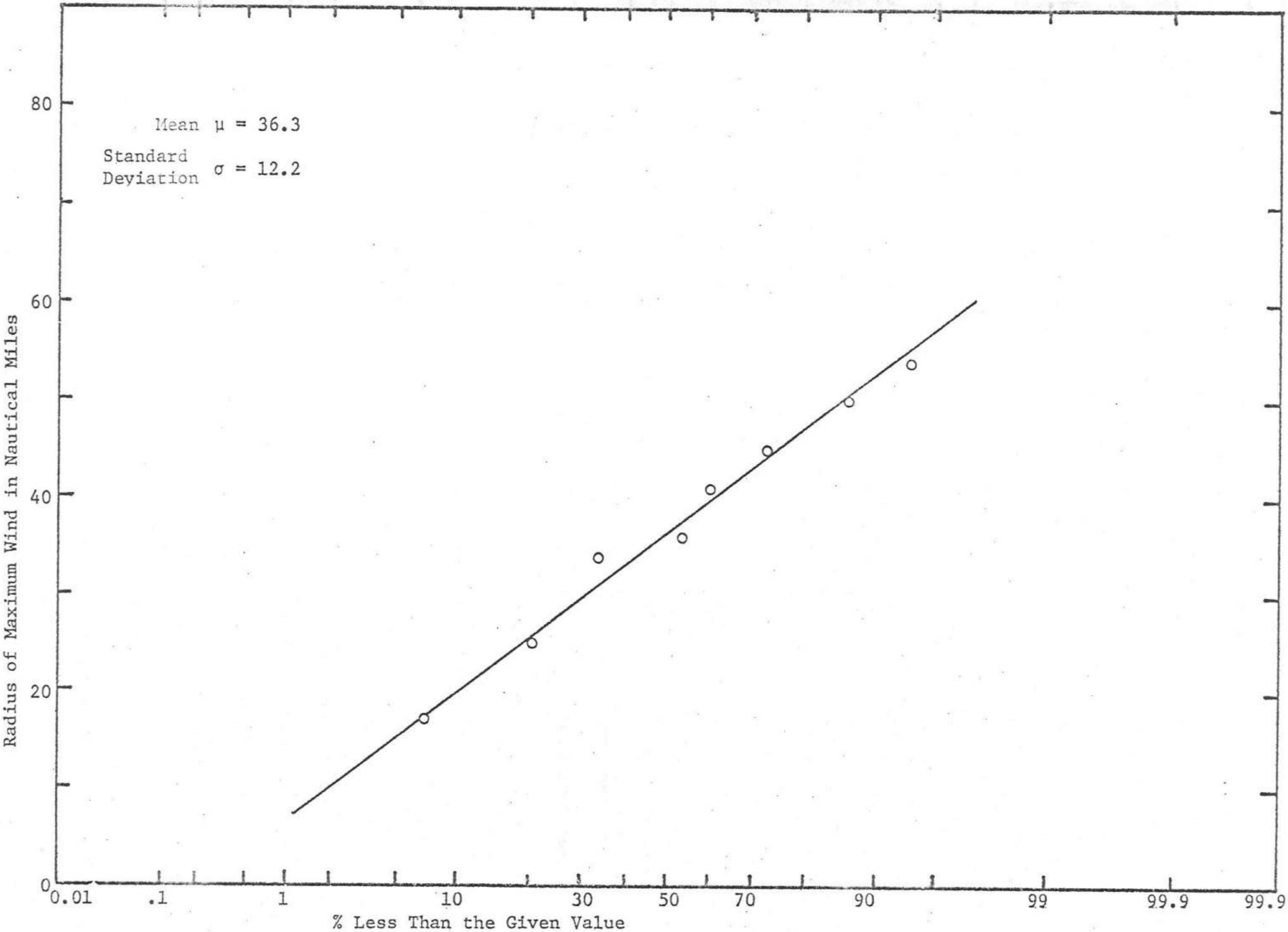

Figure 8 Probability Distribution of the Radius of Maximum Wind Plotted on Normal Probability Paper

TABLE 5
Probability Distribution of the Forward Speed of Hurricanes in Zone III

Rank	Forward Speed (knots)	Cumulative Probability in %
1	7	6.67
4	9	26.9
5	14	33.33
8	16	53.3
10	18	66.7
12	22	80.0
13	23	86.6
14	26	92.2
15	30	100.0

speed from the normal law may be attributed to the difficulty in accurately measuring small forward speeds. The mean forward speed for the hurricanes visiting this area is 17.5 knots. The standard deviation is 6.3 knots.

Direction of Approach

Historical data for azimuth and their frequency distribution has been placed in Table 6.

The frequency distribution for azimuth has been plotted on normal probability paper (Figure 10). Between 5% to 98% the distribution is well represented by the normal distribution. Only two occurrences at the lower end are far away from the normal. The mean azimuth is 214.0 degrees and the standard deviation is 24.2 degrees.

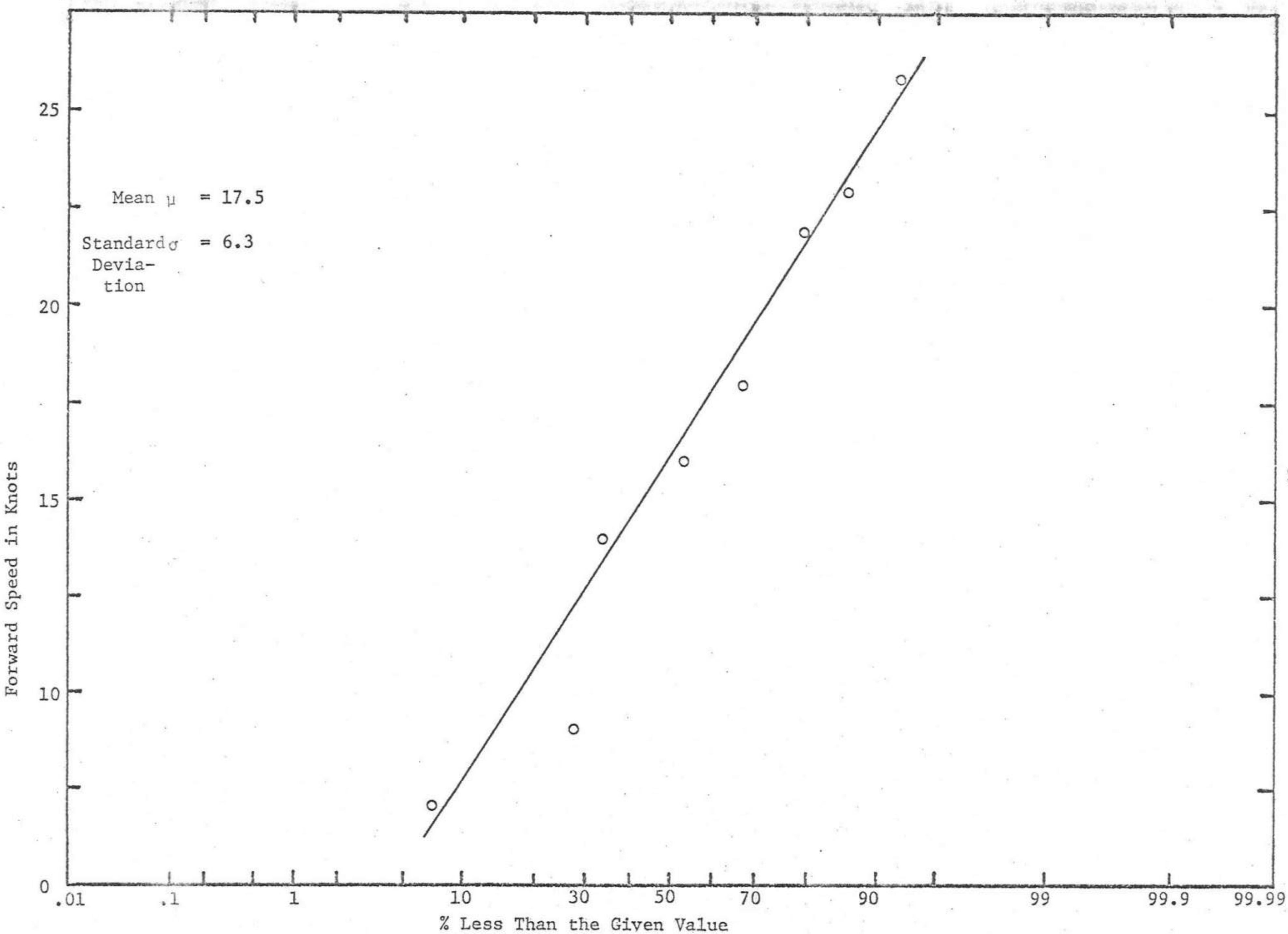

Figure 9 Probability Distribution of the Forward Speed of Hurricane Plotted on Normal Probability Paper

TABLE 6
Probability Distribution of Azimuth of Hurricanes in Zone III

Rank	Azimuth in Degrees	Cumulative Probability in %
1	100	2.22
2	150	4.44
4	180	8.88
8	190	17.76
13	200	28.90
21	210	46.60
28	220	62.30
33	230	73.40
37	240	82.40
43	250	95.50
44	260	97.90
45	280	100.00

Tide

High tides for the month of September for a 19-year epoch period have been computed for Atlantic City by the Pore and Cummings' tide program (1967). The month of September has been chosen to represent the whole of hurricane season. The cumulative frequency distribution is presented in Table 7 (after Myers', 1970).

The cumulative frequency of the tide amplitude squared has been plotted on the Rayleigh probability paper (Figure 11). It can be seen that the tide amplitude squared is excellently represented by the Rayleigh distribution.

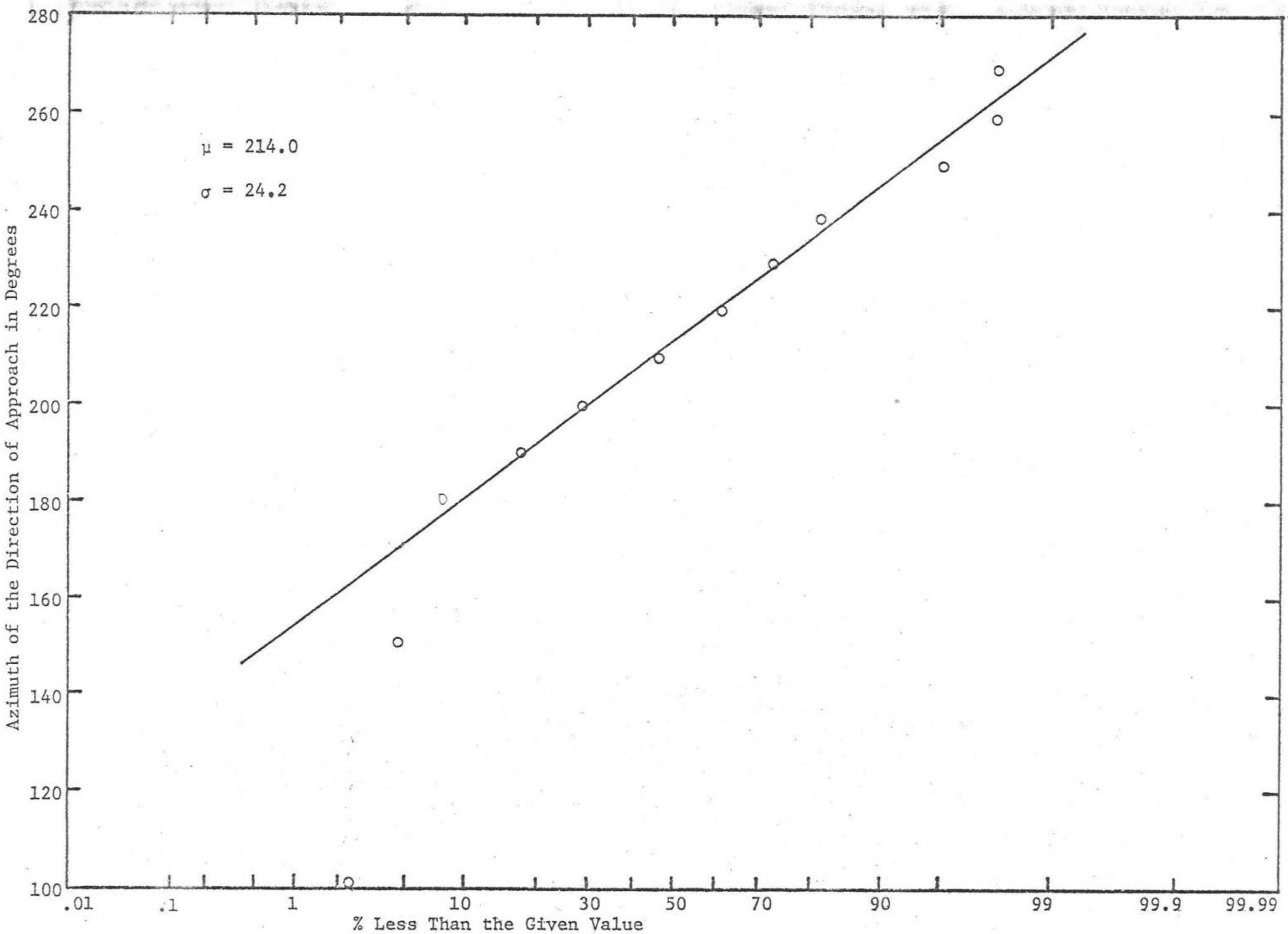

Figure 10 Probability Distribution of the Azimuth of the Direction Approach

TABLE 7
Probability Distribution of Tide Amplitude

Height Above Mean Sea Level - Ft.	Square of Column 1	Cumulative Probability in %
1.6	2.5	3.8
1.8	3.2	8.7
2.0	4.0	15.1
2.2	4.74	21.7
2.4	5.76	30.5
2.6	6.76	41.1
2.8	7.84	53.6
3.0	9.00	68.9
3.2	10.24	80.9
3.4	11.56	89.4
3.6	12.96	95.2
3.8	14.44	99.0

Winter Storm Surge

Maximum winter storm surge for the breakwater harbor for the period 1953-1974 has been analyzed. The frequency distribution for the winter storm has been computed and placed in Table 8.

The frequency distribution has been plotted on the normal probability paper (Figure 12) and it can be seen that the normal law represents the distribution very well. Mean level of maximum winter storm surge is 5.37 feet above Mean Sea Level and the standard deviation is 0.6 feet.

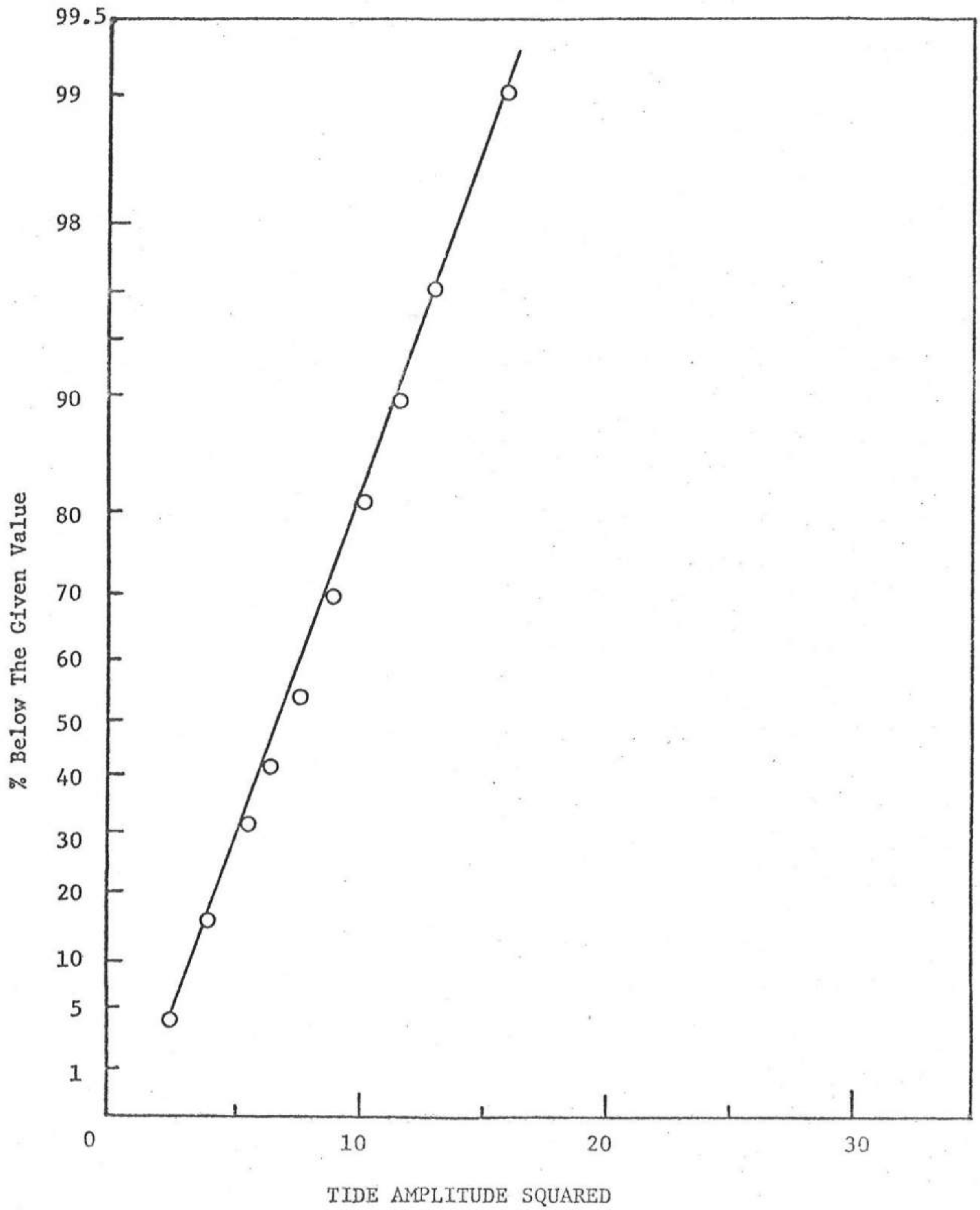

Figure 11 Probability Distribution of Tide Amplitude Squared for the Month of September Plotted on the Rayleigh Probability Paper

TABLE 8
Probability Distribution of Yearly Maximum Winter Storm Surge

Rank	Maximum Annual Winter Storm Surge Datum 4.23 Ft Below MSL	Cumulative Probability in %
2	8.9	9.5
3	9.0	14.3
4	9.1	19.0
6	9.2	28.6
7	9.3	33.3
11	9.4	52.4
13	9.7	61.9
14	9.8	66.7
15	9.9	71.4
16	10.0	76.2
17	10.2	81.0
19	10.5	90.5
20	10.6	95.2
21	12.0	100.0

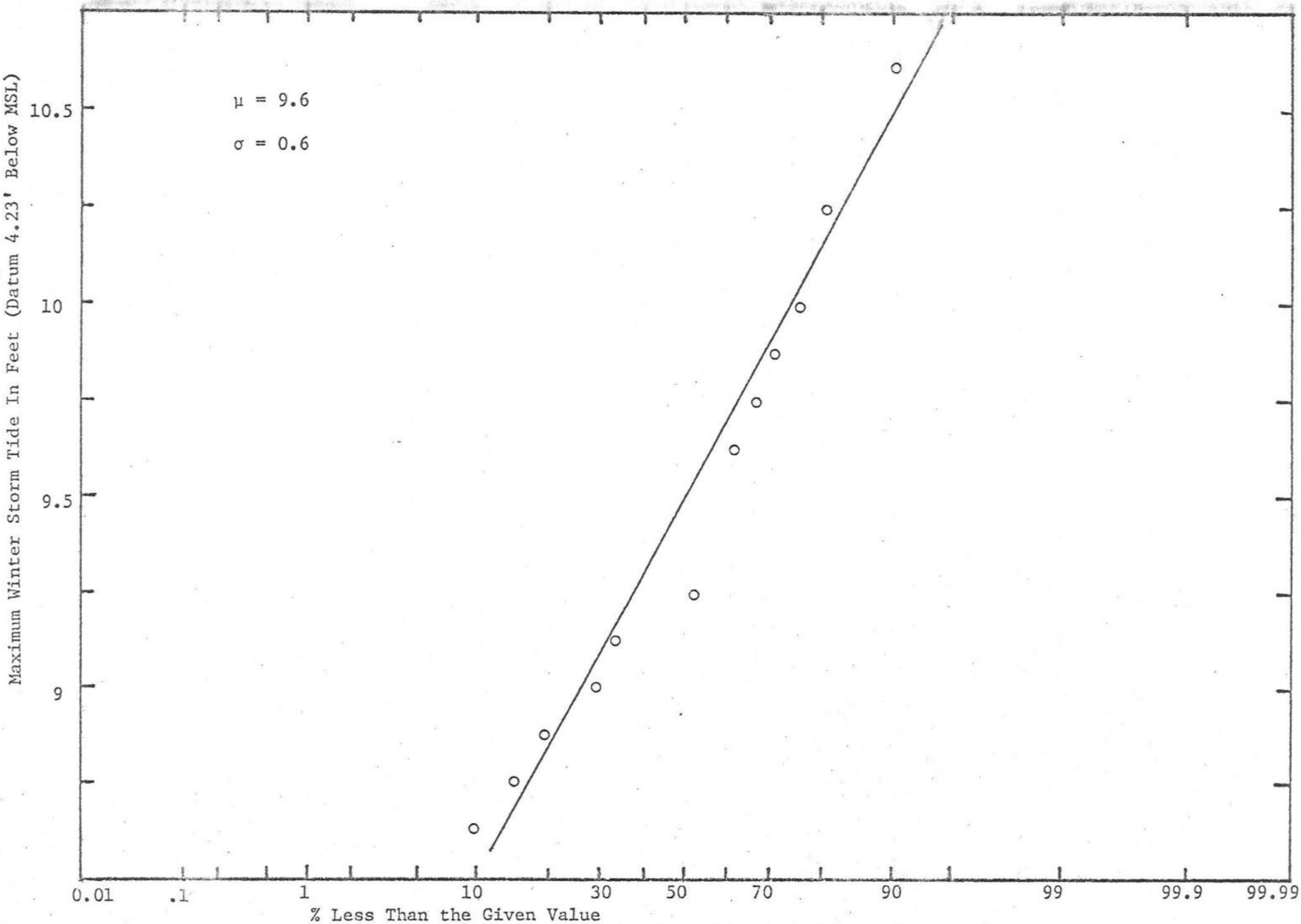

Figure 12 Probability Distribution of Maximum Winter Storm Tide Plotted on Normal Probability Paper

CHAPTER VI

Implementation of Simulation Method

The random hurricane parameters were simulated according to their underlying distribution. The surge computation was made by the hydrodynamical model of Jelesnianski in its nomogram form with verification. The compounding of tide and the effect of distance of landfall on the surge was done according to the method of Vance Myers.

Simulation of Random Hurricane Parameters

The various parameters characterizing a hurricane were generated by Gaussian random number generator. In this method two uniform random numbers are generated U_1 and U_2. Then $G = \sqrt{-2 \text{ Log } U_1} \cdot \cos (2\pi\ U_2)$ is Gaussian random variable. In order to improve the Gaussian properties further, 25 such numbers have been generated and added together. Thus random numbers very close to Gaussian have been generated. The following parameters were generated, tested and stored on card and disk for later use in surge simulation program. Means and standard deviations of each of the parameters have been listed in Table 9.

TABLE 9

Parameter	Distribution	Mean	Standard Deviation
$(\Delta P)^{1/2}$ Square Root of Central Pressure Deficiency in Inches of Mercury	Gaussian	1.22	.212
R Radius of Maximum Wind in Nautical Miles	Gaussian	36.3	12.2
V Forward Speed in Knots	Gaussian	17.5	6.3
Azimuth Direction from North in Degrees	Gaussian	214.0	24.2
Winter Storm Feet Above MSL	Gaussian	5.37	6
Tide1 and Tide2	Gaussian	0	1.54

Rayleigh variate for tide was obtained by squaring and adding two independent Gaussian random variables of Tide 1 and Tide 2.

The distributions of generated variables have been calculated and found to be the same as those of the historical observations. The correlations amongst the variables have been computed and found to be very close to zero. The correlation matrix for the generated random variables is presented in Table 10.

TABLE 10

	$(\Delta P)^{1/2}$	R	θ	V	Tide 1	Tide 2	Phase	Dist.
$(\Delta P)^{1/2}$	1	-.15	.03	-.003	.15	.12	-.037	.015
R		1	-.076	.006	-.044	-.071	.0244	.003
θ			1	.0008	-.01	.094	-.031	.10
V				1	-.057	.036	.075	.013
Tide 1					1	.165	.015	.094
Tide 2						1	.073	-.112
Phase							1	-.072
Dist.								1

The computer program for the generation of the random numbers for the given distribution is placed in Appendix I. The correlation and frequency distribution of the generated random numbers was carried on by relevant programs in the SPSS (Statistical Package Social Sciences) at University of Delaware Computing Center.

Hydrodynamical Model

In order to construct frequency distribution for the surge we need a hydrodynamical model in order to compute the surges from the random hurricanes generated in the previous subsection. Of different hydrodynamical models for computing the hurricane surge, the one due to Jelesnianski and adopted by NOAA is the best available in the sense that it takes into account maximum number of significant parameters. There is, however, one serious limitation of the method. It stems from the assumption of vertical wall at the shoreline. This also means that this model cannot handle the flooding of the coastal flatland. Other problems which need to be solved include (1) surge computation in bays, (2) the effect of wave run-up, (3) interaction between tide and surge and (4) the surge computation for ill defined wind patterns such as winter storms. Until a better method is available Jelesnianski's method has been adopted by NOAA and Shore Protection Manual Nomograms are based on the computations by this method. Hence for the present study the Jelesnianski's hydrodynamical model has been adopted.

The SPLASH II programs developed at NOAA by Jelesnianski and his associates was obtained. The original program is on tape and coded in Fortran for Model CDC 6400 computer belonging to NOAA. The program has been recoded here in Fortran IV so that it is compatible with the B6700 computer at the University of Delaware Computing Center. While recoding, many of the subroutines and sub-sections of routines specifically relating to the flood forecasting aspect of the overall program have been deleted. The recoded program has been debugged and successfully run on B6700 at UDCC. The details of the SPLASH II program as run on the B6700 computer at UDCC is placed in Appendix II.

To test the program September 1944 hurricane was used. The results of this run are placed in Figure 13. The observed surge profile at Atlantic City is shown in solid lines. The circles represent the hourly computation by the SPLASH II program on B6700. The broken line shows the surge profile based on Jelesnianski's 1967 computations.

Unfortunately, the program takes about 30 minutes of computer time on B6700 and is very expensive. Thus the original plan for running each random hurricane on the hydrodynamical model to get the storm surge frequency had to be modified.

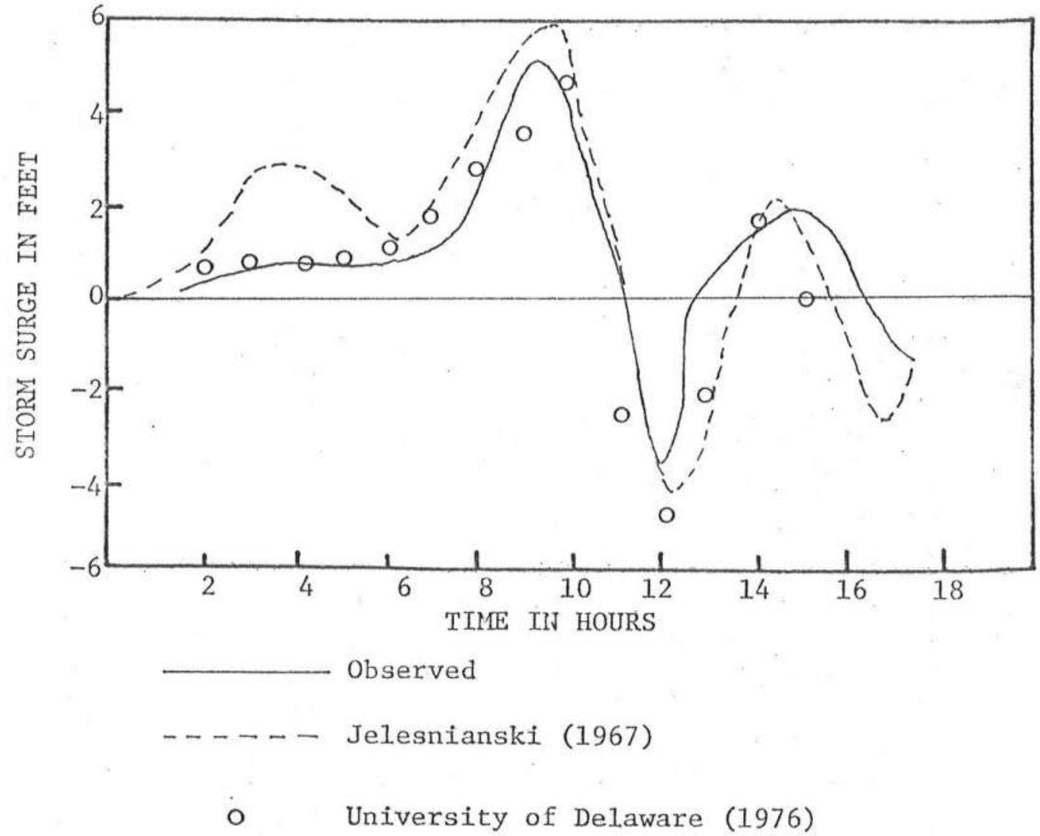

Figure 13 Observed and Computed Surges Against Time at Atlantic City for the September, 1944 Storm. Hours are for Model Time

Shore Protection Manual Nomographs with suitable verification for Delaware coast has been used instead. Several hurricanes were run with actual bathymetry relevant to Delaware coast and compared with the surge values obtained from the nomograms. The four storms selected were incident normally and moving at 15 miles per hour and had central pressures and radii listed in Table 11.

TABLE 11

	Central Pressure Deficit in mb	Radius in Miles	Surge in Feet From Nomogram	SPLASH II
1	60	30	11.6	15.0
2	60	15	10.4	8.8
3	90	30	17.9	22.9
4	90	15	15.7	13.2

The storm surge computed from the nomograph has been plotted (Figure 14) against the surge values obtained from the SPLASH II program using actual bathymetry for the Delaware region continental shelf. It can be seen in the Figure 14 that the four test values are scattered around the 45° line. It can be seen that the use of nomograms for large number of computations is quick and economical and does not involve serious errors.

For quick and error free evaluation of the surge values, the points on the nomograms have been read at equal intervals and fed to the computer. Then by a two-dimensional spline interpolation technique, the surge values have been obtained from the two nomograms.

Simulation of Surge

Random hurricanes are read from the stored set of random numbers which have been tested and found acceptable for the purposes. The parameters of the random hurricane enter into the interpolation program for finding the

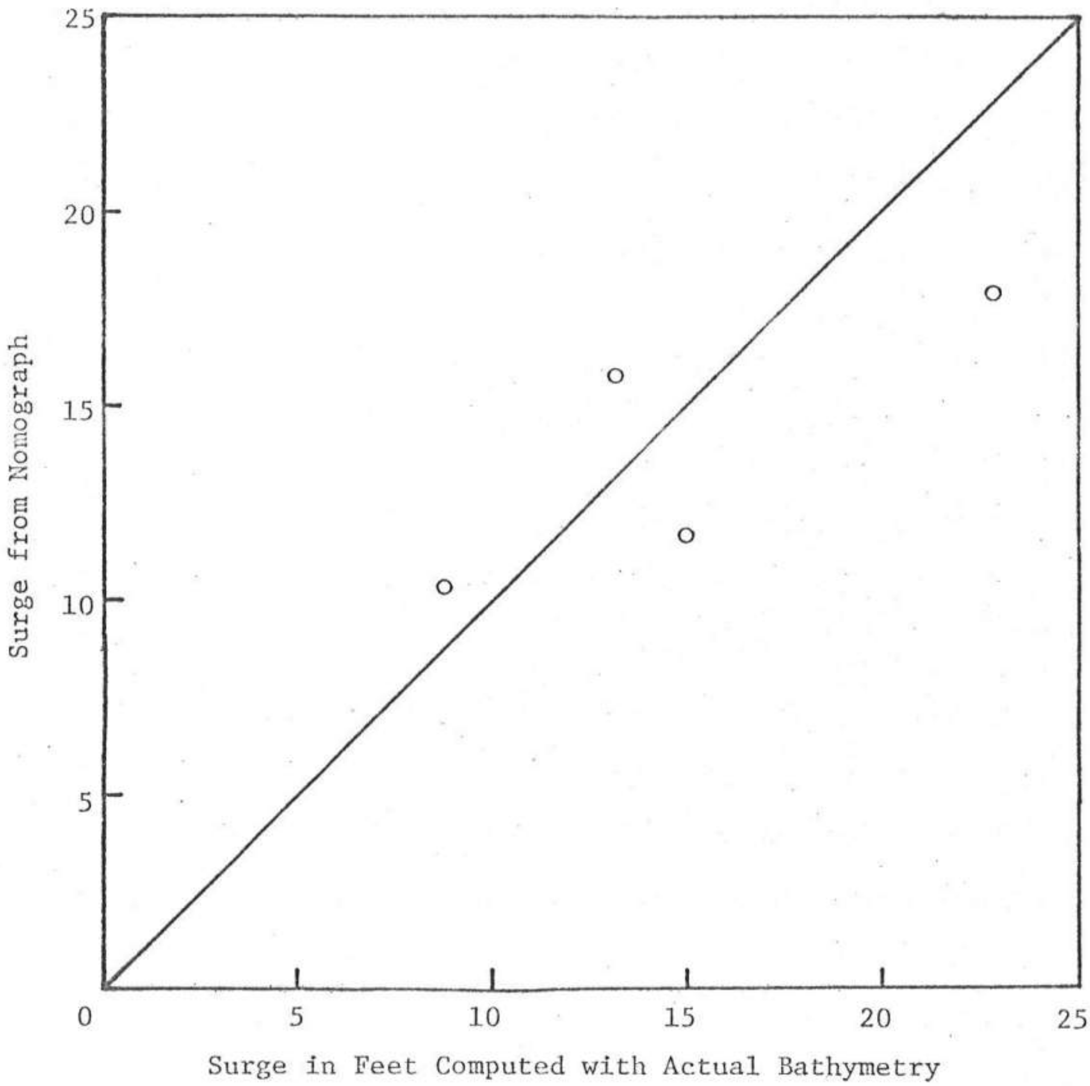

Figure 14 Comparison of the surge computed from the nomograph with the surge calculated on the computer with Jelesnianski's program using the actual bathymetry for Delaware Atlantic Coast.

surge from the nomograms. After multiplying by constant shoaling factor, we get a peak surge value. Now it needs to be combined with tide and spatial variation of surge along the coast to be taken into account.

Combination of storm surge with tide follows essentially the way Myers has done (1970). The temporal profile of the surge can be approximated by a Gaussian bell curve particularly the peak is very close to it. Temporal profile can be approximated to the following

$$S_t = S_o \text{EXP} \, [-.40547 \; (2t/t_{2/3})^2]$$

in which S_o = maximum surge at time $t = 0$

S_t = surge at time t

$t_{2/3}$ = total time in hours for $S_t \geq 2/3 \; S_o$

The parameter $t_{2/3}$ is a measure of duration of the high surge. In general, the greater the radius of the hurricane, the greater the duration of the high surge and faster it moves, less the duration of the high surge. Also oblique storm will have more duration of peak than the one incident normally. Thus

$$t_{2/3} \; \alpha \; R$$

$$t_{2/3} \; \alpha \; \frac{1}{V}$$

$$\text{and } t_{2/3} \; \alpha \; \sin \theta$$

Vance Myers has computed $t_{2/3}$ for several storms. On the basis of previous considerations, Myers data was used to find a regression equation for $t_{2/3} = f(R,V,\theta)$. Several combinations of these and other variables were entered into a stepwise regression program (BMD02R) and the results found were

$$t_{2/3} = .80674 + .89414 \frac{R}{V} + .20797 \frac{R}{V} \sin \theta$$

with a multiple correlation of 0.9875. The above regression formula has been used to find $t_{2/3}$ and approximate the temporal profile.

Tide amplitude was generated according to Rayleigh distribution fitted to the historical data for September high tide. A simple cosine profile has been assumed. The phase of the peak tide with respect to peak of the surge is assumed to be independent and uniformly distributed. From the combination of the two profiles we obtain the maximum surge on the coast.

However, the maximum surge thus obtained may not be at the point of interest. Using Myers' method again the spatial profile of the surge has been assumed to be Gaussian bell shaped curve.

$$S_d = S_m \text{ EXP } [-.40547 \ (2 \ d/d_{2/3})^2]$$

The parameter $d_{2/3}$ is distance for which $S_d \geq 2/3 \ S_m$

where S_m = maximum surge at $d = 0$

S_d = surge at distance d from the point of peak surge along the coast. The parameter $d_{2/3}$ has also been computed by regression equation obtained from the Myers data.

$$d_{2/3} = 76.73 + 1.1 \dot{V} - .01452 \ R^2 - .00625 \ V^2$$

The distance d of the point of interest from the point of maximum surge has been assumed to be uniformly distributed.

The above consideration applies to the computation of landfalling hurricane. Similar computations are carried out for the parallel hurricanes. The overall simulation method has been schematically presented in Figure 6. Maximum surge computation has been carried out in the following way. A uniform random number between 0 and 1 is generated. If this number is less than .24, a hurricane occurs and a random hurricane is drawn. Now another uniform random number is generated to decide if the hurricane is landfalling or parallel. The combined hurricane surge S_m is computed by appropriate segment of the program. If the hurricane does not occur, S_m is set equal to zero. Now the winter storm surge S_w is generated and max (S_m, S_w) is retained as the annual maximum surge level. In this manner maximum surge for 792 years have been computed.

CHAPTER VII

Discussion of Results, Conclusion and Recommendations

Simulation has been carried out for 792 years during which 173 hurricanes occurred. The distribution parameters for the observed hurricanes have been compared with those of the 173 simulated hurricane parameters in Table 12.

TABLE 12

	Parameter	Mean		Standard Deviation	
		Observed	Simulated	Observed	Simulated
$(\Delta P)^{1/2}$	Square root of central pressure deficiency in inches of mercury	1.22	1.227	.212	.214
R	Radius of maximum wind in nautical miles	36.3	36.72	12.2	10.95
V	Forward speed in knots	17.5	16.37	6.3	5.17
	Azimuth, direction from north in degrees	214.0	213.78	24.2	23.68
	Winter storm	5.37	5.36	0.6	0.64

All the parameters have been simulated reasonably accurately. Noticeable deviations in R and V have been caused due to the fact that some of the simulated values were beyond the range of the nomograms. Noting that R and V have secondary influence on the surge, it is believed that deletion of these radii and velocities would have insignificant influence on the extreme surge distribution.

Annual maximum surges for 792 years have been obtained by the method outlined in the last chapter. The frequency distribution of the annual maxima has been computed and placed in Table 13.

TABLE 13

Surge Level (Datum MSL)	Surge Level Datum 4.23' Below MSL	Cumulative Probability in %
3.99	8.17	1.0
4.60	8.83	10.0
4.88	9.11	20.0
5.09	9.32	30.0
5.26	9.49	40.0
5.39	9.62	50.0
5.53	9.76	60.0
5.70	9.93	70.0
5.87	10.10	80.0
6.12	10.35	90.0
6.36	10.59	95.0
6.62	10.85	98.0
6.73	10.96	99.0
6.89	11.12	99.5
7.06	11.29	99.6
7.16	11.39	99.8
8.36	12.59	99.9

The above frequency data has been plotted on the Gumbel extreme value probability paper. On Figure 15, the points are plotted as crosses. For comparison with similar studies, data of Yang, et al. (1970) have been plotted as circles. This study was based on the historical high water record at the Breakwater Harbor for the last 21 years. The circle at 12.1 ft represents the 1962 storm surge. This is the highest recorded water level at the Breakwater. In order to compare the present simulation method with the Myers' method, on Figure 15 the surge frequency for Atlantic City computed by Myers' method has been plotted as triangles connected by solid lines. It can be seen that the three types of approaches lead to the same general trend in the extreme surge frequency distribution below 90%.

It is interesting to note that the difference between the Myers' results for Atlantic City curve upwards above 90% whereas results of the simulation method fall neatly along a straight line in 90% to 99.8% range. The point

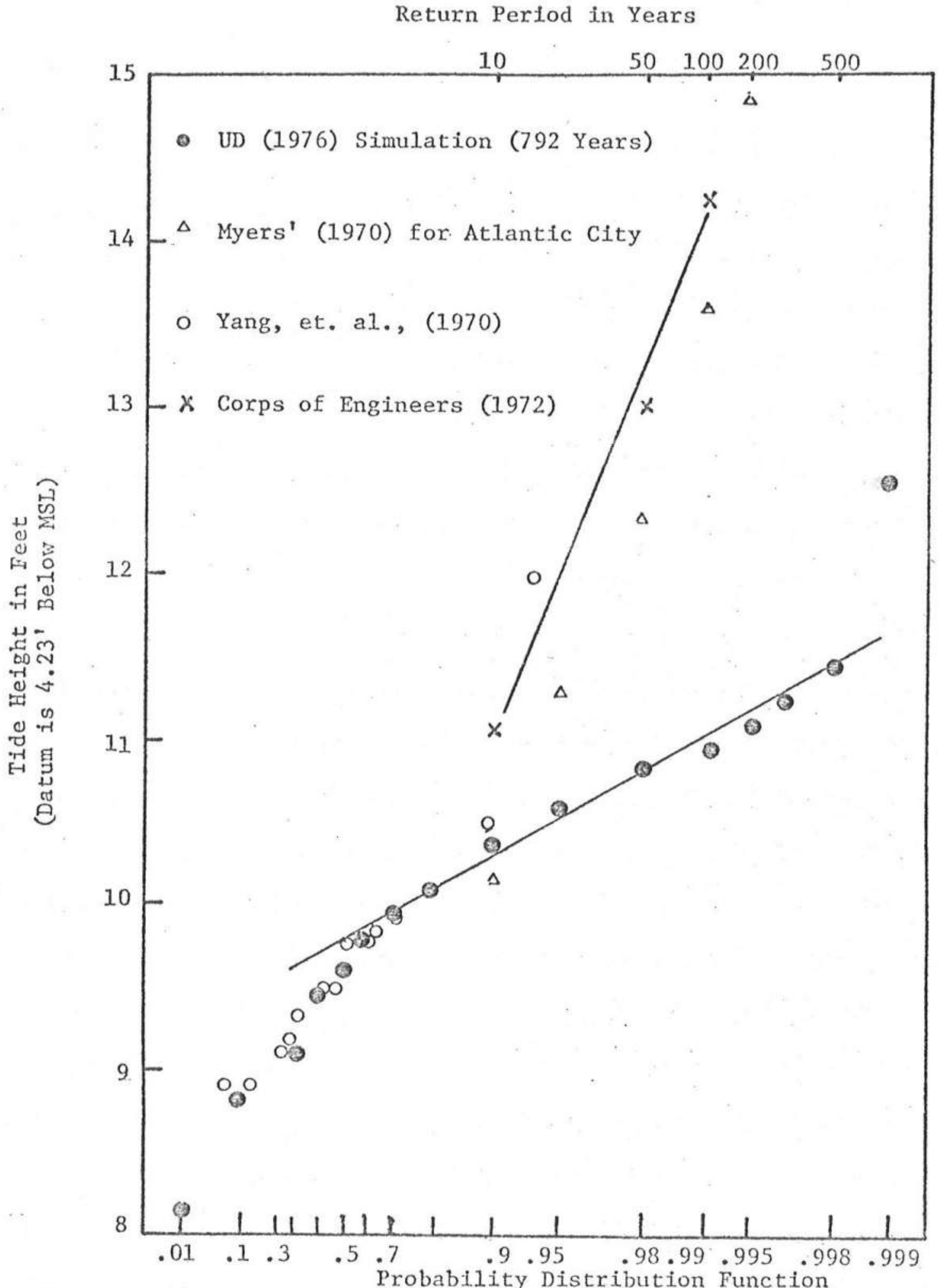

FIGURE 15 Comparison of Extreme Tide Distribution from Simulated Model for Breakwater Harbor with Yang, et al. (1970) Result Based on Historical Tide Record at Breakwater Harbor and with Vance Myers' (1970) Result for Atlantic City Based on His Combined Statistical Model. and with the Corps of Engineers (1972) for Rehoboth Beach, Delaware Based on the Standard Project Hurricane and Tide Data for Atlantic City.

corresponding to the highest value in the 792 years of simulation seems to have a return period much greater than 792 years. Above 90% the results of Yang et al., has only one point which definitely has a return period greater than 21 years for which data is available.

Of the historical surge distribution, only one point, i.e., at 12.1 ft., pertaining to the 1962 storm deviates significantly from the general trend. It seems that the storm of this size, intensity and duration has a return period much longer than the time span for which data was available to construct the extreme surge frequency. Hence this point lies to the left of the general trend.

The 1962 storm has been studied in greater detail because it recorded the highest surge level and caused the severest damage along the Delaware coast and also similar winter storms hit the Delaware coast more often than the hurricanes. Figure 16 shows the development of the storm in various stages. At the peak of the storm, it had a central pressure deficiency of 50 mb. By the nomograph method the maximum surge has been computed to be 4.5 ft. The SPLASH II program has also been used to generate the surge profile. The actual surge and the computed surge are shown in Figure 17. The difference between the actual and computed is not surprising if we remember that SPLASH II modeled the sprawling, elongated storm system by a compact pressure and wind pattern appropriate for a hurricane. It did not take into account the fact that the long fetch of the wind patterns had been accelerating the surface water over long distances and for a long length of time. The actual surge recorded at the Breakwater Harbor is shown in Figure 18. It is interesting to note that as high as two feet of interaction between tide and storm-driven currents occurred. The interaction peaks occur during the receding tide just after the mean sea level time.

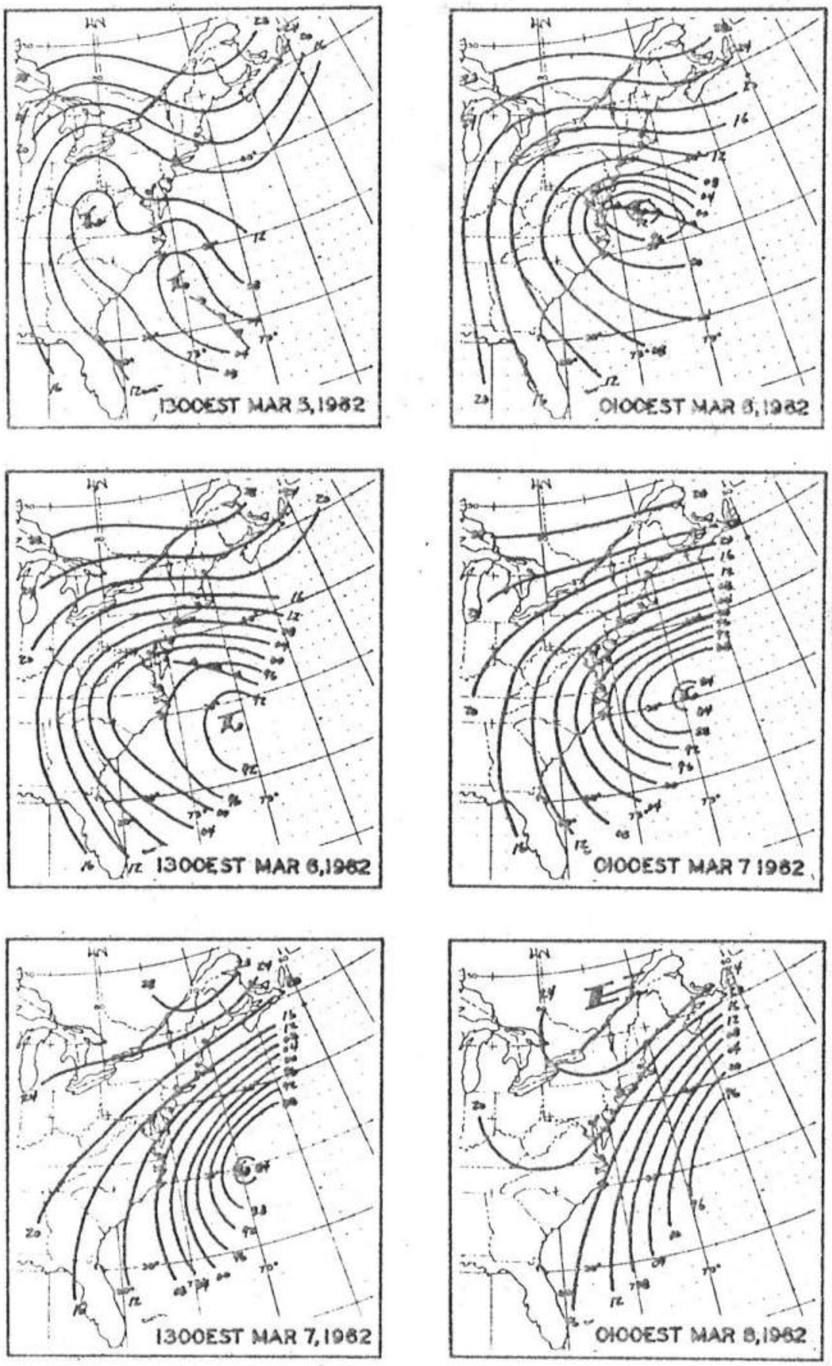

Figure 16 Sea-Level Pressure Charts from 1300 EST March 5, 1962 to 0100 EST March 8, 1962.

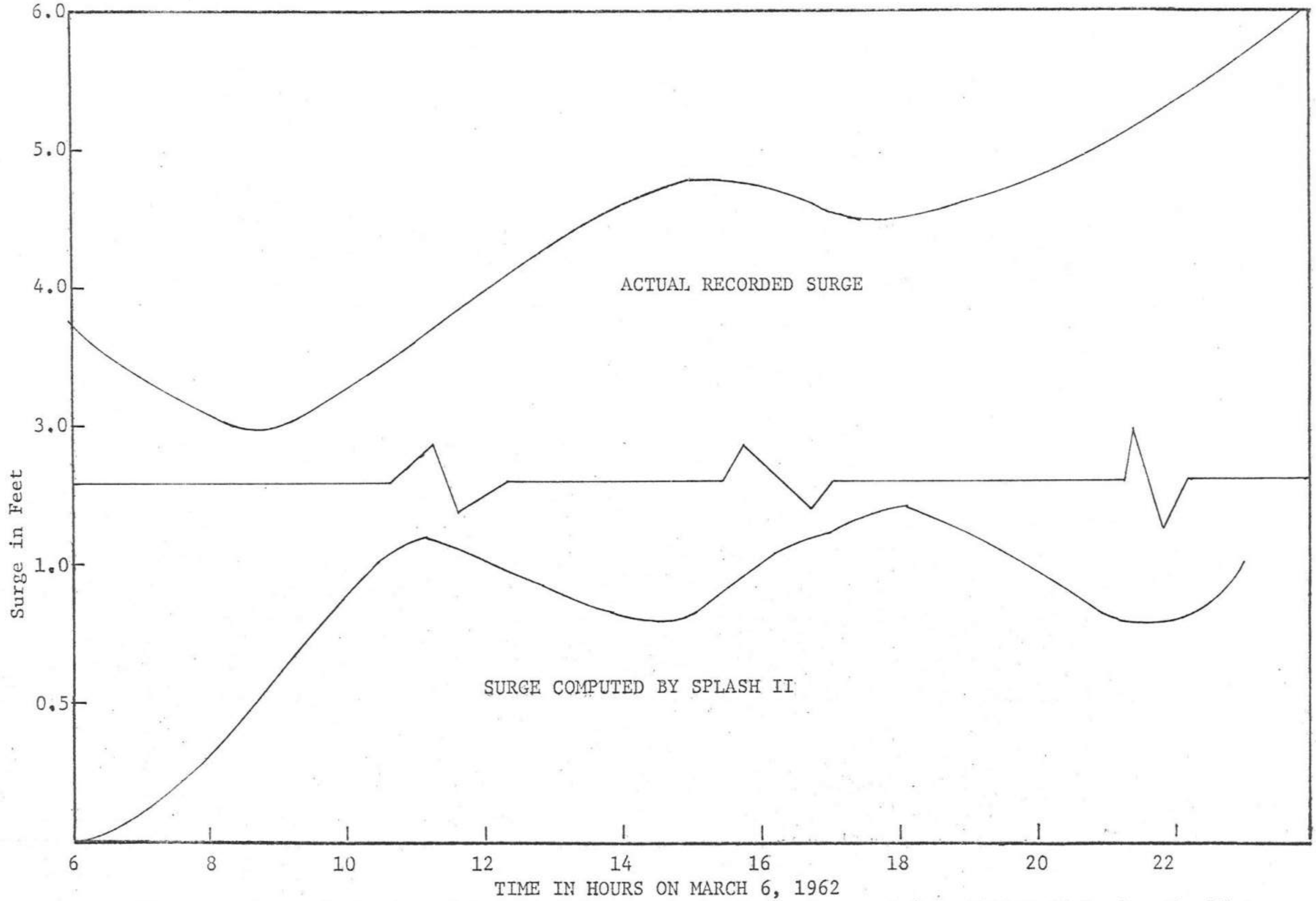

Figure 17 Comparison of the Actual Recorded Surge and the Surge Computed from SPLASH II During the Winter Storm of March 5-8, 1962 at Breakwater Harbor.

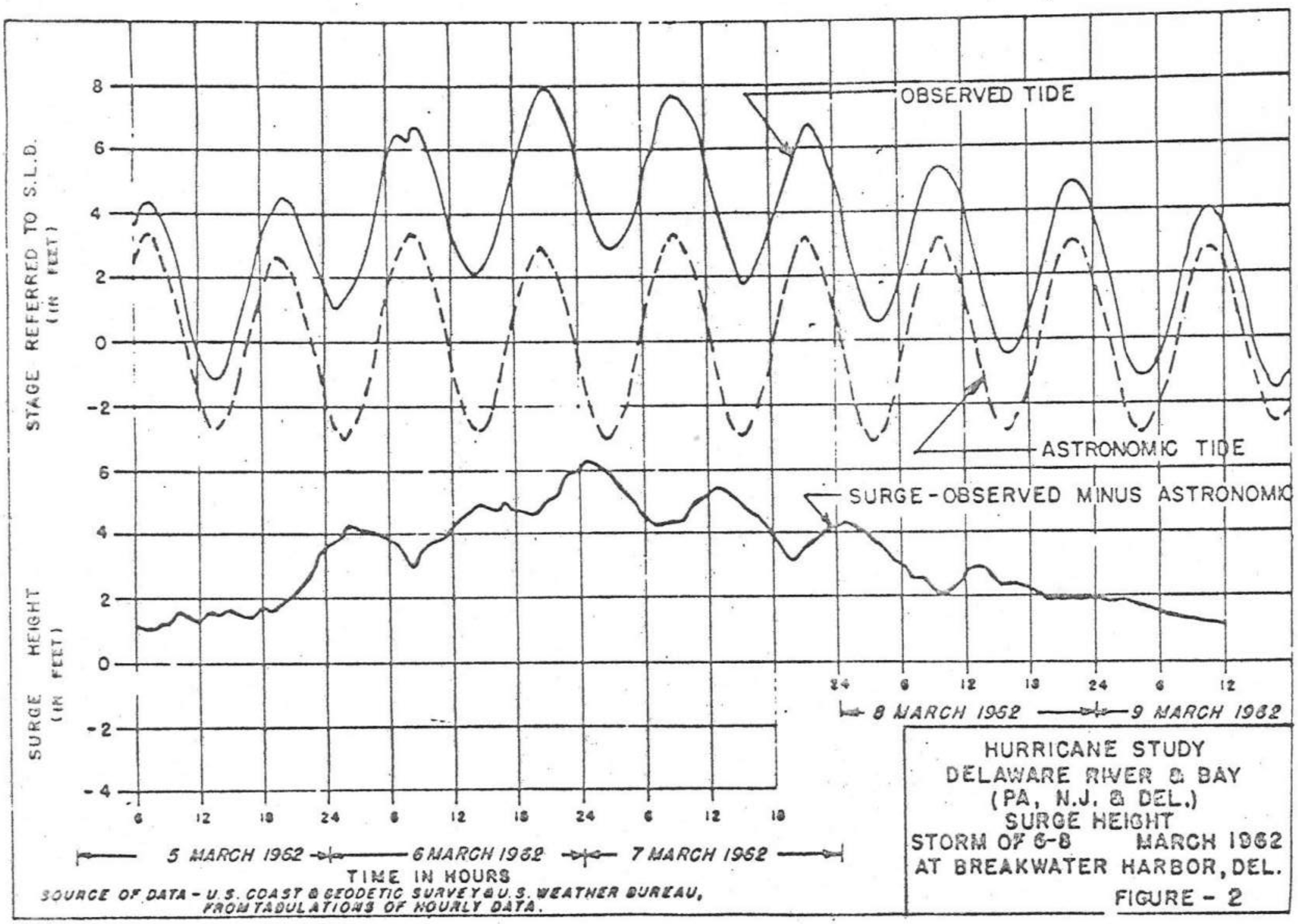

Figure 18 Actual Recorded Surge at Breakwater Harbor During the Winter Storm of March 5-8, 1962.

Some of the simulation points, particularly those associated with high probability, deviate from the general trend. This is due to the fact that the 792 years of simulation contains only 173 hurricanes and, out of those, very few came close to the point of our present interest. It is, therefore, expected that the surge estimates for return periods close to 792 years may not be very accurate.

In conclusion, the following limited objectives have been achieved:

(1) On the basis of physical interaction among metereological variables, it has been derived that $(\Delta P)^{1/2}$, R, V and θ have Gaussian distribution.

(2) The previous conclusions derived from heuristic reasonings have been found to be reasonably accurate for the Delaware region.

(3) There is no significant correlations among the variables.

(4) Tide amplitude for the hurricane season has Rayleigh distribution.

(5) A computer program has been developed to generate uncorrelated Gaussian random variables.

(6) Jelesnianski's SPLASH II program has been adopted to the Burroughs Model B6700 computer of the University of Delaware Computing Center.

(7) A simulation technique has been developed for computing annual extreme surge distribution.

(8) The newly developed technique has been applied to the Delaware coast.

(9) The results thus obtained have been compared with the extreme value distributions (i) derived from the historical data (Yang, et al., 1970) and (ii) computed by Myers method for the Atlantic City area.

(10) A computer algorithm has been developed for simulation method when the variables have significant correlations amongst themselves.

In the process of developing a new method and applying it to the Delaware coast, it was found that the simulation method as well as the hydrodynamical model need to be considerably sharpened. The following points are suggested for future studies.

(1) Historical data pertaining to hurricanes need to be researched and refined so that we can have more confidence in the reported data.

(2) Correlation among variables can be taken into account by the algorithm developed in the present study. The method needs to be implemented on computer.

(3) The interaction between tide and surge is noticeable and it needs to be quantified.

(4) Hydrodynamical model needs to be improved to take into account coastal flatlands, curved coastline and bays like Delaware Bay.

(5) Effect of wave run-up on flooding needs to be taken into account.

APPENDIX I

(A) Computer Program for Generating Random Numbers

This program generates 6 Gaussian random variables with zero mean and unit standard deviation and two random variables uniformly distributed between 0 and 1.

The uniform random numbers are generated by the system subroutine URAN31. The Gaussian random variables are generated by the following procedure. Two random variables u_1 and u_2 are generated according to uniform distribution between 0 and 1. Then

$$B = \sqrt{-2 \log u_1} \cdot \cos (2\pi u_2)$$

has Gaussian distribution with zero mean. The Gaussian properties of the random variable has been further improved by averaging 25 of them.

In the beginning the user can specify the following variables.

N = no. of data in each variable.

lx = seed no. for the program generating uniformly distributed random numbers. Should be large integers and relatively prime.

M = integer specifying the no. of raw Gaussian numbers to be averaged.

DP, R, PHI, V, TIDE1 and TIDE2 are Gaussian random variables. DIST and PHASE are uniform random variables. All the random numbers written on the printer as well as on the diskpack and cards for testing and for final use in simulation.

The program can be modified by changing N to get required sets of random numbers. The output and listing of the program is given below for reference.

```
@SET AUTOBIND
FILE  9=RANDOM/STORM/DATA,UNIT=DISKPACK,RECORD=54,RECORDING=30
      DIMENSION DP(200),R(200),PHI(200),V(200),DIST(200),PHASE(200),
     1 TIDE(200),TIDE1(200),TIDE2(200)
      N=200
      IX=34571
      CALL GRAND(DP,N,IX)
      CALL NORMAL(DP,N,0.,1.)
      CALL GRAND(R,N,IX)
      DO 1 I=1,N
    1 PHASE(I)=URAN31(IX)
      CALL GRAND(V,N,IX)
      CALL GRAND(PHI,N,IX)
      DO 10 I=1,N
   10 DIST(I)=URAN31(IX)
      CALL GRAND(TIDE1,N,IX)
      CALL GRAND(TIDE2,N,IX)
      CALL NORMAL(PHI,N,0.,1.)
12345 CALL NORMAL(R,N,0.,1.)
      CALL NORMAL(V,N,0.,1.)
      CALL NORMAL(TIDE1,N,0.,1.)
      CALL NORMAL(TIDE2,N,0.,1.)
      WRITE(6,70)(DP(I),R(I),PHI(I),V(I),TIDE1(I),TIDE2(I),DIST(I),
     1 PHASE(I),I,I=1,N)
      WRITE(7,70)(DP(I),R(I),PHI(I),V(I),TIDE1(I),TIDE2(I),DIST(I),
     1 PHASE(I),I,I=1,N)
   70 FORMAT(6F10.6,1X,2F7.4,1X,I4)
   90 FORMAT(9A6)
      LOCK 9
      STOP
      END

      SUBROUTINE GRAND(A,N,IX)
      REAL*8 TP8
      DIMENSION A(N)
      DIMENSION B(625)
      M=25
      DO 1 I=1,N
```

```
      DO 2 J=1,M
        UO=URAN31(IX)
        UT=URAN31(IX)
      B(J)=SQRT(-2.0*ALOG(UO))*COS(6.28315*UT)
    2 CONTINUE
      TP8=0.0D0
      DO 3 J=1,M
    3 TP8=TP8+B(J)
      A(I)=TP8
    1 CONTINUE
      RETURN
      END

      SUBROUTINE NORMAL(A,N,AVER,SIG)
      DIMENSION A(N)
      DOUBLE PRECISION SUM
      SUM=0.0D0
      DO 1 I=1,N
    1 SUM=SUM+A(I)
      AM=SUM/DFLOAT(N)
      SUM=0.0D0
      DO 2 I=1,N
      TP=A(I)-AM
    2 SUM=SUM+TP*TP
      SUM=SUM/DFLOAT(N)-DBLE(AM*AM)
      SIGMA=DSQRT(SUM)
      DO 3 I=1,N
    3 A(I)=(A(I)-AM)/SIGMA
      DO 4 I=1,N
    4 A(I)=A(I)*SIG+AVER
      RETURN
      END

      SUBROUTINE RANDAT(X,N,AVER,SIGMA)
      DIMENSION X(1)
      DO 1 I=1,N
    1 X(I)=X(I)*SIGMA+AVER
      RETURN
      END
```

0.283211	2.748542	0.537495	-0.026659	-0.100560	1.231960	0.5232	0.4687	1
1.582951	0.567171	-1.937997	-0.149253	1.509947	0.217474	0.3897	0.6504	2
0.055170	-1.104264	-0.945812	-0.637491	-0.023242	0.041386	0.2115	0.3777	3
1.310534	0.134281	1.202393	-0.124329	-0.304558	-0.678823	0.5380	0.3455	4
0.915704	-0.499221	0.182252	-0.057306	0.116101	-0.548747	0.1398	0.7454	5
-1.041536	0.359123	-0.570150	0.952138	-1.761567	-0.437972	0.9761	0.2433	6
-0.024362	-0.090172	1.418402	-1.375603	0.819622	1.514721	0.4154	0.3110	7
-0.421930	0.253293	-0.397376	1.274807	-1.808273	-0.519748	0.9024	0.2757	8
1.475724	-1.257327	1.704844	-0.396352	-0.018450	-2.059392	0.3166	0.5335	9
-2.152625	0.273939	1.071468	0.126497	-0.689325	0.596991	0.3957	0.1825	10
-0.162123	-0.175300	0.778464	-1.201375	0.931089	0.847789	0.5812	0.2296	11
1.429329	1.077103	2.399525	0.497721	-0.240474	-0.431343	0.2407	0.4395	12
-2.065033	-0.374765	-0.467070	-0.401516	-1.414564	0.477877	0.0350	0.2997	13
-1.053815	-1.392798	1.592025	0.398082	-0.065450	0.148713	0.6270	0.6359	14
-0.564250	-1.329739	0.125933	1.026467	-1.484695	-0.909117	0.4411	0.2172	15
-0.066396	-1.327142	-0.145772	-0.054643	-1.627551	-1.103097	0.9795	0.7075	16
-1.866145	-0.843106	-1.402484	1.931891	0.236010	-0.319390	0.9181	0.8769	17
-0.349357	0.206125	-0.052496	-0.149780	0.098137	-0.927622	0.9641	0.1808	18
-0.924252	-0.549759	0.507753	0.822277	0.525019	2.241619	0.8649	0.0574	19
-0.711021	-0.632066	0.361841	2.025316	1.864086	-0.086314	0.9476	0.3362	20
1.606224	1.121612	-0.269913	-0.046098	-0.081641	0.273714	0.8082	0.5421	21
-0.064107	0.647375	-0.981257	0.255979	1.072413	-0.254433	0.6570	0.9442	22
0.165262	-1.853472	-1.359496	-0.235407	1.033280	-1.525062	0.1134	0.6685	23
-1.570981	0.145259	-0.293975	0.381093	-0.270479	0.869951	0.4420	0.9833	24
-0.067525	-1.136022	0.206957	0.036564	-0.059815	-0.287447	0.1057	0.8450	25
-0.335624	-0.710099	1.211272	1.901021	0.500584	-0.463533	0.3024	0.4935	26
0.846573	-0.513297	0.950989	2.295311	0.779596	-0.634745	0.1413	0.3123	27
0.916947	0.446867	0.764701	0.737591	-0.050924	1.018165	0.5917	0.4737	28
0.141443	1.435065	1.187367	0.176218	-1.693007	-0.372213	0.8416	0.1358	29
-2.600475	1.444431	1.390228	-2.217404	1.203477	-1.309224	0.9845	0.4773	30
0.123207	-1.121135	1.970699	1.375017	1.783692	1.764224	0.5505	0.5483	31
0.124111	-0.366093	-0.313320	-2.102600	-0.356449	0.514383	0.3056	0.3146	32
0.095433	-2.033405	0.350203	-0.530432	-0.187652	-2.103498	0.5069	0.1434	33
-0.030506	0.995437	-0.315668	-0.305712	0.945900	-0.296307	0.1651	0.0157	34
-0.009458	-1.845299	-1.347623	0.077763	-1.277772	-0.446387	0.0132	0.7318	35
1.749351	0.516793	-0.796137	-1.235906	1.236777	-0.491833	0.2367	0.9618	36
0.140413	0.125165	0.277062	-0.553337	0.731516	-0.261026	0.6308	0.5535	37
-0.076132	-0.849869	0.277793	-0.711616	-0.395576	0.157705	0.3249	0.8411	38
-0.278331	0.255552	0.293164	-1.542517	-1.144398	-1.250910	0.1850	0.4726	39
-0.188697	-1.171445	-1.285861	0.507752	0.929135	-0.593081	0.9081	0.3347	40
0.742151	-0.144092	0.884616	0.311936	0.946045	-2.276150	0.1066	0.3370	41
-1.164916	-0.409700	-0.334398	0.771466	-2.214033	0.417233	0.3534	0.1891	42
-0.892544	-0.030982	2.054133	0.640596	-0.103125	0.113567	0.4079	0.8349	43
-0.557278	-0.322184	-2.413013	0.438931	0.057347	0.089977	0.6788	0.0823	44
0.400530	0.225117	-1.509758	-1.286145	0.286254	0.481554	0.2799	0.0776	45
1.432366	-0.379468	0.133576	-1.920302	-0.404755	1.738612	0.6003	0.4385	46
-0.184912	-1.354544	-0.269513	0.092966	0.770508	-0.278604	0.1638	0.2916	47
1.107496	-0.153681	-0.686346	1.062454	-0.146935	-0.323765	0.7490	0.0987	48
-1.076433	0.604290	-0.104809	-0.331875	-2.009813	-1.153495	0.7569	0.3502	49
1.000334	-1.133133	-0.584094	0.371162	0.137592	-0.086289	0.2154	0.5025	50
-1.843027	0.208643	0.395088	-1.349887	-3.386871	-0.132192	0.2771	0.4268	51
-0.871432	-0.429354	-1.264522	-0.597804	-0.224323	0.695529	0.8461	0.7687	52
0.321415	0.224587	1.310674	0.762648	-0.451171	-0.612857	0.0922	0.7994	53
-0.624637	-0.152346	0.959297	0.034542	0.373631	-0.180297	0.0899	0.9691	54
0.235653	-0.503771	-0.133600	-0.059555	1.993473	0.084051	0.8633	0.5896	55
0.470065	1.625664	0.473214	0.162501	-0.382021	-0.001503	0.2894	0.5837	56

-0.234223	-0.290391	-0.832730	-0.654111	-0.525782	1.244112	0.6573	0.9667	57
0.313059	0.100496	1.472459	-0.578300	-2.856351	-0.525095	0.1463	0.9917	58
-0.997636	0.779235	0.311354	-0.362515	-0.621952	1.654549	0.0568	0.0967	59
0.135872	0.113532	-0.184371	-0.059650	0.289907	-1.394652	0.3484	0.2067	60
-0.356236	0.769391	0.324921	-0.354791	0.131722	2.592576	0.0205	0.8697	61
1.316031	0.451496	-0.732195	-1.787439	0.337441	0.520374	0.0296	0.9297	62
1.983111	1.256929	0.573255	-1.135945	-0.045527	1.707863	0.4142	0.1857	63
0.259240	0.340620	1.321452	-0.338693	0.071935	1.189037	0.2537	0.1886	64
0.139475	0.399951	-0.092934	0.769535	-1.396366	-0.543302	0.8749	0.3295	65
0.441392	0.749796	-0.485543	0.200643	-0.206424	-0.492842	0.0077	0.7391	66
1.099353	0.761203	-0.924293	0.430214	-0.678520	0.290402	0.1673	0.7181	67
-1.252720	0.317876	-0.991993	-0.509517	-0.613946	-0.263539	0.9274	0.1335	68
-0.922923	0.225338	2.305738	0.264010	-1.415357	1.334853	0.0469	0.0490	69
0.870461	0.515091	-0.656831	1.018985	0.596036	0.970175	0.0122	0.1135	70
0.410779	0.293693	0.062498	-0.958937	0.454205	0.713103	0.1516	0.6329	71
0.170118	1.662348	-0.085327	0.527314	-0.514838	-0.347781	0.6059	0.7342	72
0.970213	0.455510	-1.496292	1.748292	-0.103222	1.166656	0.8739	0.4411	73
1.034396	-0.007710	1.346154	0.433616	0.645629	0.303677	0.0056	0.3741	74
-0.031604	-1.250376	-0.699349	-1.571317	-0.134328	-0.060294	0.5137	0.1490	75
0.726398	-1.136938	1.129359	0.453680	-1.371036	-1.167135	0.1568	0.5383	76
0.513291	-0.244603	-0.270765	-0.309222	-0.136960	0.063898	0.8829	0.2058	77
0.677845	1.646164	0.996497	-0.502758	0.210346	0.411135	0.0375	0.1110	78
-0.334071	-1.739406	1.478504	-1.539435	0.456114	0.059652	0.1650	0.7189	79
0.407272	1.522622	-1.133728	-1.325230	1.261684	-0.599635	0.5035	0.4633	80
0.917592	0.537248	0.222683	-0.276679	0.702405	0.659372	0.6181	0.6632	81
0.244908	0.344995	-0.991702	1.579507	-0.063795	0.477463	0.5646	0.5730	82
0.654431	-0.658470	-0.022232	1.036398	0.453371	0.143672	0.9248	0.7315	83
-0.201826	-0.729608	0.262372	0.366374	0.290594	0.885860	0.5420	0.0623	84
-0.969661	0.451803	-1.320892	-0.519191	0.332565	-0.576300	0.7194	0.0220	85
1.020808	0.384667	-0.527610	-0.344136	0.612407	-0.190670	0.1020	0.8093	86
1.429518	0.467302	-1.452132	-0.402463	-0.279872	0.768617	0.7732	0.9656	87
0.319358	1.021895	-1.559595	-1.069670	0.427643	0.215023	0.3454	0.5402	88
-0.351579	-0.196352	0.140036	-1.125398	2.254065	0.499644	0.4704	0.2171	89
1.551178	-0.073458	-0.283553	0.435727	-0.635044	-0.179412	0.0082	0.5596	90
-0.632515	0.212346	-0.875072	-0.058544	-0.557775	-0.083547	0.9544	0.7925	91
-0.124019	-2.507103	-0.973577	-0.370686	-0.604765	-0.766429	0.4204	0.5186	92
-0.655833	-0.112641	0.795071	-0.111942	0.724751	1.551098	0.8366	0.6832	93
-1.247405	1.106324	-0.263780	-0.364130	0.469709	2.310134	0.4992	0.8925	94
1.539290	-0.170533	0.043092	0.619468	1.151849	-0.825327	0.0295	0.1295	95
2.621799	-1.420042	0.226524	0.591430	-0.002374	-0.291523	0.2724	0.5510	96
0.929296	0.010225	0.978142	-0.612089	0.435237	0.271645	0.2934	0.6834	97
-0.554218	0.966443	-0.599442	-2.108748	0.237493	0.794947	0.9260	0.6020	98
-0.117519	0.132028	0.219131	1.612525	-1.262596	0.479921	0.7802	0.1628	99
0.332018	1.125009	0.196677	1.083762	0.746354	-0.915559	0.2613	0.3918	100
0.466673	1.725455	-1.391050	0.741232	0.057065	-0.577419	0.6043	0.3879	101
-0.613493	-0.603424	-0.881212	0.796399	-0.470197	0.339347	0.3494	0.3417	102
0.624960	2.275873	2.617593	1.057749	-0.378181	-0.587082	0.2215	0.7011	103
0.846026	-1.329204	-0.535326	0.558350	-0.770061	0.814473	0.1172	0.0056	104
0.972214	0.236543	-0.113635	-0.311384	-0.925612	-1.736930	0.1409	0.5019	105
-0.401683	0.732573	-1.453033	-0.854474	0.361793	-0.394021	0.2027	0.5189	106
-1.066477	0.200350	-0.673105	-0.701571	-0.578536	-0.543404	0.3047	0.5780	107
-0.619130	-0.783993	-1.375001	-0.567638	-2.145540	1.976610	0.2058	0.3388	108
-0.679661	-1.422192	0.742267	-0.787039	-0.088526	1.037230	0.0013	0.8435	109
1.141165	-1.025604	1.265678	-0.404113	-1.143339	-0.526557	0.9499	0.9345	110
1.017176	-0.579510	0.319412	-0.929903	-0.300923	-0.640521	0.3711	0.4057	111
0.361497	-0.110034	-0.427352	-0.024867	0.727217	0.126520	0.5442	0.8325	112
0.322876	-1.072943	1.554498	0.053101	-0.259446	0.981755	0.7580	0.4721	113
0.325512	1.445420	-1.430639	-1.220572	1.085372	-0.259924	0.6129	0.1736	114

-1.523731	1.132291	-0.222455	0.092322	-0.756226	-0.833754	0.3544	0.3778	115
-0.403790	-0.051367	-0.990879	1.363959	2.083040	-0.482269	0.5665	0.5882	116
-1.276775	[illegible]	-0.111661	0.942004	-0.660826	0.254568	0.1160	0.7663	117
0.583164	1.354652	1.268705	-1.049110	-0.573624	-0.719913	0.5746	0.7458	118
0.246931	1.309900	0.205326	-0.926853	0.329366	-1.030138	0.7346	0.7027	119
-0.743186	-0.994905	-0.361974	0.231498	1.377307	0.397802	0.6491	0.8842	120
0.340552	1.035965	-1.231699	-0.610574	1.396518	0.797033	0.2013	0.2525	121
1.562913	0.710364	1.633549	-1.363300	-1.813682	0.393714	0.9396	0.9766	122
0.056319	1.217709	1.379448	-0.925600	-0.503431	-1.237909	0.2404	0.8064	123
-0.427255	-0.436757	-1.178539	-0.428559	0.209051	-0.451125	0.3292	0.9405	124
0.258549	0.290872	-0.557574	0.099307	-0.148359	1.148704	0.6463	0.1823	125
0.379722	1.213993	-0.713215	1.246122	-0.644195	0.150831	0.5747	0.6471	126
1.275262	0.213395	-0.474692	0.428334	-0.276467	-0.666494	0.3029	0.2852	127
-0.314324	-0.351273	-2.135304	0.829395	1.838371	0.045949	0.4129	0.4348	128
1.774528	-1.532173	1.461729	0.593552	-1.231205	1.542082	0.4187	0.8612	129
0.341345	0.591799	-1.491652	1.988042	1.291144	0.071168	0.4096	0.3855	130
1.275656	0.706237	-1.039959	-0.151320	-1.109558	0.641939	0.2531	0.6122	131
-0.526931	0.855255	1.253383	0.220027	-0.344772	0.793163	0.6497	0.2681	132
-0.283554	-1.931172	-0.109276	1.233533	0.847340	-2.249614	0.3692	0.7267	133
1.300095	-0.503178	-0.067214	1.575913	1.076335	0.732763	0.5278	0.8069	134
-0.748911	0.652311	-1.537614	-0.239036	-1.633384	-0.716729	0.3909	0.5836	135
1.325771	1.287056	-1.764967	0.215862	-0.209532	-0.495615	0.2039	0.5801	136
-1.917509	-0.953225	-0.762659	0.193312	1.515995	-0.932935	0.7097	0.1758	137
-0.337653	-0.073635	2.185055	-0.271068	0.229468	0.078444	0.6557	0.4045	138
-0.643022	-1.072452	0.523673	-0.379461	0.872304	-1.792092	0.1973	0.5983	139
1.309519	0.472992	0.574942	-1.049316	-1.969724	-1.311295	0.3571	0.0151	140
-0.169712	-0.996870	-0.821565	0.314612	0.012451	1.172223	0.7313	0.1441	141
-0.576767	2.115312	-1.631615	0.203060	0.228058	0.168059	0.7087	0.1905	142
-0.254417	0.517417	1.055355	-0.165593	0.065697	0.173333	0.6932	0.2583	143
0.547977	0.652167	-1.117778	-0.267618	-1.457099	1.078515	0.6324	0.2376	144
0.995715	-0.332670	0.594577	-0.197014	-0.227339	0.326275	0.2327	0.4330	145
-3.025062	2.478868	2.334744	-1.058004	-1.085083	-1.456330	0.3615	0.0354	146
-0.477777	0.969409	-0.360743	-1.709162	-0.489820	0.612058	0.7021	0.7719	147
0.146957	-0.390623	-0.992138	-0.611988	-0.353380	-0.655586	0.4516	0.1977	148
0.083236	-1.053635	-0.540750	1.722920	1.751027	-0.575658	0.3483	0.7885	149
-2.223153	-1.324516	0.360575	0.491344	-0.113233	-0.709328	0.5890	0.0601	150
-0.192315	0.876157	0.798521	-1.100960	0.083389	-1.277384	0.6565	0.7071	151
0.556623	-1.016118	-0.533066	-0.598319	0.257089	-1.334832	0.2050	0.6479	152
-0.132727	0.006410	-0.265522	1.729978	-1.425119	0.036264	0.5061	0.7293	153
-0.144432	0.952570	1.570084	0.159338	0.079234	-0.316469	0.4516	0.0253	154
0.047134	-0.467462	-0.412135	1.356368	0.373524	0.033268	0.3912	0.5446	155
0.542222	-1.387731	0.553970	1.063701	-1.144817	-0.438384	0.6058	0.0039	156
-1.377196	0.616670	-0.511881	0.306622	0.597310	-0.270857	0.2057	0.1234	157
1.230053	-0.050325	-0.197459	-0.716790	-0.954618	2.376064	0.8372	0.4747	158
2.443521	-0.211413	-0.560665	1.309354	-0.730653	-0.155733	0.1404	0.5612	159
-0.261067	-0.909030	0.333637	0.564982	1.169854	-2.496845	0.7065	0.8698	160
0.918033	-1.163378	-0.556578	0.701467	0.108597	-0.039692	0.9071	0.5193	161
0.867615	-0.089916	1.491509	-1.173066	-0.371359	0.131237	0.5514	0.8709	162
-1.094567	0.101051	0.112694	0.747080	-0.159714	0.059231	0.0073	0.5326	163
-0.493524	0.379670	-0.060353	1.009854	1.631987	0.047901	0.6639	0.2935	164
-1.422113	0.105765	0.739790	1.431635	0.368139	-0.548236	0.6980	0.2214	165
0.695776	-0.531239	1.564301	0.692979	1.480275	-0.676812	0.9185	0.7905	166
-3.143373	0.221657	-1.308901	0.155106	-0.645075	-0.960948	0.2061	0.1365	167
0.347537	0.833504	-1.615606	1.101759	0.701303	-1.859900	0.2548	0.7385	168
-0.113255	1.764359	-0.767565	-0.533446	0.333549	0.066916	0.1725	0.1190	169
1.093234	-0.774192	0.367936	-0.067268	-0.549349	0.090321	0.1720	0.6126	170
-1.017229	-2.731125	-0.247525	1.326252	-1.610320	-2.170767	0.5477	0.4061	171
0.112434	-0.835905	0.586767	2.368103	1.734451	1.049031	0.1419	0.0983	172

1.687332	1.775465	1.298701	-1.727962	0.475492	-1.034727	0.4092	0.2647	173
-0.637559	0.503406	-0.652500	0.643687	0.213616	-2.573146	0.5052	0.1601	174
-0.934771	-1.129263	-0.693672	1.531954	-0.749488	-2.675533	0.0527	0.1329	175
-0.155660	-1.460402	-0.120253	-1.160555	-1.981040	-0.813098	0.3892	0.7098	176
0.345323	1.420660	-0.539074	-3.200334	0.556141	-0.226491	0.3087	0.2023	177
-0.751199	0.535461	0.543906	0.641156	-0.706106	1.003545	0.4117	0.0897	178
-1.855572	-1.555226	-0.776058	0.559334	-1.216662	1.040019	0.7042	0.3200	179
-0.081303	-0.324573	-0.352119	-0.576430	0.009624	0.651546	0.7269	0.1219	180
-0.702592	1.743353	-0.233977	-0.453476	1.254628	0.369436	0.5726	0.0643	181
-1.107615	-0.350562	0.584957	-0.902770	0.658406	1.457361	0.4264	0.0332	182
0.615253	1.326273	1.069508	1.141069	-0.958541	-0.817757	0.4515	0.8851	183
0.653560	0.332161	-0.469231	0.163950	0.703517	0.041946	0.0714	0.6592	184
-0.421115	0.225493	-1.241546	-1.454878	0.008954	0.529500	0.0411	0.3029	185
-0.798212	-1.343699	-0.310659	1.686983	0.830711	0.703165	0.4156	0.4478	186
0.182179	0.307965	-0.550015	-0.588307	-0.446588	-0.165865	0.6023	0.4135	187
-0.633428	-0.017114	0.062128	-0.707214	-0.036977	0.571375	0.7917	0.2390	188
-2.103418	0.372084	-0.452625	-2.013805	1.362491	1.134261	0.6711	0.4626	189
-0.114516	-0.232128	-0.977503	0.466470	-1.527401	-1.068080	0.2680	0.6560	190
-0.899547	0.234952	-1.683093	-0.758649	0.233077	-0.357158	0.4484	0.6617	191
1.116194	-0.713294	-1.003966	0.271955	-0.954173	0.255931	0.1845	0.8671	192
-1.547764	-1.000325	0.678335	-0.029750	-0.270196	-0.510606	0.4147	0.3139	193
0.407335	0.230547	0.688277	1.071246	1.566442	0.917330	0.8753	0.4395	194
1.566525	0.313113	0.116922	-1.057239	-0.341720	1.937933	0.4339	0.3101	195
-1.059361	-1.755704	-2.142940	1.002330	-0.042687	0.212593	0.4350	0.9994	196
1.170474	-0.133257	0.303559	-0.017602	1.307267	0.079059	0.3865	0.0233	197
0.098151	0.031394	0.765493	0.734245	0.238589	-2.319867	0.7723	0.5736	198
-0.383387	-0.345179	0.370781	2.848198	1.442552	1.594900	0.1133	0.4161	199
-1.709152	0.065182	-0.719651	-0.054607	0.459599	0.195134	0.0337	0.3632	200

(B) Computer Program for Simulation

This program uses the random numbers generated in the previous program to implement the simulation model.

Input to the program:

(1) Through DATA statement:

ADP	Average of square root of central pressure index of hurricane in inches of mercury
SIGDP	Standard deviation of
AR	Averaging the radius of maximum wind in nautical miles
SIGR	Standard deviation of
APHI	Average azimuth of hurricane direction
SIGPHI	Standard deviation of
AV	Average speed of hurricane center in knots
SIGV	Standard deviation of
RANGE	Length of coastline considered in simulation

(2) Through executable statements:

PHIS	Azimuth of the imaginary straight coastline
SHFACT	Shoaling factor from Shore Protection Manual
SIGTID	Standard deviation of tide amplitudes for hurricane season

(3) Sets of random numbers either on disk or cards. In the present case cards have been used.

Output from the program:

(1) Listing of the data read for interpolating the Shore Protection Manual nomographs.

(2) Listing of sets of random numbers which were beyond the range of the nomographs.

(3) Listing of the actual hurricane parameters used in the simulation and computed hurricane surge on disk and printer. The output on disk only was used in the present instance for finding the extreme value distribution of the surge and the parameters.

```
αSET AUTOBIND
αBIND= FROM FORTLIB/=
FILE  8(TITLE= DELSURGE  ,KIND=DISKPACK,MAXRECSIZE=14,BLOCKSIZE=420)
FILE  9(TITLE= ALLDATA   ,KIND=DISKPACK,MAXRECSIZE=14,BLOCKSIZE=420)
      LOGICAL Q
      EXTERNAL SURGET
      COMMON/F/SURGEF,TIDEA,T2BY3,THR,PHASE
      DATA DPMIN,DPMAX,RMIN,RMAX,PHIMIN,PHIMAX,VMIN,VMAX,NDP,NRAD,NPHI,
     1 NVEL /0.0,140.0, 7.5,67.5,-20.0,380.0,0.0,30.0,15,9,41,7 /
      DATA ADP,SIGDP,AR,SIGR,APHI,SIGPHI,AV,SIGV,RANGE
     1 /1.22,.212,36.3,12.2,214.,24.2,17.5,6.3,500./
      DIMENSION SSPR(15,9),SSF(41,7),WK(20),Y(1)
      DIMENSION SSP(1),SSFACT(1),SURGE(950)
      DIMENSION WSF(287)
      EQUIVALENCE(WSF(1),SSF(1,1))
      FNAUT=6080.0/5280.0
      PHIS=45.0
      SHFACT=0.9
      SIGTID=7.0/3.0
      RANGE2=RANGE/2.0
      HGMB=1.0/0.0295
      READ(5,50) SSPR
   50 FORMAT(5X,15F5.0)
      WRITE(6,65) SSPR
   65 FORMAT(10X,15F8.3)
      READ(5,51) SSF
   51 FORMAT(5X,15F5.0/16F5.0/10F5.0,30X)
      WRITE(6,66)(WSF(I),WSF(I+41),WSF(I+82),WSF(I+123),WSF(I+164),
     1 WSF(I+205),WSF(I+246),I=1,41)
   66 FORMAT(10X,7F10.4)
      PH=0.24
      THR=12.57
      IU=63127
      IN=651741
      DIMENSION A(950)
      N=950
```

```
      CALL GRAND(A,N,IN)
      CALL NORMAL(A,N,0.,1.)
      NY=0
   99 SURGEN=0.0
      NY=NY+1
   98 CONTINUE
      IF(URAN31(IU)-PN) 30,30,40
   30 CONTINUE
      READ(5,55,END=100)  DP,R,PHI,V,TIDE1,TIDE2,DIST,PHASE,NS
   55 FORMAT(6F10.6,1X,2F7.4,1X,I4)
      DP=DP*SIGDP+ADP
      DPMB=HGMB*DP**2
      R=R*SIGR+AR
      SSP(1)=R*FNAUT
      CALL CSIE2(DPMIN,DPMAX,RMIN,RMAX,NDP,NRAD,SSPR,DPMB,
     1 1,SSP,WK,NDP,\1)
      GO TO 10
    1 WRITE(6,61)
   61 FORMAT(15X, ERROR IN PRESSURE AND RADIUS DATA )
      WRITE(6,66) DP,R,PHI,V,DIST
       GO TO 98
   10 CONTINUE
      V=V*SIGV+AV
      SSFACT(1)=V*FNAUT
      PHI=PHI*SIGPHI+APHI
      PHIB=PHI-PHIS
      CALL CSIE2(PHIMIN,PHIMAX,VMIN,VMAX,NPHI,NVEL,SSF,PHIB,1,SSFACT,
     1 WK,NPHI,\2)
      GO TO 20
    2 WRITE(6,63)
   63 FORMAT(15X, ERROR IN ANGLE AND VELOCITY DATA )
      WRITE(6,66) DP,R,PHI,V,DIST
      GO TO 98
   20 CONTINUE
      SURGEP=SHFACT*SSFACT(1)*SSP(1)
      DIST=DIST*RANGE-RANGE2
      D2BY3=76.73333+V*(1.1-0.00625*V)-0.01452*R*R
      SURGEF=SURGEP*EXP(-0.40547*(2.0*DIST/D2BY3)**2)
```

```
      TIDEA=SIGTID*(TIDE1**2+TIDE2**2)
      TIDEA=SQRT(TIDEA)
      T2BY3=0.80674+0.89414*R/V+0.20797*R/V*SIN(PHI)
      TT=(0.5-PHASE)*THR
      TL=AMIN1(TT,0.0)
      TU=AMAX1(TT,0.0)
      TOL=1.0E-3
      Q=.TRUE.
      CALL FIBON(SURGET,TL,TU,Q,TOL,SURGEH,T)
C    SURGEP IS THE MAXIMUM SURGE ANYWHERE IN THE REGION
C   SURCEF IS THE MAXIMUM SURGE AT THE POINT OF INTEREST
C   SURGEH IS THE COMBINED MAXIMUM SURGE DUE TO HURRICANE AND TIDE
C   TT IS THE TIME IN HOURS THE TIDE LAGS THE PEAK HURRICANE SURGE
      WRITE(9,90)  NY,DP,R,PHI,V,TIDEA**2,DIST,TT,SURGEP,
     1 SURGEF,SURGEH,NS
   90 FORMAT(I5,10F7.2,I5)
   40 SSG=A(NY)*0.6+5.37
      A(NY)=SSG
      SURGE(NY)=AMAX1(SURGEH,SSG)
      GO TO 99
  100 WRITE(6,69)
   69 FORMAT(10X, OPERATION SUCCESSFULLY COMPLETED )
      WRITE(8,75)(SURGE(I),A(I),I=1,NY)
   75 FORMAT(2F10.2)
      LOCK 8
      LOCK 9
      STOP
      END

      SUBROUTINE GRAND(A,N,IX)
      REAL*8 TP8
      DIMENSION A(N)
      DIMENSION B(625)
      M=25
      DO 1 I=1,N
      DO 2 J=1,M
        UO=URAN31(IX)
```

```
      UT=URAN31(IX)
      B(J)=SQRT(-2.0*ALOG(UO))*COS(6.28315*UT)
    2 CONTINUE
      TP8=0.0D0
      DO 3 J=1,M
    3 TP8=TP8+B(J)
      A(I)=TP8
    1 CONTINUE
      RETURN
      END

      SUBROUTINE NORMAL(A,N,AVER,SIG)
      DIMENSION A(N)
      DOUBLE PRECISION SUM
      SUM=0.0D0
      DO 1 I=1,N
    1 SUM=SUM+A(I)
      AM=SUM/DFLOAT(N)
      SUM=0.0D0
      DO 2 I=1,N
      TP=A(I)-AM
    2 SUM=SUM+TP*TP
      SUM=SUM/DFLOAT(N)-DBLE(AM*AM)
      SIGMA=DSQRT(SUM)
      DO 3 I=1,N
    3 A(I)=(A(I)-AM)/SIGMA
      DO 4 I=1,N
    4 A(I)=A(I)*SIG+AVER
      RETURN
      END

      FUNCTION SURGET(T)
      COMMON/F/SURGEF,TIDEA,T2BY3,THR,PHASE
      SURGET=SURGEF*EXP(-0.40547*(2.0*T/T2BY3)**2)
     1 +TIDEA*COS(6.28*(T/THR+PHASE-0.5))
      RETURN
      END
```

0.000	1.800	3.600	5.400	7.200	8.900	10.800	12.800	14.800	16.700	18.700	20.70
0.000	2.000	4.000	6.000	8.000	10.100	12.200	14.200	15.300	18.400	20.500	22.50
0.000	2.200	4.200	6.400	8.600	10.900	13.100	15.300	17.600	19.900	22.200	24.50
0.000	2.300	4.400	6.600	8.800	11.100	13.600	16.000	18.500	20.900	23.400	25.90
0.000	2.200	4.300	6.400	8.600	10.800	13.200	15.500	17.900	20.200	22.500	24.90
0.000	2.050	4.000	6.200	8.300	10.400	12.600	14.800	17.000	19.200	21.500	23.90
0.000	2.000	4.000	5.900	7.800	9.800	11.800	13.700	16.000	18.100	20.400	22.60
0.000	1.800	3.600	5.400	7.200	8.900	10.800	12.800	15.000	17.000	19.100	21.20
0.000	1.700	3.400	5.100	6.800	8.500	10.200	11.900	13.900	15.900	17.900	19.90

0.6180	0.5300	0.5700	0.5850	0.6000	0.6750	0.7300
0.6180	0.5900	0.5950	0.6100	0.6400	0.7050	0.7550
0.6180	0.6200	0.6400	0.6600	0.7050	0.7550	0.8050
0.6180	0.6500	0.7100	0.7500	0.8050	0.8650	0.9250
0.6180	0.6900	0.8050	0.8700	0.9300	1.0100	1.0500
0.6180	0.7200	0.8650	0.9550	1.0250	1.1000	1.1500
0.6180	0.7100	0.8600	0.9650	1.0750	1.1500	1.2200
0.6180	0.6850	0.8300	0.9650	1.1000	1.1900	1.2700
0.6180	0.6300	0.8200	0.9850	1.1100	1.2200	1.3100
0.6180	0.7000	0.8400	1.0100	1.1300	1.2400	1.3300
0.6180	0.7250	0.8600	1.0150	1.1400	1.2500	1.3350
0.6180	0.7250	0.8600	1.0000	1.1250	1.2350	1.3100
0.6180	0.7050	0.8400	0.9650	1.0900	1.2050	1.2750
0.6180	0.6800	0.8000	0.9100	1.0350	1.1600	1.2400
0.6180	0.6600	0.7550	0.8600	0.9800	1.1150	1.2000
0.6180	0.6550	0.7200	0.8150	0.9300	1.0600	1.1500
0.6180	0.6500	0.7050	0.7850	0.8900	1.0050	1.0900
0.6180	0.6500	0.7000	0.7650	0.8600	0.9500	1.0250
0.6180	0.6400	0.7000	0.7600	0.8500	0.9100	0.9450
0.6180	0.6400	0.6900	0.7550	0.8350	0.8800	0.9000
0.6180	0.6300	0.6750	0.7400	0.8150	0.8400	0.8650
0.6180	0.6100	0.6450	0.7050	0.7600	0.7900	0.8200
0.6180	0.5900	0.6100	0.6400	0.6750	0.7050	0.7400
0.6180	0.5800	0.5800	0.5800	0.6000	0.6200	0.6500
0.6180	0.5750	0.5600	0.5400	0.5400	0.5700	0.5800
0.6180	0.5700	0.5400	0.5050	0.4950	0.5300	0.5300
0.6180	0.5600	0.5200	0.4900	0.4800	0.5000	0.4800
0.6180	0.5500	0.5100	0.4900	0.4800	0.4750	0.4550
0.6180	0.5450	0.5000	0.4950	0.4500	0.4600	0.4500
0.6180	0.5450	0.4950	0.5000	0.5100	0.4450	0.4550
0.6180	0.5500	0.5000	0.5100	0.5250	0.4500	0.4700
0.6180	0.5500	0.5000	0.5200	0.5400	0.4550	0.4900
0.6180	0.5100	0.5050	0.5300	0.5600	0.4700	0.5150
0.6180	0.5450	0.5100	0.5400	0.5650	0.5400	0.5750
0.6180	0.5500	0.5200	0.5500	0.5700	0.6200	0.6800
0.6180	0.5600	0.5400	0.5700	0.5850	0.6500	0.7150
0.6180	0.5750	0.5650	0.5850	0.6000	0.6750	0.7300
0.6180	0.5950	0.5950	0.6100	0.6400	0.7050	0.7550
0.6180	0.6200	0.6400	0.6600	0.7050	0.7550	0.8050
0.6180	0.6500	0.7100	0.7500	0.8050	0.8650	0.9250
0.6180	0.6900	0.8050	0.8700	0.9300	1.0100	1.0500

```
ERROR IN INPUT TO CSIE2 SUBROUTINE
       ERROR IN PRESSURE AND RADIUS DATA
     1.2905    69.8334    0.5675   -0.8267    0.5332
ERROR IN INPUT TO CSIE2 SUBROUTINE
       ERROR IN ANGLE AND VELOCITY DATA
     0.8371    26.0141   180.0599   29.6703    0.9181
ERROR IN INPUT TO CSIE2 SUBROUTINE
       ERROR IN ANGLE AND VELOCITY DATA
     1.0693    26.1480   222.7566   30.2595    0.9478
ERROR IN INPUT TO CSIE2 SUBROUTINE
       E    R I    HG    ANG    LO    Y D
     1.1352    27.6270   243.3128   29.4764    0.3024
```

```
    1.2461    22.0215   261.6764    26.1620    0.5305
INPUT TO CSIE2 SUBROUTINE
     ERROR IN PRESSURE AND RADIUS DATA
    1.2405     5.3690     0.3592    -0.5304    0.5069
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.3357    41.8572   177.7413    28.5142    0.8339
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.2719    40.2219   190.0008    27.4509    0.5046
INPUT TO CSIE2 SUBROUTINE
     ERROR IN PRESSURE AND RADIUS DATA
    1.1937     5.7133    -0.9736    -0.3707    0.4204
INPUT TO CSIE2 SUBROUTINE
     ERROR IN PRESSURE AND RADIUS DATA
    1.3525    64.0657     2.9196     1.0577    0.2215
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.1344    35.0245   191.7147    26.0929    0.5668
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.2924    46.0010   179.5912    30.0247    0.4996
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.6016    39.1612   212.3734    27.4283    0.5278
INPUT TO CSIE2 SUBROUTINE
     ERROR IN PRESSURE AND RADIUS DATA
    1.0277    62.1434    -1.6316     0.2031    0.7087
INPUT TO CSIE2 SUBROUTINE
     ERROR IN PRESSURE AND RADIUS DATA
    0.5737    66.9415     2.3047    -1.0580    0.3215
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.2376    13.1900   200.9139    28.3544    0.3483
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.1219    46.1392   207.5477    29.6589    0.5061
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.2304    39.3530   204.0263    26.0591    0.3212
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.3350    12.0997   229.9745    29.2413    0.6058
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    0.9176    37.5901   231.7335    26.5193    0.6080
INPUT TO CSIE2 SUBROUTINE
     ERROR IN PRESSURE AND RADIUS DATA
    1.0043     0.5427    -0.2495     1.3263    0.5677
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.2438    46.3770   223.1998    32.4190    0.1419
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.0218    22.5551   197.2131    27.1516    0.0227
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.2933    53.7297   200.9551    -2.6637    0.8987
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.0505    19.4129   206.4966    28.1280    0.4156
INPUT TO CSIE2 SUBROUTINE
     ERROR IN ANGLE AND VELOCITY DATA
    1.1377    25.2784   237.4929    35.4436    0.1133
OPERATION SUCCESSFULLY COMPLETED
```

MAIN PROGRAM

VOL1 652020601 1
HDR1 LINE 0001000100010O100 76208 76213 000000000000000 B65C0
HDR2F00020C0020 30,000000000000000004680 00

MAIN PROGRAM

```
B6700/B7700   F O R T R A N   C O M P I L A T I O N   M A R K   2.6.000   MONDAY, 07/26/76   06:23 PM

                                                                                   FIB IS 0009 LONG
                                                                                   FIB IS 0007 LONG
                                                                            START OF SEGMENT 002
FILE   1=HTHDATA,UNIT=DISKPACK,RECORD=19,AREA=570*60,BLOCKING=30           00001010  C  002:0000:0
FILE   2=DATA,UNIT=DISKPACK,RECORD=14,BLOCKING=30                          00001020  C  002:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                                    00002000  C  002:0000:0
      COMMON /THRD/ C1,C2,C7,C17,C19,C21,C22,C23,C24,C25                   00003000  C  002:0000:0
      COMMON /FFTH/ ITIME,KTIME,MHALT                                      00004000  C  002:0000:0
      COMMON /HTS/ HTH(19,81)                                              00005000  C  002:0000:0
      COMMON /FRTH/ IC12,IC19                                              00006000  C  002:0000:0
      COMMON /DELTH/ NDLTHR,NDLTH2,DLTHR,DLTH2                             00007000  C  002:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                                        00008000  C  002:0000:0
      NDLTHR=3600./DELT                                                    00009000  C  002:0000:0
      NDLTH2=NDLTHR/2                                                      00010000  C  002:0002:1
      DLTHR=NDLTHR                                                         00011000  C  002:0004:1
      DLTH2=NDLTHR                                                         00012000  C  002:0005:4
      IC19=2*NDLTHR                                                        00013000  C  002:0007:1
      DO 5 I=1,81                                                          00014000  C  002:0009:1
      HTH(1,I)=0.                                                          00015000  C  002:000A:0
    5 CONTINUE                                                             00016000  C  002:000C:1
      CALL STRMPR                                                          00017000  C  002:000E:2
      X12(49)=C1                                                           00018000  C  002:000F:0
      X12(50)=C2                                                           00019000  C  002:0010:3
      ANG=C22                                                              00020000  C  002:0012:0
      X12(20)=COS(ANG)                                                     00021000  C  002:0013:1
      X12(21)=SIN(ANG)                                                     00022000  C  002:0015:1
      CALL INITLZ                                                          00023000  C  002:0017:1
      CALL CMPUTE                                                          00024000  C  002:0017:5
      STOP                                                                 00030000  C  002:0018:3
      END                                                                  00031000  C  002:0019:2
                                                                            SEGMENT 002 IS 001E LONG

##############################################################################################################

                                                                            START OF SEGMENT 005
      SUBROUTINE DATEX(JULHR,KYR,KMO,KDA,KHR,KDAYWK)                       00032000  C  005:0000:0
C**CONVERTS JULHR, THE NUMBER OF HOURS SINCE 0000Z,JAN1,1901, TO DATE      00033000  C  005:0000:0
C** IN TERMS OF DAY, MONTH, YEAR, AND HOUR OF DAY                          00034000  C  005:0000:0
      COMMON /MTH/ MONTH(12)                                               00035000  C  005:0000:0
      DIMENSION KWEEK(7)                                                   00036000  C  005:0000:0
      DATA KWEEK/3HSUN,3HMON,3HTUE,3HWED,3HTHU,3HFRI,3HSAT/                00037000  C  005:0000:0
      JULDA=JULHR/24                                                       00038000  C  005:0000:0
      KWK=MOD(JULDA,7)                                                     00039000  C  005:0001:3
      KDAYWK=KWEEK(KWK+1)                                                  00040000  C  005:0002:4
      KHR=JULHR-JULDA*24                                                   00041000  C  005:0003:3
      KLEAP=(JULDA+307)/1461                                               00042000  C  005:0005:3
      LLEAP=(JULDA+306)/1461                                               00043000  C  005:0007:5
      JULDA=JULDA-KLEAP                                                    00044000  C  005:000A:1
      KYR=JULDA/365+1                                                      00045000  C  005:000B:4
      JULDA=JULDA-365*(KYR-1)                                              00046000  C  005:000D:2
      DO 10 JMO=2,12                                                       00047000  C  005:000F:5
      IF(JULDA.GT.MONTH(JMO))  GO TO 10                                    00048000  C  005:0011:0
      KMO=JMO-1                                                            00049000  C  005:0013:0
      GO TO 15                                                             00050000  C  005:0014:2
   10 CONTINUE                                                             00051000  C  005:0014:5
      KMO=12                                                               00052000  C  005:0017:0
   15 KDA=JULDA-MONTH(KMO)+KLEAP-LLEAP                                     00053000  C  005:0017:5
      RETURN                                                               00054000  C  005:001B:0
      END                                                                  00055000  C  005:001B:3
                                                                            SEGMENT 005 IS 0023 LONG
```

```
##########################################################################################################

                                                                               START OF SEGMENT 006
      FUNCTION JULHR(KDA,KMO,KYR,KHR)                                 00056000  C  006:0000:0
C**   TIMI IN HOURS SINCE 0000Z,JAN 1, 1901                           00057000  C  006:0000:0
      COMMON /MTH/ MONTH(12)                                          00058000  C  006:0000:0
      JUL=KDA+MONTH(KMO)                                              00059000  C  006:0000:0
      INCR=.208 333 333 333 333E-1*(12*KYR+KMO-3) + .1E-7             00060000  C  006:0002:1
      JUL=JUL+INCR+365*(KYR-1)                                        00061000  C  006:0008:5
      JULHR=24*JUL+KHR                                                00062000  C  006:0008:5
      RETURN                                                          00063000  C  006:000D:5
      END                                                             00064000  C  006:000E:2
                                                                             SEGMENT 006 IS 0010 LONG

##########################################################################################################

                                                                               START OF SEGMENT 007
      SUBROUTINE TIMER                                                00065000  C  007:0000:0
      COMMON /DUMMY2/ I1(151),I2(151)                                 00066000  C  007:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                               00067000  C  007:0000:0
      COMMON /THRD/ C1,C2,C7,C17,C19,C21,C22,C23,C24,C25              00068000  C  007:0000:0
      COMMON /FFTH/ ITIME,KTIME,MHALT                                 00069000  C  007:0000:0
      COMMON /SXTH/ NMAX,NMX1,NMX2,LMAX,LMX1,LMX2                     00070000  C  007:0000:0
      X12(49)=X12(49)+C21*X1(9)*X12(20)                               00071000  C  007:0000:0
      X12(50)=X12(50)+C21*X1(9)*X12(21)                               00072000  C  007:0003:5
C     SET KTIME=2 WHEN STARTING PROGRAM AT TIMI=0,BUT NOT FOR A RESTAR  00073000  C  007:0007:4
  100 IF (KTIME.NE.2) GO TO 1504                                      00074000  C  007:0007:4
      KTIME=0                                                         00075000  C  007:0009:1
      IQ=LMAX                                                         00076000  C  007:000A:1
      IC=0                                                            00077000  C  007:000B:2
      GO TO 1506                                                      00078000  C  007:000C:0
 1504 IQ=0                                                            00079000  C  007:000C:3
      IC=LMAX                                                         00080000  C  007:000D:1
 1506 KTIME=KTIME+1                                                   00081000  C  007:000E:2
      ITIME=ITIME+1                                                   00082000  C  007:0010:0
      TIMI=ITIME                                                      00083000  C  007:0011:4
      DO 1520 L=1,LMAX                                                00084000  C  007:0013:1
      I1(L)=L+IQ                                                      00085000  C  007:0014:0
      I2(L)=L+IC                                                      00086000  C  007:0016:2
 1520 CONTINUE                                                        00087000  C  007:0018:5
      RETURN                                                          00088000  C  007:001B:2
      END                                                             00089000  C  007:001B:5
                                                                             SEGMENT 007 IS 0021 LONG

##########################################################################################################

                                                                               START OF SEGMENT 008
      BLOCK DATA                                                      00090000  C  008:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                               00091000  C  008:0000:0
      COMMON /THRD/ C1,C2,C7,C17,C19,C21,C22,C23,C24,C25              00092000  C  008:0000:0
      COMMON /FRTH/ IC12,IC19                                         00093000  C  008:0000:0
      COMMON /FFTH/ ITIME,KTIME,MHALT                                 00094000  C  008:0000:0
      COMMON /SXTH/ NMAX,NMX1,NMX2,LMAX,LMX1,LMX2                     00095000  C  008:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                                   00096000  C  008:0000:0
      COMMON /MTH/ MONTH(12)                                          00097000  C  008:0000:0
      COMMON /DMN/ AMON(12),  IDAY,NMNTH,IYEAR,IMTH                   00098000  C  008:0000:0
      COMMON /STRMPS/ XT(50),YT(50),PT(50),RT(50),DIR(50),SP(50),     00099000  C  008:0000:0
     A PDROP,RAD                                                      00100000  C  008:0000:0
      DATA ITIME,KTIME/0,2/                                           00101000  C  008:0000:0
      DATA ....,DE..../21.... 35 , ..0. , ...2 /                      .010....  C  ...:00..
      DATA NMAX,LMAX/ 10 , 151 /                                      0010....  C  ...:0000:0
```

```
 DATA IC12 /795/                                                  00104000  C  008:0000:0
 DATA C7,C17,C19,C25 / .006 , .00115 , 3.E-6,.25 /                 00105000  C  008:0000:0
 DATA X12(20),X12(21)/2*0./                                        00106000  C  008:0000:0
 DATA MONTH /-1,30,58,89,119,150,180,211,242,272,303,333/          00107000  C  008:0000:0
 DATA AMON/3HJAN,3HFEB,3HMAR,3HAPR,3HMAY,3HJUN,3HJUL,3HAUG,3HSEP,  00108000  C  008:0000:0
A 3HOCT,3HNOV,3HDEC /                                              00109000  C  008:0000:0
 DATA RAD/ 1.74532925E-2/                                          00110000  C  008:0000:0
 END                                                               00111000  C  008:0000:0

################################################################################################################

                                                                    FORMAT SEGMENT 034 IS 005D LONG.
                                                                    FORMAT SEGMENT 035 IS 0050 LONG.
                                                                    FORMAT SEGMENT 036 IS 0079 LONG.
                                                                    FORMAT SEGMENT 037 IS 0069 LONG.
      SUBROUTINE STRMPR                                            00112000  C  009:0000:0
 DIMENSION WM(150),WB(150), DUM1(50),DUM2(50),DUM3(8)              00113000  C  009:0000:0
 REAL*8  STA                                                       00115000  C  009:0000:0
 REAL*8 DUM1,DUM2,DUM3                                             00116000  C  009:0000:0
 REAL*8 NBPOS                                                      00117000  C  009:0000:0
 COMMON /THRD/ C1,C2,C7,C17,C19,C21,C22,C23,C24,C25                00119000  C  009:0000:0
 COMMON /FRTH/ IC12,IC19                                           00120000  C  009:0000:0
 COMMON /FFTH/ ITIME,KTIME,MHALT                                   00121000  C  009:0000:0
 COMMON /SXTH/ NMAX,NMX1,NMX2,LMAX,LMX1,LMX2                       00122000  C  009:0000:0
 COMMON /EGTH/ DELS,DELT,G,COR                                     00123000  C  009:0000:0
 COMMON /BSN/  PHI,ALAT                                            00124000  C  009:0000:0
 COMMON /RESULT/ HT(151),LSTRM                                     00125000  C  009:0000:0
 COMMON /SPRM/ PO,PE,RO,RE                                         00129000  C  009:0000:0
 COMMON  /STRMPS/ X(50),Y(50),P(50),R(50),DIR(50),SP(50),PDROP,RAD 00130000  C  009:0000:0
 COMMON /STRPOS/ ALT(5),ALN(5),AX(5),AY(5),ALTO,ALNO,PI            00131000  C  009:0000:0
 COMMON /STIME/ ISTM,JHR,IT,IBGNT,ITEND                            00132000  C  009:0000:0
 COMMON /LLPRT/ ALTI(5),ALNI(5),RLG(5),ANGD(5),RLNGTH              00133000  C  009:0000:0
 COMMON /DMN/ AMON(12),IDAY,NMNTH,IYEAR,IMTH                       00134000  C  009:0000:0
 COMMON /XYLL/ XLAT(50),YLONG(50)                                  00135000  C  009:0000:0
 COMMON /STRNA/ NBPOS,LMLE                                         00137000  C  009:0000:0
 COMMON /DELTH/ NDLTHR,NDLTH2,DLTHR,DLTH2                          00138000  C  009:0000:0
 EQUIVALENCE (PSI1,C22),(SPEED,C21),(SSIZE,C24)                    00140000  C  009:0000:0
 EQUIVALENCE (PHI,SLNT)                                            00141000  C  009:0000:0
 INTEGER AMON,AM                                                   00142000  C  009:0000:0
 DATA DUM1/50*1H /,DUM2/50*1H /                                    00151000  C  009:0000:0
 DATA DUM3/10H   INITLZE,10H  COMPTTNS,10H   NEAREST,10H  APPROACH 00152000  C  009:0000:0
1,10H   TERMNTE,10H  COMPTTNS,10H   TO BASI,10HN CENTER  /         00153000  C  009:0000:0
 DATA WB/12.,23.,29.,33.,37.,39.,41.,43.,45.,47.,49.,51.,53.,55.,  00154000  C  009:0000:0
157.,58.,60.,62.,63.,65.,67.,68.,70.,71.,73.,74.,76.,77.,78.,80.,  00155000  C  009:0000:0
281.,82.,84.,85.,86.,88.,89.,90.,92.,93.,94.,95.,96.,98.,99.,100., 00156000  C  009:0000:0
3101.,102.,104.,105.,106.,107.,108.,109.,110.,112.,113.,114.,115., 00157000  C  009:0000:0
4116.,117.,118.,119.,120.,121.,122.,123.,123.,124.,125.,126.,127., 00158000  C  009:0000:0
5128.,129.,130.,131.,132.,132.,133.,134.,135.,136.,137.,137.,138., 00159000  C  009:0000:0
6139.,140.,141.,141.,142.,143.,144.,145.,145.,146.,147.,148.,148., 00160000  C  009:0000:0
7149.,150.,151.,151.,152.,153.,154.,154.,155.,156.,157.,157.,158., 00161000  C  009:0000:0
8158.,159.,160.,160.,161.,162.,162.,163.,164.,164.,165.,166.,166., 00162000  C  009:0000:0
9167.,167.,168.,169.,169.,170.,171.,171.,172.,172.,173.,174.,174., 00163000  C  009:0000:0
1175.,175.,176.,176.,177.,177.,178.,179.,179.,180.,180.,181.,182./ 00164000  C  009:0000:0
 DATA WM/.10,.14,.17,.20,.23,.25,.28,.30,.32,.33,.35,.37,.38,.39,  00165000  C  009:0000:0
1.41,.42,.43,.44,.45,.46,.46,.47,.48,.49,.49,.50,.51,.52,.52,.53,  00166000  C  009:0000:0
2.53,.54,.54,.55,.56,.56,.57,.57,.58,.58,.59,.59,.60,.60,.61,.62,  00167000  C  009:0000:0
3.62,.63,.63,.64,.65,.65,.66,.66,.67,.68,.69,.69,.70,.71,.71,.72,  00168000  C  009:0000:0
4.72,.73,.73,.74,.74,.75,.75,.76,.76,.76,.77,.77,.77,.77,.78,.78,  00169000  C  009:0000:0
5.78,.78,.79,.79,.79,.79,.80,.80,.80,.80,.80,.81,.81,.81,.81,.81,  00170000  C  009:0000:0
6.82,.82,.82,.82,.82,.82,.83,.83,.83,.83,.84,.84,.84,.84,.84,.84,  00171000  C  009:0000:0
7.84,.85,.85,.85,.85,.85,.85,.85,.86,.86,.86,.86,.86,.86,.86,.86,  00172000  C  009:0000:0
9.86,.86,.87,.87,.87,.87,.87,.87,.87,.87,.87,.87,.87,.87,.87,.87,  00173000  C  009:0000:0
```

```
     9.87,.87,.87..87,.87,.87,.87,.87/                               00174000  C  009:0000:0
      READ 5,AIDENT                                                  00175000  C  009:0000:0
                                                                                   FIB IS 0006 LONG
    5 FORMAT(13A6,A2)                                                00176000  C  009:0007:2
      PRINT 6,AIDENT                                                 00182000  C  009:0007:2
                                                                                   FIB IS 0006 LONG
    6  FORMAT(1H1,13A6,A2/1X,13A6,A2,'  SPLASH CALCULATIONS PERFORMED AT 00183000  C  009:000E:2
     1 DAY -TIMI ',7A4//)                                            00184000  C  009:000E:2
      LSTRM=(LMAX-1)*.5                                              00185000  C  009:000E:2
C      READ NEAREST STATION TO CENTER OF BASIN, LATITUDE AND LONGITUDE 00186000  C  009:0012:3
C     OF BASIN CENTER, BASIN NUMBER (PRE-PUNCHED CARD)               00187000  C  009:0012:3
C     IBASIN= BASIN NUMBER FROM 1-30                                 00188000  C  009:0012:3
C     NCOAST=1, MEAN ON THE GULF COAST                               00189000  C  009:0012:3
C     NCOAST=2, MEANS ON THE EAST COAST                              00190000  C  009:0012:3
C     NBASIN= BASIN NUMBER FROM 1-15, ON EAST AND GULF CSTS REAPCTVLY 00191000  C  009:0012:3
      READ 7,STA                                                     00192000  C  009:0012:3
    7 FORMAT(2X,A10)                                                 00193000  C  009:001B:2
   24 IBASIN=20                                                      00204000  C  009:001B:2
      CALL CRDRED (IBASIN)                                           00205000  C  009:001C:1
C     READ 5 STORM PSTNS IN LAT AND LOND, 6 HRS APART IN REAL TIMI   00206000  C  009:001D:2
      DO 10 I=1,5                                                    00207000  C  009:001D:2
      READ 9, ALT(I),ALN(I)                                          00208000  C  009:001E:0
   10 CONTINUE                                                       00209000  C  009:0029:2
    9 FORMAT (2F10.5)                                                00210000  C  009:002B:3
C     READ INITIAL, AND FINAL, PRSSRE DROP AND STRM SIZE OF THE STRM 00211000  C  009:002B:3
      READ 12, PO                                                    00212000  C  009:002B:3
      READ 12,PE                                                     00213000  C  009:0033:2
      READ 12,RO                                                     00214000  C  009:003B:2
      READ 12,RE                                                     00215000  C  009:0043:2
   12 FORMAT (F5.1)                                                  00216000  C  009:004B:2
   70 DO 77 I=1,2                                                    00217000  C  009:004B:2
      GO TO  (71,72),I                                               00218000  C  009:004C:0
   71 PS=PO                                                          00219000  C  009:0051:0
      RS=RO                                                          00220000  C  009:0052:0
      GO TO 73                                                       00221000  C  009:0053:1
   72 PS=PE                                                          00222000  C  009:0053:4
      RS=RE                                                          00223000  C  009:0054:4
   73 IF ((PS.LT.10.).OR.(PS.GT.140.)) GO TO 75                      00224000  C  009:0055:5
      IF ((RS.LT.10.) .OR.(RS.GT.60.)) GO TO 76                      00225000  C  009:0058:1
   74 GO TO  77                                                      00226000  C  009:005A:3
   75 PRINT 90,PS                                                    00227000  C  009:005B:0
      GO TO 999                                                      00228000  C  009:0061:2
   76 PRINT 150,RS                                                   00229000  C  009:0061:5
      GO TO 999                                                      00230000  C  009:0068:2
  999 STOP                                                           00231000  C  009:0068:5
   77 CONTINUE                                                       00232000  C  009:006A:0
C     READ INITIAL TIMI, HOUR, DAY, MONTH, YEAR, FOR 1ST OF 5 STORM POS 00233000  C  009:006C:1
      READ 80,ISTM                                                   00234000  C  009:006C:1
      READ 82,IDAY                                                   00235000  C  009:0074:2
      READ 84,NMNTH                                                  00236000  C  009:007C:2
      READ 80,IYEAR                                                  00237000  C  009:0084:2
   80 FORMAT (I4)                                                    00238000  C  009:008C:2
   82 FORMAT (I2)                                                    00239000  C  009:008C:2
   84 FORMAT (A3)                                                    00240000  C  009:008C:2
      ISTM=ISTM/100                                                  00241000  C  009:008C:2
   90 FORMAT('  YOUR PRESSURE DROP IS',F5.1,' MBS.  THIS IS OUTSIDE THE 00242000  C  009:008E:1
     1RANGE 10 TO 140 MBS.')                                         00243000  C  009:008E:1
  150 FORMAT('  YOUR PRESSURE DROP IS',F5.1,' MILES,THIS IS OUTSIDE THE 00244000  C  009:008E:1
     1RANGE 10 TO 60 MILES.')                                        00245000  C  009:008E:1
  160 CALL STEREO                                                    00246000  C  009:008E:1
        F FC     STI     Y S                                         ...470    C  (...)08E.
  134 SPD=0                                                          00248000  C  009:008E:5
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      DO 166 I=14,35                                                  C  009:008F:3
      SPD=SPD+SP(I)                                                   C  009:0091:0
  166 CONTINUE                                                        C  009:0093:1
      SPD=SPD/22                                                      C  009:0095:2
      IF (SPD.GT.5.) GO TO 180                                        C  009:0096:4
      IF (SPD.GT.1.) GO TO 168                                        C  009:0097:4
      JHR=25                                                          C  009:0098:5
      PRINT 165                                                       C  009:009A:0
  165 FORMAT('   YOUR STORM IS STATIONARY AND YOUR ENVELOPE OF SURGES M C  009:009E:2
     1AY BE POLLUTED WITH TRANSIENTS.'/'  IF  YOU WANT TO CONSIDER THIS  C  009:009E:2
     2STORM, REFER TO TIMI-HISTORY PLOT OF  SURGES FOR SURGE PROFILE AGA C  009:009E:2
     3INST TIM!')                                                     C  009:009E:2
      GO TO 170                                                       C  009:009E:2
  168  PRINT 169,SPD                                                  C  009:009E:5
  169 FORMAT('   YOUR AVERAGE STORM SPEED FOR YOUR 24 HR STORM TRACK   C  009:00A5:2
     1S',F5.1' MPH,'/'  THIS IS ALMOST A STATIONARY STORM. YOUR ENVELO C  009:00A5:2
     2PE OF SURGES MAY BE POLLUTED WITH TRANSIENTS.')                  C  009:00A5:2
  180 ASSIGN 170 TO JSTOP                                             C  009:00A5:2
      IF(JHR.GT.35.OR.JHR.LT.15) ASSIGN 162 TO JSTOP                  C  009:00A6:0
      GO TO JSTOP,(162,170)                                           C  009:00A9:3
  162 PRINT 163                                                       C  009:00AB:3
  163 FORMAT('  ONE END--INSTED OF THE MIDDLE--OF YOUR 24 HOUR TRACK   C  009:00AF:2
     1SGMENT IS TOO CLOSE TO BASIN CENTER. TRY AGAIN WITH'/           C  009:00AF:2
     2'        1.  A DIFFERENT TRACK SEGMENT TO MATCH YOUR BASIN'/    C  009:00AF:2
     3'        2.  A DIFFERENT BASIN TO MATCH YOUR TRACK SEGMENT')    C  009:00AF:2
      GO TO 403                                                       C  009:00AF:2
  170 CONTINUE                                                        C  009:00AF:5
C***(I)   TABULATED STRM VALUES AT HRLY INTERVALS FOR 48 HRS*********** C  009:00AF:5
C      *49                                                            C  009:00AF:5
C      *37                                                            C  009:00AF:5
C          JHR  =                                                     C  009:00AF:5
C      *25  JHR  =               (FROM SUBROUTINE STERD)              C  009:00AF:5
C           JHR  =TBLTD HR,  NERST APPRCH OF STRM TO BSN CNTR (NEAR I=25) C  009:00AF:5
C      *13  ISTM =(ADD THIS ONTO (I)) FOR REAL TIMI OF 1ST OF 5 STRM POS* C  009:00AF:5
C          IT  =TIMI INTERVAL FRM NRST APPRCH TO STRM INITLZTN        C  009:00AF:5
C           IBGNT=JHR-IT, TBLTD HR FOR STRM INITLZTN                  C  009:00AF:5
C     *01                                                             C  009:00AF:5
C***(I)    TABULATED  STRM VALUES AT HRLY INTERVALS FOR 48 HRS ******** C  009:00AF:5
C     COMPUTING INITIAL STORM POSITION                                C  009:00AF:5
 1100 IT=12                                                           C  009:00AF:5
C     TABULATED HOUR FOR STORM INITIALIZATION                         C  009:00B1:1
      IBGNT=JHR-IT                                                    C  009:00B1:1
      C1=X(IBGNT)                                                     C  009:00B3:4
      C2=Y(IBGNT)                                                     C  009:00B5:5
      C21= SP(IBGNT)                                                  C  009:00B8:1
      C22=DIR(IBGNT)                                                  C  009:00BA:4
      C24=  R(IBGNT)                                                  C  009:00BD:1
C     PRESSURE CORRECTION (LATITUDINAL)  FOR INITIALIZATION           C  009:00BF:4
      PR=P(IBGNT)                                                     C  009:00BF:4
      PF=((PR/67.7)**2)*.3*(30.-ALAT)                                 C  009:00C1:4
      KPRES=PR+PF+0.5                                                 C  009:00C6:5
      C23=-WM(KPRES)*C24+WB(KPRES)                                    C  009:00C9:5
      IPRES=P(JHR)                                                    C  009:00CE:0
      T=IT                                                            C  009:00D0:0
      MHALT=((1.5*T*3600.+1.)/DELT)                                   C  009:00D1:1
      ITEND=IBGNT+(MHALT+NDLTH2+1)/NDLTHR                             C  009:00D6:3
      DUM1(IBGNT)=DUM3(1)                                             C  009:00DA:5
      DUM2(IBGNT)=DUM3(2)                                             C  009:00DD:0
      DUM1(JHR)=DUM3(3)                                               C  009:00DF:1
      DUM2(JHR)=DUM3(4)                                               C  009:00E1:2
      DUM1(ITEND)=DUM3(5)                                             C  009:00E3:3
      DUM2(ITEND)=DUM3(6)                                             C  009:00E5:5
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      DUM1(JHR+1)=DUM3(7)                                                 00311000  C  009:00E8:1
      DUM2(JHR+1)=DUM3(8)                                                 00312000  C  009:00EA:0
      IF (C21.LT.1.E-5) GO TO 1102                                        00313000  C  009:00EB:5
C     NO OF DELT TIMI STEPS FOR STROM TO MOVE 1 DIAMETEER IN LENGTH       00314000  C  009:00EE:4
      IGRWTH=(2.*C24/C21)*DLTHR                                           00315000  C  009:00EE:4
      GO TO 1104                                                          00316000  C  009:00F2:1
 1102 IGRWTH=4*NDLTHR+4                                                   00317000  C  009:00F2:4
 1104 CONTINUE                                                            00318000  C  009:00F4:5
      IC19=MAXO(IC19,MINO(4*NDLTHR+4,IGRWTH))                             00319000  C  009:00F4:5
      DO 1110 I=1,5                                                       00320000  C  009:00FB:3
      J=IBGNT+I-1                                                         00321000  C  009:00FD:0
      IF (ABS(X(J)-1.).LT.(.25*C24)) IC19=4*NDLTHR                        00322000  C  009:00FF:1
 1110 CONTINUE                                                            00323000  C  009:0105:3
      AL=ALAT         *1.74532925E-2                                      00324000  C  009:0107:4
      COR=2.*(7.292116E-5)*SIN(AL)                                        00325000  C  009:010A:4
      DO 400 I=1,12                                                       00326000  C  009:010E:3
      IF (NMNTH.EQ.AMON(I))  GO TO 404                                    00327000  C  009:0110:0
  400 CONTINUE                                                            00328000  C  009:0112:2
      PRINT 402,NMNTH                                                     00329000  C  009:0114:3
  402 FORMAT(///'  YOU HAVE READ IN (',A3,'), FOR THE MONTH OF LANDFALL.  00330000  C  009:011B:2
     A THIS IS INADMISSABLE.')                                            00331000  C  009:011B:2
  403 STOP                                                                00332000  C  009:011B:2
  404 IMTH=I                                                              00333000  C  009:011C:3
      PRINT 512                                                           00334000  C  009:011D:5
  512 FORMAT (//'  THESE ARE THE 5 STORM POSITIONS READ IN BY THE COMP    00335000  C  009:0122:2
     1UTER'/' PLEASE CHECH TIMES, LATITUDES, LONGTITUDES, PRESSURE DROPS  00336000  C  009:0122:2
     2  AND STORM SIZES FOR AGREEMENT AND CONSISTENCY')                   00337000  C  009:0122:2
      PRINT 514                                                           00338000  C  009:0122:2
  514 FORMAT( //'     HOUR  DAY MNTH YEAR  LATITUDE LONGITUDE PRS DROP    00339000  C  009:0126:2
     1 STRM SIZE    LENGTH  AZIMUTH    X-CORD    Y-CORD')                 00340000  C  009:0126:2
      IST=JULHR(IDAY,IMTH,IYEAR,ISTM)                                     00341000  C  009:0126:2
      DO 610 I=1,5                                                        00342000  C  009:012A:4
      J=IST+(I-1)*6                                                       00343000  C  009:012C:0
      CALL DATEX(J,NYR,NMO,NDA,NHR,KDAYWK)                                00344000  C  009:012E:2
      AM=AMON(NMO)                                                        00345000  C  009:0132:0
      K=13+(I-1)*6                                                        00346000  C  009:0133:3
      PRINT 620,NHR,NDA,AM,NYR,ALTI(I),ALNI(I),P(K),R(K),RLG(I),ANGD(I)   00347000  C  009:0135:5
     1,AX(I),AY(I)                                                        00348000  C  009:014B:4
  610 CONTINUE                                                            00349000  C  009:0153:2
  620 FORMAT(4X,2I5,2X,A3,I5,8F10.2)                                      00350000  C  009:0155:3
      IST=JULHR(IDAY,IMTH,IYEAR,ISTM)-13                                  00351000  C  009:0155:3
      CALL DATEX(JHR+IST,NYR,NMO,NDA,NHR,KDAYWK)                          00352000  C  009:015A:3
      NHOUR=NHR*100                                                       00353000  C  009:015E:4
      NDAY=NDA                                                            00354000  C  009:0160:1
      MONTH=AMON(NMO)                                                     00355000  C  009:0161:0
      NYEAR=NYR                                                           00356000  C  009:0162:3
      PRINT 104,RLNGTH,NHR,KDAYWK,NDA,AMON(NMO),NYR,LMLE,NBPOS,STA        00357000  C  009:0163:2
  104 FORMAT(//'  MINIMUM DISTANCE OF STORM FROM BASIN CENTER IS',F6.1,'  00358000  C  009:0177:2
     1 MILES AT HOUR',I3,', ',A3,I3,1X,A3,I5/'O BASIN CENTER IS ',I5,'    00359000  C  009:0177:2
     2ILES TO THE ',A5,' OF ',A10,'. OBSERVER IS ON SEA AND FACING LAND   00360000  C  009:0177:2
     3.')                                                                 00361000  C  009:0177:2
      PRINT 289                                                           00362000  C  009:0177:2
  289 FORMAT(// 5X'   HOURLY VALUES OF (SMOOTHED) STORM POSITIONS, SPEE   00363000  C  009:017B:2
     1D AND DIRECTION (MATHEMATICAL) OF MOTION, PRESSURE DROP, AND SIZE'  00364000  C  009:017B:2
     2)                                                                   00365000  C  009:017B:2
      PRINT 290                                                           00366000  C  009:017B:2
  290 FORMAT(///25X    'HOUR  DAY MNTH YEAR LATITDE LONGTDE    X-PT     Y 00367000  C  009:017F:2
     1-PT   SPEED STRM DR     DELP     SIZE')                             00368000  C  009:017F:2
      ASSIGN 1999 TO LEAP                                                 00369000  C  009:017F:2
      IR(5  IR(                                                           )037      C     ):0
      DO 300 I=1,49                                                       00371000  C  009:0181:5
      J=IST+I
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      CALL DATEX(J.NYR.NMO.NDA.NHR.KDAYWK)                                 00373000  C  009:0184:3
      AM=AMON(NMO)                                                         00374000  C  009:0188:1
      DIRR=DIR(I)/RAD                                                      00375000  C  009:0189:4
      DLAT=90.-XLAT(I)/RAD                                                 00376000  C  009:018C:2
      DLONG=YLONG(I)/RAD                                                   00377000  C  009:018F:2
      PRINT 312.DUM1(I).DUM2(I).NHR.NDA.AM.NYR.DLAT.DLONG.X(I).Y(I).       00378000  C  009:0192:0
     1 SP(I).DIRR.P(I).R(I).DUM1(I).DUM2(I)                                00379000  C  009:01A6:1
      IF (SP(I).LE.60.) GO TO 292                                          00380000  C  009:01B5:2
      ASSIGN 403 TO LEAP                                                   00381000  C  009:01B7:3
      PRINT 291.SP(I)                                                      00382000  C  009:01B8:2
  291 FORMAT(//25X'YOUR STORM SPEED IS'.F8.2.' MPH.  THIS SUGGESTS YOUR    00383000  C  009:01C0:2
     A5 STORM POSITIONS ARE NOT PROPERLY PUNCHED. OR CONSISTENT.'//)       00384000  C  009:01C0:2
  292 IF ((ABS(AMOD((DIR(I)-DIR(I+1))/RAD+540..360.)-180.)).LT.15.)        00385000  C  009:01C0:2
     1 GO TO 300                                                           00386000  C  009:01C7:0
      PRINT 293                                                            00387000  C  009:01C7:0
  293 FORMAT(//25X'YOUR DIRECTION OF STORM MOTION IS CHANGING BY MORE      00388000  C  009:01CB:2
     1HAN 15 DEGREES/HOUR.'/25X'THIS SUGGESTS YOUR 5 STORM POSITIONS ARE   00389000  C  009:01CB:2
     2 NOT PROPERLY  PUNCHED. OR CONSISTENT'//)                            00390000  C  009:01CB:2
  300 CONTINUE                                                             00391000  C  009:01CB:2
  312 FORMAT(4X.2A10.2I5.2X.A3.I5.8F8.2.2A10)                              00392000  C  009:01CD:3
      GO TO LEAP.(1999.403)                                                00393000  C  009:01CD:3
 1999 CONTINUE                                                             00394000  C  009:01CF:3
      PRINT 310.NMAX.LMAX.MHALT.IC12.IC19                                  00395000  C  009:01CF:3
  310 FORMAT (///'     X-GRID  Y-GRID  STOP PGM  FRCE DST STM GRWTH'       00396000  C  009:01DD:2
     1 /5I10)                                                              00397000  C  009:01DD:2
      PRINT 320. COR.DELS.DELT.C7.C17.C19.C25                              00398000  C  009:01DD:2
  320  FORMAT (////'     CORIOLIS  GRID SPACE  TIMI INCRM   SLIP COER   DN 00399000  C  009:01EF:2
     1STY ATM   DRAG COEF   VISCOSITY'/F12.8.2F12.1.F12.7.3F12.8)          00400000  C  009:01EF:2
       DLAT=90.-XLAT(IBGNT)/RAD                                            00401000  C  009:01EF:2
       DLONG=YLONG(IBGNT)/RAD                                              00402000  C  009:01F2:4
       PRINT 330.DLAT.DLONG                                                00403000  C  009:01F5:4
  330  FORMAT(///'      INTL LATTD  INTL LONGT'/2X.2F12.2)                 00404000  C  009:01FE:2
      RETURN                                                               00405000  C  009:01FE:2
       END                                                                 00406000  C  009:01FE:5
                                                                              FORMAT SEGMENT 00A IS 0029 LONG.
                                                                              FORMAT SEGMENT 038 IS 0031 LONG.
                                                                                  SEGMENT 009 IS 0235 LONG

##########################################################################################################

                                                                                START OF SEGMENT 00D
      SUBROUTINE  CRDRED(IBASIN)                                           00410000  C  00D:0000:0
      COMMON /SXTH/ NMAX.NMX1.NMX2.LMAX.LMX1.LMX2                          00411000  C  00D:0000:0
      COMMON /SKWL/ SKW(151)                                               00412000  C  00D:0000:0
      COMMON /BSN/ PHI.ALAT                                                00413000  C  00D:0000:0
      COMMON /DBD/ DD(10.151).DB(151)                                      00416000  C  00D:0000:0
      COMMON /STRNA/ NBPOS.LMLE                                            00417000  C  00D:0000:0
      COMMON /BASIN/ NBASIN.NCOAST                                         00418000  C  00D:0000:0
      COMMON /STRPOS/ ABCD(20).ALTO.ALNO.PI                                00419000  C  00D:0000:0
      REAL*8 NBPOS                                                         00420000  C  00D:0000:0
      READ(5.32) ALTO.ALNO.              .NBPOS.LMLE                       00429000  C  00D:0000:0
   32 FORMAT(2F10.3.    A5.I5)                                             00430000  C  00D:0017:2
      READ(5.30) PHI.ALAT                                                  00431000  C  00D:0017:2
   30 FORMAT (2F5.1    )                                                   00432000  C  00D:0021:2
   11 FORMAT(14F6.1)                                                       00439000  C  00D:0021:2
      READ(2.11) (SKW(L).L=1.LMAX)                                         00440000  C  00D:0021:2
      READ(2.11) ((DD(N.L).N=1.NMAX).L=1.LMAX)                             00441000  C  00D:002E:2
      RETURN                                                               00445000  C  00D:0041:2
  999 PRINT 1000                                                           00446000  C  00D:0041:5
 1000 FORMAT (' BASIN OUT OF BOUNDS')                                      00447000  C  00D:0045:2
      STOP                                                                 00448000  C  00D:0045:2
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                                                              FORMAT SEGMENT 00E IS 000D LONG.
                                                              FORMAT SEGMENT 049 IS 0007 LONG.
                                                                 SEGMENT 00D IS 0053 LONG

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                                                                      START OF SEGMENT 00F
      SUBROUTINE STEREO                                             00450000  C  00F:0000:0
      COMMON /STRMPS/ X(50),Y(50),P(50),R(50),DIR(50),SP(50),PDROP,RAD  00451000  C  00F:0000:0
      COMMON /STRPOS/ ALT(5),ALN(5),AX(5),AY(5),ALTO,ALNO,PI        00452000  C  00F:0000:0
      COMMON /BSN/ SLNT,ALAT                                        00453000  C  00F:0000:0
      COMMON /LLPRT/ ALTI(5),ALNI(5),RL(5),ANGD(5),RLNGTH           00454000  C  00F:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                                 00455000  C  00F:0000:0
      COMMON /RESULT/ HT(151),LSTRM                                 00456000  C  00F:0000:0
      DATA ERAD/3437.87/,FTPNM/6080.21/                             00457000  C  00F:0000:0
      DO 10 I=1,5                                                   00458000  C  00F:0000:0
      ALT(I)=RAD*(90.-ALT(I))                                       00459000  C  00F:0001:0
   10 ALN(I)=RAD*ALN(I)                                             00460000  C  00F:0004:1
      ALTO=RAD*(90.-ALTO)                                           00461000  C  00F:000A:0
      ALNO=RAD*ALNO                                                 00462000  C  00F:000C:5
      SLNT=RAD*SLNT                                                 00463000  C  00F:000F:3
      SO=SIN(ALTO)                                                  00464000  C  00F:0011:5
      CO=COS(ALTO)                                                  00465000  C  00F:0013:4
      ERAD2=2.*ERAD                                                 00466000  C  00F:0015:3
      CO2=2.*CO                                                     00467000  C  00F:0016:5
      DO 100 I=1,5                                                  00468000  C  00F:0018:1
      DLAT=ALTO-ALT(I)                                              00469000  C  00F:0019:0
      DLAT2=.5*DLAT                                                 00470000  C  00F:001B:2
      DLON=ALNO-ALN(I)                                              00471000  C  00F:001E:0
      DLON2=.5*DLON                                                 00472000  C  00F:0020:3
      S2=SIN(DLON2)**2                                              00473000  C  00F:0023:0
      S=SIN(DLAT2)**2+SO*SIN(ALT(I))*S2                             00474000  C  00F:0024:5
      RL(I)=ERAD2*SQRT(S/(1.-S))                                    00475000  C  00F:0029:3
      IF (RL(I).NE.0.) GO TO 20                                     00476000  C  00F:002D:2
      AX(I)=1                                                       00477000  C  00F:002F:2
      AY(I)=75.                                                     00478000  C  00F:0031:0
      ALTI(I)=ALTO/RAD                                              00479000  C  00F:0032:5
      ALNI(I)=ALNO/RAD                                              00480000  C  00F:0035:5
      ANGD(I)=0.                                                    00481000  C  00F:0039:0
      GO TO 100                                                     00482000  C  00F:003A:4
   20 AN=SIN( ALT(I))*SIN(DLON)                                     00483000  C  00F:003B:1
      AD=SIN(DLAT)+CO2*SIN(ALT(I))*S2                               00484000  C  00F:003E:3
      ANG=PI+ATAN2(-AN,-AD)-SLNT                                    00485000  C  00F:0042:5
      AX(I)=(RL(I)*SIN(ANG))*FTPNM/DELS+1.                          00486000  C  00F:0046:3
      AY(I)=(RL(I)*COS(ANG))*FTPNM/DELS+LSTRM                       00487000  C  00F:004B:5
      ANGD(I)=ANG/RAD                                               00488000  C  00F:0051:4
      ALTI(I)=90.-ALT(I)/RAD                                        00489000  C  00F:0054:3
      ALNI(I)=ALN(I)/RAD                                            00490000  C  00F:0058:2
  100 CONTINUE                                                      00491000  C  00F:005C:0
      SLNT=SLNT/RAD                                                 00492000  C  00F:005E:1
      CALL SMOOTH                                                   00493000  C  00F:0060:2
      RETURN                                                        00494000  C  00F:0061:0
      END                                                           00495000  C  00F:0061:3
                                                                       SEGMENT 00F IS 0068 LONG

##########################################################################################################

                                                                      START OF SEGMENT 012
      SUBROUTINE STMTRK                                             00496000  C  012:0000:0
      CO    /S   S/ X    ,Y(    P(5(    50)    (50    50)    DP,    0(   )00     012    ):0
      COMMON /XYLL/ XLAT(50),YLONG(50)                              00498000  C  012:0000:0
                                                                    004     00  C  012:0000:0
```

```
      COMMON /STRPOS/ ALT(5),ALN(5),AX(5),AY(5),ALTO,ALNO,PI              00500000  C  012:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                                        00501000  C  012:0000:0
      COMMON /RESULT/ HT(151),LSTRM                                        00502000  C  012:0000:0
      DATA  ERAD/3437.87/,FTPNM/6080.21/                                   00503000  C  012:0000:0
      CLTO=COS(ALTO)                                                       00504000  C  012:0000:0
      SLTO=SIN(ALTO)                                                       00505000  C  012:0001:5
      SLNT=RAD*SLNT                                                        00506000  C  012:0003:4
      DO 100 I=1,50                                                        00507000  C  012:0006:0
      XCORD=(X(I)-1.)*DELS/FTPNM                                           00508000  C  012:0007:0
      YCORD=(Y(I)-LSTRM)*DELS/FTPNM                                        00509000  C  012:000A:0
      RL=SQRT(XCORD**2+YCORD**2)                                           00510000  C  012:000D:4
      ENU=ATAN2(XCORD,YCORD)+SLNT                                          00511000  C  012:0010:2
      PSI=2.*ATAN(.5*RL/ERAD)                                              00512000  C  012:0012:5
      SPSI=SIN(PSI)                                                        00513000  C  012:0016:5
      XLAT(I)=ARCOS(CLTO*COS(PSI)+SPSI*SLTO*COS(ENU))                      00514000  C  012:0018:2
      YLONG(I)=ALNO-ARSIN(SPSI*SIN(ENU)/SLTO)                              00515000  C  012:001E:0
  100 CONTINUE                                                             00516000  C  012:0023:0
      SLNT=SLNT/RAD                                                        00517000  C  012:0025:1
      RETURN                                                               00518000  C  012:0027:2
      END                                                                  00519000  C  012:0027:5
                                                                              SEGMENT 012 IS 002E LONG

##############################################################################################################

                                                                              START OF SEGMENT 016
      SUBROUTINE SMOOTH                                                    00520000  C  016:0000:0
      DIMENSION PII(5,4),XY(50,2),AAXY(5,2),AXY(4,2)                       00521000  C  016:0000:0
      DIMENSION GAMR(4),PO(5),P1(5),P2(5),P3(5)                            00522000  C  016:0000:0
      COMMON /STRMPS/ X(50),Y(50),P(50),R(50),DIR(50),SP(50),PDROP,RAD     00523000  C  016:0000:0
      COMMON /STRPOS/ ALT(5),ALN(5), AX(5),AY(5),ALTO,ALNO,PI              00524000  C  016:0000:0
      COMMON /SPRM/ PO,PE,RO,RE                                            00525000  C  016:0000:0
      COMMON /STIME/ ISTM,JHR,IT,IBGNT,ITMADV                              00526000  C  016:0000:0
      COMMON /LLPRT/ ALTI(5),ALNI(5),RLG(5),ANGD(5),RLNGTH                 00529000  C  016:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                                        00530000  C  016:0000:0
      EQUIVALENCE (PO(1),PII(1,1)),(P1(1),PII(1,2)),(P2(1),PII(1,3)),      00531000  C  016:0000:0
     1 (P3(1),PII(1,4))                                                    00532000  C  016:0000:0
      EQUIVALENCE (X(1),XY(1,1)),(AX(1),AAXY(1,1))                         00533000  C  016:0000:0
      DATA GAMR/5.,2.5,3.5,10./                                            00534000  C  016:0000:0
      DATA PO/1.,1.,1.,1.,1./                                              00535000  C  016:0000:0
      DATA P1/-1.,-.5,0.,.5,1./                                            00536000  C  016:0000:0
      DATA P2/1.,-.5,-1.,-.5,1./                                           00537000  C  016:0000:0
      DATA P3/-1.,2.,0.,-2.,1./                                            00538000  C  016:0000:0
      DO 10 I=1,4                                                          00539000  C  016:0000:0
      DO 10 J=1,2                                                          00540000  C  016:0001:0
      AXY(I,J)=0.                                                          00541000  C  016:0002:0
   10 CONTINUE                                                             00542000  C  016:0004:4
      DO 20 K=1,2                                                          00543000  C  016:0009:0
      DO 20 J=1,4                                                          00544000  C  016:000A:0
      DO 20 I=1,5                                                          00545000  C  016:000B:0
      AXY(J,K)=AXY(J,K)+AAXY(I,K)*PII(I,J)/GAMR(J)                         00546000  C  016:000C:0
   20 CONTINUE                                                             00547000  C  016:0014:4
      RMIN=1000.                                                           00548000  C  016:001B:1
      DO 100 J=1,49                                                        00549000  C  016:001C:1
      XJ=-12+J-1                                                           00550000  C  016:001D:0
      T=(XJ-12.)/6.                                                        00551000  C  016:001E:5
      DO 50 K=1,2                                                          00552000  C  016:0020:2
      XY(J,K)=AXY(1,K)+AXY(2,K)*T*.5+.5*AXY(3,K)*(T**2-2.)+                00553000  C  016:0021:0
     1 AXY(4,K)*(5.*(T**3)-17.*T)/6.                                       00554000  C  016:002E:2
   50 CONTINUE                                                             00555000  C  016:0033:2
      IF ((J.LT.13).OR.(J.GT.37)) GO TO 100                                00556000  C  016:0035:3
      RLNGTH=SQRT((X(J)-1.)**2+(Y(J)-75.)**2)                              00557000  C  016:0037:5
      RMIN=AMIN1(RMIN,RLNGTH)                                              00558000  C  016:003D:2
```

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      IF (RMIN.EQ.RLNGTH) TME=XJ                                        00559000  C  016:0040:3
  100 CONTINUE                                                          00560000  C  016:0042:4
C       TIMI OF NEAREST APPROACH TO BASIN CENTER. MEASURED FROM -12 HOURS 00561000  C  016:0044:5
C       BSFORE FIRST OF 5 GEOGRAPHICALLY GIVEN STORM POSITIONS          00562000  C  016:0044:5
      JHR=TME+.5+12.+1.                                                 00563000  C  016:0044:5
      AL=DELS/5280.                                                     00564000  C  016:0048:2
  102 RLNGTH=RMIN*AL                                                    00565000  C  016:004A:0
      LLOC=RLNGTH                                                       00566000  C  016:004B:5
      DO 150 I=13.37                                                    00567000  C  016:004C:3
      XJ=-12+I-1                                                        00568000  C  016:004E:0
      SP(I)=SQRT((X(I+1)-X(I))**2+(Y(I+1)-Y(I))**2)*AL                  00569000  C  016:004F:5
      P(I)=PO-(PO-PE)*(XJ**2)*(1.-XJ/36.)/(8.*24.)                      00570000  C  016:0057:4
      R(I)=RO-(RO-RE)*(XJ**2)*(1.-XJ/36.)/(8.*24.)                      00571000  C  016:005E:1
      IF (SP(I).LT.1.E-5) GO TO 142                                     00572000  C  016:0065:1
      DIR(I)=PI+ATAN2(Y(I)-Y(I+1),X(I)-X(I+1))                          00573000  C  016:0068:4
      GO TO 150                                                         00574000  C  016:0070:0
  142 DIR(I)=PI                                                         00575000  C  016:0070:3
  150 CONTINUE                                                          00576000  C  016:0072:4
      VX=X(14)-X(13)                                                    00577000  C  016:0074:5
      VY=Y(14)-Y(13)                                                    00578000  C  016:0076:5
      DO 160 I=1.12                                                     00579000  C  016:0078:5
      J=12-I+1                                                          00580000  C  016:007A:0
      SP(I)=SP(13)                                                      00581000  C  016:007B:5
      P(I)=PO                                                           00582000  C  016:007E:1
      R(I)=RO                                                           00583000  C  016:0080:1
      DIR(I)=DIR(13)                                                    00584000  C  016:0082:2
      X(J)=X(J+1)-VX                                                    00585000  C  016:0084:3
      Y(J)=Y(J+1)-VY                                                    00586000  C  016:0087:0
  160 CONTINUE                                                          00587000  C  016:008A:1
      VX=X(37)-X(36)                                                    00588000  C  016:008C:2
      VY=Y(37)-Y(36)                                                    00589000  C  016:008E:2
      DO 170 I=37.50                                                    00590000  C  016:0090:2
      SP(I)=SP(36)                                                      00591000  C  016:0092:0
      P(I)=PE                                                           00592000  C  016:0094:2
      R(I)=RE                                                           00593000  C  016:0096:2
      DIR(I)=DIR(36)                                                    00594000  C  016:0098:3
      X(I)=X(I-1)+VX                                                    00595000  C  016:009A:4
      Y(I)=Y(I-1)+VY                                                    00596000  C  016:009D:4
  170 CONTINUE                                                          00597000  C  016:00A0:5
      CALL STMTRK                                                       00598000  C  016:00A3:0
      RETURN                                                            00599000  C  016:00A3:4
      END                                                               00600000  C  016:00A4:1
                                                                   SEGMENT 016 IS 00AE LONG

##########################################################################################################

                                                                   START OF SEGMENT 017
      BLOCK DATA                                                        00601000  C  017:0000:0
      COMMON /STRPOS/ ALT(5).ALN(5).AX(5).AY(5).ALTO.ALNO.PI            00602000  C  017:0000:0
      DATA PI/3.14159265358979/                                         00603000  C  017:0000:0
      END                                                               00604000  C  017:0000:0

##########################################################################################################

      SUBROUTINE INITLZ                                                 00605000  C  018:0000:0
      CALL CNSTNT                                                       00606000  C  018:0000:0
      CALL DEPTHS                                                       00607000  C  018:0000:4
      CALL TIMER                                                        00608000  C  018:0001:2
      RETURN                                                            00609000  C  018:0002:0
      END                                                               00[illegible]  C  018:[illegible]:3
                                                                   SEGMENT 018 IS 0007 LONG
```

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########################################################################################################################
                                                                                     START OF SEGMENT 019
      SUBROUTINE CNSTNT                                                     00611000  C  019:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                                     00612000  C  019:0000:0
      COMMON /SXTH/ NMAX,NMX1,NMX2,LMAX,LMX1,LMX2                           00613000  C  019:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                                         00614000  C  019:0000:0
      COMMON /SPLP/ IB(15)                                                  00615000  C  019:0000:0
      NMX1=NMAX-1                                                           00616000  C  019:0000:0
      NMX2=NMAX-2                                                           00617000  C  019:0001:5
      LMX1=LMAX-1                                                           00618000  C  019:0004:0
      LMX2=LMAX-2                                                           00619000  C  019:0006:1
      X1(1)=G*DELT/(2.*DELS)                                                00620000  C  019:0008:3
      X1(6)=DELT/(2.*DELS)                                                  00621000  C  019:000B:5
      X1(8)=1./5280.                                                        00622000  C  019:000E:3
      X1(9)=DELT/(3600.*DELS/5280.)                                         00623000  C  019:0010:2
      X1(25)=4.*DELS/G                                                      00624000  C  019:0013:5
      X1(36)=2.*DELT                                                        00625000  C  019:0016:4
      X1(43)=X1(36)*COR                                                     00626000  C  019:0018:4
      IB(15)=1                                                              00627000  C  019:001B:1
      IB(13)=IB(15)                                                         00628000  C  019:001C:2
      IB(7)=IB(13)                                                          00629000  C  019:001E:0
      IB(2)=IB(7)                                                           00630000  C  019:001F:4
      IB(1)=IB(2)                                                           00631000  C  019:0021:1
      IB(6)=NMAX                                                            00632000  C  019:0022:3
      IB(3)=IB(6)                                                           00633000  C  019:0024:0
      IB(5)=NMX1                                                            00634000  C  019:0025:4
      IB(4)=IB(5)                                                           00635000  C  019:0027:1
      IB(14)=2                                                              00636000  C  019:0028:5
      IB(8)=IB(14)                                                          00637000  C  019:002A:1
      IB(9)=1                                                               00638000  C  019:002B:5
      IB(10)=LMAX                                                           00639000  C  019:002D:0
      IB(11)=LMX1                                                           00640000  C  019:002E:4
      IB(12)=LMAX                                                           00641000  C  019:0030:2
      RETURN                                                                00642000  C  019:0032:0
      END                                                                   00643000  C  019:0032:3
                                                                                 SEGMENT 019 IS 0037 LONG
########################################################################################################################
                                                                                     START OF SEGMENT 01A
      SUBROUTINE DEPTHS                                                     00644000  C  01A:0000:0
      COMPLEX    EFACT,CSINH,CCOSH,ITIMZ,Z,CO1,CO2,CO3,CO4,CO5,CO7,CO17     00645000  C  01A:0000:0
      COMPLEX    CO16,CO10,CP                                               00646000  C  01A:0000:0
      COMMON /DBD/ DD(10,151),DB(151)                                       00647000  C  01A:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                                     00648000  C  01A:0000:0
      COMMON /SCND/ AR(300),AI(300),BR(300),BI(300),CR(300),CI(300)         00649000  C  01A:0000:0
      COMMON /THRD/ C1,C2,C7,C17,C19,C21,C22,C23,C24,C25                    00650000  C  01A:0000:0
      COMMON /SXTH/ NMAX,NMX1,NMX2,LMAX,LMX1,LMX2                           00651000  C  01A:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                                         00652000  C  01A:0000:0
      COMMON /SKWL/ SKW(151)                                                00653000  C  01A:0000:0
      COMMON /BASIN/ NBASIN,NCOAST                                          00654000  C  01A:0000:0
      DIMENSION DSWAP(10,151)                                               00655000  C  01A:0000:0
      ITIMZ(Z)=CMPLX(-AIMAG(Z),REAL(Z))                                     00656000  C  01A:0000:0
      CSINH(Z)=-ITIMZ(CSIN(ITIMZ(Z)))                                       00657000  C  01A:0003:0
      CCOSH(Z)=CCOS(ITIMZ(Z))                                               00658000  C  01A:0007:4
      AR(1)=SKW(1)                                                          00659000  C  01A:000A:2
      AR(LMAX)=SKW(LMAX)                                                    00660000  C  01A:000B:4
      DO 20 L=2,LMX1                                                        00661000  C  01A:000E:4
   20 AR(L)=.25*(SKW(L-1)+2.*SKW(L)+SKW(L+1))                               00662000  C  01A:0010:0
      DO 30 L=1,LMAX                                                        00663000  C  01A:0019:3
   30 SKW(L)=AR(L)*DELS                                                     00664000  C  01A:001B:0
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      IF (NBASIN.LE.3.AND.NCOAST.EQ.2) GO TO 200                        C  01A:0020:3
      GO TO 530                                                         C  01A:0023:1
  200 CONTINUE                                                          C  01A:0023:4
      I=-1                                                              C  01A:0023:4
      DO 500 L=2,LMX1                                                   C  01A:0024:3
      I=-1-I                                                            C  01A:0026:0
      NA=1-I                                                            C  01A:0027:3
      DO 500 N=NA,NMX1                                                  C  01A:0028:5
      DSWAP(N,L)=(4.*DD(N,L)+DD(N+I,L+1)+DD(N+1+I,L+1)+DD(N+I,L-1)+     C  01A:002A:0
     1 DD(N+I+1,L-1))*.125                                              C  01A:0037:3
  500 CONTINUE                                                          C  01A:003C:2
      I=-1                                                              C  01A:0041:1
      DO 510 L=2,LMX1                                                   C  01A:0042:0
      I=-1-I                                                            C  01A:0043:0
      NA=1-I                                                            C  01A:0044:3
      DO 510 N=NA,NMX1                                                  C  01A:0045:5
      DD(N,L)=AMIN1(DSWAP(N,L),DD(N,L))                                 C  01A:0047:0
  510 CONTINUE                                                          C  01A:004D:4
  530 CONTINUE                                                          C  01A:0052:3
      PRINT 100,(N,N=1,19)                                              C  01A:0052:3
  100 FORMAT(///'      DEPTH FIELD IN FEET, GRID DISTANCES ARE 4 STAT MI C  01A:005D:2
     1LES (3.5 NM) APART, POINT 752 ON ORDINATE IS CENTER OF BASIN'///3X C  01A:005D:2
     219I5)                                                             C  01A:005D:2
      DO 110 I= 1,7,2                                                   C  01A:005D:2
      L=80-I                                                            C  01A:005E:0
      K=L-1                                                             C  01A:005F:3
      PRINT 120,L,(DD(N,L), N=1,NMAX)                                   C  01A:0060:3
      IF (K.EQ.0) GO TO 110                                             C  01A:006F:2
      PRINT 130,K,(DD(N,K), N=1,NMX1)                                   C  01A:0070:3
  110 CONTINUE                                                          C  01A:007F:2
  120 FORMAT(//I4,1X,F5.0,12F10.0)                                      C  01A:0081:4
  130 FORMAT(//I4,6X,F5.0,11F10.0)                                      C  01A:0081:4
      DO 350 N=1,300                                                    C  01A:0081:4
      A=N                                                               C  01A:0083:0
      E=A    *SQRT(COR/(2.*C25))                                        C  01A:0083:5
      COR1=COR*A   /C7                                                  C  01A:0087:1
        EFACT=CMPLX(E,E)                                                C  01A:0089:4
      CO1=CCOSH(EFACT)                                                  C  01A:008B:0
      CO2=EFACT/CSINH(EFACT)                                            C  01A:008C:3
      CO1=CO1*CO2                                                       C  01A:0090:4
C     CO1=SIGMA/TANH(SIGMA) , CO2=SIGMA/SINH(SIGMA)                     C  01A:0093:5
      CO3=1./(CO1+CMPLX(-1.,COR1))                                      C  01A:0093:5
      CO4=CO3*CO3                                                       C  01A:0099:0
      CO5=CO2*CO2+CO1                                                   C  01A:009B:5
      CP=1.-CO2                                                         C  01A:00A1:3
      CO7=(.5*CO5-1.)*CO4                                               C  01A:00A4:0
      CO17=1./(1.+CO7)                                                  C  01A:00AB:5
      CO16=(1.+CO3)*CO17                                                C  01A:00B0:0
      AR(N)=REAL(CO16)                                                  C  01A:00B4:0
      AI(N)=AIMAG(CO16)                                                 C  01A:00B6:1
      BR(N)=REAL(CO17)                                                  C  01A:00B8:5
      BI(N)=AIMAG(CO17)                                                 C  01A:00BB:2
      CO10=(1.+CP*CO3)*CO17                                             C  01A:00BE:0
      CR(N)=REAL(CO10)                                                  C  01A:00C4:2
      CI(N)=AIMAG(CO10)                                                 C  01A:00C6:5
  340 AR(N)=AR(N)*X1(43)                                                C  01A:00C9:3
      AI(N)=1.+X1(43)*AI(N)                                             C  01A:00CC:0
  350 CONTINUE                                                          C  01A:00CF:1
      DO 400 L=3,LMX2,2                                                 C  01A:00D1:3
      K=DD(1,L)                                                         C  01A:00D3:0
      K1=D[illegible],L+1)                                              C  [illegible]
      K2=DD(2,L+2)                                                      C  01A:00D7:1
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      K3=DD(1,L-1)                                             00727000  C  01A:00D9:3
      K4=DD(2,L-2)                                             00728000  C  01A:00DB:5
      DX=4.*DD(1,L+1)*BR(K1)-DD(2,L+2)*BR(K2)                  00729000  C  01A:00DE:1
     1 +4.*DD(1,L-1)*BR(K3)-DD(2,L-2)*BR(K4)                   00730000  C  01A:00E4:2
      DY=4.*DD(1,L+1)*BI(K1)-DD(2,L+2)*BI(K2)                  00731000  C  01A:00EC:2
     1 -4.*DD(1,L-1)*BI(K3)+DD(2,L-2)*BI(K4)                   00732000  C  01A:00F2:3
      DB(L)=DX-DY                                              00733000  C  01A:00FA:3
  400 CONTINUE                                                 00734000  C  01A:00FD:0
      DX=4.*DD(1,2)-DD(2,3)                                    00735000  C  01A:00FF:4
      K=DD(1,1)                                                00736000  C  01A:0102:1
      DB(1)=DX*(1.-BI(K)/BR(K))                                00737000  C  01A:0103:2
      DX=4.*DD(1,LMX1)-DD(2,LMX2)                              00738000  C  01A:0108:1
      K=DD(1,LMAX)                                             00739000  C  01A:010D:2
      DB(LMAX)=DX*(1.+BI(K)/BR(K))                             00740000  C  01A:0110:0
      RETURN                                                   00741000  C  01A:0115:4
      END                                                      00742000  C  01A:0116:1
                                                                 FORMAT SEGMENT 01B IS 000E LONG.
                                                                 FORMAT SEGMENT 058 IS 001B LONG.
                                                                    SEGMENT 01A IS 012E LONG

##########################################################################################################

                                                                 START OF SEGMENT 020
      SUBROUTINE CMPUTE                                        00743000  C  020:0000:0
      COMMON /FFTH/ ITIME,KTIME,MHALT                          00744000  C  020:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                        00745000  C  020:0000:0
      COMMON /DUMMY1/ U(10,302),V(10,302),H(10,302)            00746000  C  020:0000:0
      COMMON /DUMY22/ XY1(151), XY3(151),FYPP(151)             00747000  C  020:0000:0
      COMMON /SXTH/ NMAX,NMX1,NMX2,LMAX,LMX1,LMX2              00749000  C  020:0000:0
      COMMON /RESULT/ HT(151),LSTRM                            00750000  C  020:0000:0
      COMMON /THRD/ C1,C2,C7,C17,C19,C21,C22,C23,C24,C25       00751000  C  020:0000:0
      COMMON /STRMPS/ XT(50),YT(50),PT(50),RT(50),DIR(50),SP(50),   00752000  C  020:0000:0
     1 PDROP,RAD                                               00753000  C  020:0000:0
      COMMON /STIME/ ISTM,JHR,IT,IBGNT,ITEND                   00754000  C  020:0000:0
      COMMON /HTS/ HTH(19,81)                                  00755000  C  020:0000:0
      COMMON /DUMMY2/ I1(151),I2(151)                          00756000  C  020:0000:0
      COMMON /DMN/ AMON(12),IDAY,NMNTH,IYEAR,IMTH              00757000  C  020:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                            00758000  C  020:0000:0
      COMMON /DELTH/ NDLTHR,NDLTH2,DLTHR,DLTH2                 00759000  C  020:0000:0
      DATA ITA/1/                                              00760000  C  020:0000:0
      N1=NDLTHR                                                00761000  C  020:0000:0
      N2=N1                                                    00762000  C  020:0001:0
      N3=N1+NDLTH2                                             00763000  C  020:0001:3
      IST= JULHR(IDAY,IMTH,IYEAR,ISTM)-13                      00764000  C  020:0003:1
      IPT=IST+IBGNT                                            00765000  C  020:0008:1
      DO 94 L=1,LMAX                                           00766000  C  020:0009:4
      HT(L)=0.                                                 00767000  C  020:000B:0
      FYPP(L)=HT(L)                                            00768000  C  020:000C:3
      DO 94 N=1,NMAX                                           00769000  C  020:000F:1
      H(N,L)=0.                                                00770000  C  020:0010:0
      V(N,L)=H(N,L)                                            00771000  C  020:0012:5
      U(N,L)=V(N,L)                                            00772000  C  020:0017:5
      LL=L+LMAX                                                00773000  C  020:001C:4
      H(N,LL)=0.                                               00774000  C  020:001E:3
      V(N,LL)=H(N,LL)                                          00775000  C  020:0021:0
      U(N,LL)=V(N,LL)                                          00776000  C  020:0026:0
   94 CONTINUE                                                 00777000  C  020:002A:5
      DO 95 L=2,LMAX,2                                         00778000  C  020:002F:4
      HT(L)=-2                                                 00779000  C  020:0031:0
   95 CONTINUE                                                 00780000  C  020:0032:5
      ITMADV=IBGNT                                             00781000  C  020:0035:3
      PDROP=PT(ITMADV)                                         00782000  C  020:0036:4
```

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      CALL  FORCE1                                                       00783000  C  020:0039:0
      CALL  FORCE                                                        00784000  C  020:0039:4
  110 CALL TIMER                                                         00785000  C  020:003A:2
      CALL INSIDE                                                        00786000  C  020:003B:0
      CALL BNDRY                                                         00787000  C  020:003B:4
      IF (ITIME.EQ.N1) GO TO 120                                         00788000  C  020:003C:2
      IF (ITIME.NE.N3) GO TO 200                                         00789000  C  020:003D:5
      ISM=ITA-1                                                          00790000  C  020:003F:2
      DO 130 L=36,114,2                                                  00791000  C  020:0040:4
      LC=I2(L)                                                           00792000  C  020:0042:0
      I=L-35+1                                                           00793000  C  020:0043:4
      HTH(ISM,I)=(9.*(H(1,LC+1)+H(1,LC-1))-H(1,LC+3)-H(1,LC-3))/16.      00794000  C  020:0045:3
  130 CONTINUE                                                           00795000  C  020:0050:3
      GO TO 200                                                          00796000  C  020:0052:5
  120 DO 132 L=35,115,2                                                  00797000  C  020:0053:2
      LC=I2(L)                                                           00798000  C  020:0055:0
      I=L-35+1                                                           00799000  C  020:0056:4
      HTH(ITA,I)=H(1,LC)                                                 00800000  C  020:0058:3
  132 CONTINUE                                                           00801000  C  020:005C:3
      ITA=ITA+1                                                          00802000  C  020:005E:5
      N3=N1+N2/2                                                         00803000  C  020:0060:1
      N1=N1+N2                                                           00804000  C  020:0062:1
      ITMADV=ITMADV+1                                                    00805000  C  020:0063:4
      C21=SP(ITMADV)                                                     00806000  C  020:0065:0
      C22=DIR(ITMADV)                                                    00807000  C  020:0067:1
      ANG=C22                                                            00808000  C  020:0069:2
      X12(20)=COS(ANG)                                                   00809000  C  020:0069:5
      X12(21)=SIN(ANG)                                                   00810000  C  020:006B:5
      C23=C23*SQRT(PT(ITMADV)/PDROP)                                     00811000  C  020:006D:5
      PDROP=PT(ITMADV)                                                   00812000  C  020:0072:1
      C24=RT(ITMADV)                                                     00813000  C  020:0074:3
      CALL FORCE1                                                        00814000  C  020:0076:4
  200 CALL FORCE                                                         00815000  C  020:0077:2
      IPTT=IPT+(ITIME+NDLTH2)/NDLTHR                                     00816000  C  020:0078:0
      CALL DATEX(IPTT,NYR,NMO,NDA,NHR,KDAYWK)                            00817000  C  020:007B:0
      HT(151)=NHR                                                        00818000  C  020:007E:4
      CALL HBNDRY                                                        00819000  C  020:0080:0
  290 IF (MHALT.NE.ITIME) GO TO 110                                      00820000  C  020:0080:4
       WRITE(6,99) (JI,(HTH(IJ,JI),IJ=1,19),JI=1,81)                     00820001  C  020:0082:3
   99 FORMAT(1H0,I4,3X,5F6.1,3X,5F6.1,5X,5F6.1,3X,4F6.1)                 00820002  C  020:0095:2
      WRITE(1,999) ((HTH(IJ,JI),IJ=1,19),JI=1,81)                        00820003  C  020:0095:2
  999 FORMAT(19F6.1)                                                     00820004  C  020:00A6:2
      LOCK 1                                                             00820005  C  020:00A6:2
      RETURN                                                             00821000  C  020:00A7:5
      END                                                                00822000  C  020:00A8:2
                                                                            FORMAT SEGMENT 021 IS 0003 LONG.
                                                                            FORMAT SEGMENT 05D IS 000D LONG.
                                                                                   SEGMENT 020 IS 00B4 LONG

##############################################################################################################

                                                                                   START OF SEGMENT 022
      SUBROUTINE INSIDE                                                  00823000  C  022:0000:0
      COMMON /DBD/  DD(10,151),DB(151)                                   00824000  C  022:0000:0
      COMMON /DUMMY1/U(10,302),V(10,302),H(10,302)                       00825000  C  022:0000:0
      COMMON /DUMMY2/ I1(151),I2(151)                                    00826000  C  022:0000:0
      COMMON /DUMMY3/  FX(10,151),FY(10,151)                             00827000  C  022:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                                  00828000  C  022:0000:0
      COMMON /SCND/ AR(300),AI(300),BR(300),BI(300),CR(300),CI(300)      00829000  C  022:0000:0
      COMMON /[illegible]XTH [illegible]AX,N[illegible] NMX[illegible] [illegible]AX,[illegible],LMX[illegible]   [illegible]  C  [illegible]
      I=-1                                                               00831000  C  022:0000:0
      DO 100 I=2,LMX1                                                    00832000  C  022:0000:5
```

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      LQ=I1(L)                                                          00833000  C  022:0002:0
      LC=I2(L)                                                          00834000  C  022:0003:3
      I=-1-I                                                            00835000  C  022:0005:1
      NA=1-I                                                            00836000  C  022:0006:4
      DO 99 N=NA,NMX1                                                   00837000  C  022:0008:0
      B1=(4.*H(N,LC)+H(N+I,LC+1)+H(N+1+I,LC+1)+H(N+I,LC-1)+H(N+1+I,     00838000  C  022:0009:0
     1 LC-1))*.125                                                      00839000  C  022:0016:2
      H1=-DD(N+I,L+1)*(H(N+I,LC+1)-B1)+DD(N+1+I,L-1)*(H(N+1+I,LC-1)-B1) 00840000  C  022:001A:4
      H3=-DD(N+I,L-1)*(H(N+I,LC-1)-B1)+DD(N+1+I,L+1)*(H(N+1+I,LC+1)-B1) 00841000  C  022:0028:2
      DHX=H1+H3                                                         00842000  C  022:0036:0
      DHY=-H1+H3                                                        00843000  C  022:0037:2
      K=DD(N,L)                                                         00844000  C  022:0038:5
      U(N,LQ)=AI(K)*U(N,LQ)-X1(1)*(BR(K)*DHX-BI(K)*DHY)                 00845000  C  022:003B:4
     1  +AR(K)*V(N,LC)+X1(36)*FX(N,L)                                   00846000  C  022:0044:1
      V(N,LQ)=AI(K)*V(N,LQ)-X1(1)*(BR(K)*DHY+BI(K)*DHX)                 00847000  C  022:004B:3
     1 -AR(K)*U(N,LC)+X1(36)*FY(N,L)                                    00848000  C  022:0054:1
      H(N,LQ)=H(N,LQ)-X1(6)*(-U(N+I,LC+1)+U(N+1+I,LC-1)-U(N+I,LC-1)+    00849000  C  022:005B:3
     1 U(N+1+I,LC+1)                                                    00850000  C  022:0067:4
     2     +V(N+I,LC+1)-V(N+1+I,LC-1)-V(N+I,LC-1)+                      00851000  C  022:006A:3
     3 V(N+1+I,LC+1))                                                   00852000  C  022:0074:0
   99 CONTINUE                                                          00853000  C  022:0077:5
  100 CONTINUE                                                          00854000  C  022:007A:1
      RETURN                                                            00855000  C  022:007C:4
      END                                                               00856000  C  022:007D:1
                                                                         SEGMENT 022 IS 0083 LONG

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                                                                         START OF SEGMENT 023
      SUBROUTINE BNDRY                                                  00857000  C  023:0000:0
      COMMON /DBD/ DD(10,151),DB(151)                                   00858000  C  023:0000:0
      COMMON  /DUMMY1/ U(10,302),V(10,302),H(10,302)                    00859000  C  023:0000:0
      COMMON /DUMMY2/ I1(151),I2(151)                                   00860000  C  023:0000:0
      COMMON /DUMY22/ XY1(151), XY3(151),FYPP(151)                      00861000  C  023:0000:0
      COMMON /DUMMY3/ FX(10,151),FY(10,151)                             00863000  C  023:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                                 00864000  C  023:0000:0
      COMMON /SCND/ AR(300),AI(300),BR(300),BI(300),CR(300),CI(300)     00865000  C  023:0000:0
      COMMON /SXTH/ NMAX,NMX1,NMX2,LMAX,LMX1,LMX2                       00866000  C  023:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                                     00867000  C  023:0000:0
      M=NMAX                                                            00868000  C  023:0000:0
C      U/V ON VERTICAL BOUNDARIES                                       00869000  C  023:0001:0
      DO 100 L=3,LMX2,2                                                 00870000  C  023:0001:0
      LQ=I1(L)                                                          00871000  C  023:0002:0
      LC=I2(L)                                                          00872000  C  023:0003:3
      B1=H(1,LC)                                                        00873000  C  023:0005:1
      H1=4.*DD(1,L+1)*(H(1,LC+1)-B1)-DD(2,L+2)*(H(2,LC+2)-B1)           00874000  C  023:0007:1
      H2=4.*DD(1,L-1)*(H(1,LC-1)-B1)-DD(2,L-2)*(H(2,LC-2)-B1)           00875000  C  023:0010:1
      DHX=H1+H2                                                         00876000  C  023:0019:4
      DHY=H1-H2                                                         00877000  C  023:001B:0
      K=DD(1,L)                                                         00878000  C  023:001C:2
      V(1,LQ)=AI(K)*V(1,LQ)-X1(1)*(BR(K)*DHY+BI(K)*DHX)+X1(36)*FY(1,L)  00879000  C  023:001E:4
      B1=H(NMAX,LC)                                                     00880000  C  023:002A:1
      H1=-4.*DD(NMX1,L+1)*(H(NMX1,LC+1)-B1)+DD(NMX1,L+2)*(H(NMX1,       00881000  C  023:002D:1
     1 LC+2)-B1)                                                        00882000  C  023:0035:3
      H2=-4.*DD(NMX1,L-1)*(H(NMX1,LC-1)-B1)+DD(NMX1,L-2)*(H(NMX1,       00883000  C  023:0039:2
     1 LC-2)-B1)                                                        00884000  C  023:0041:5
      K=DD(M,L)                                                         00885000  C  023:0045:4
      DHX=H1+H2                                                         00886000  C  023:0048:3
      DHY=-H1+H2                                                        00887000  C  023:0049:5
      U(M,LQ)=AI(K)*U(M,LQ)-X1(1)*(BR(K)*DHX-BI(K)*DHY)                 00888000  C  023:004B:2
     1 +AR(K)*V(M,LC)+X1(36)*FX(M,L)                                    00889000  C  023:0053:5
      V(M,LQ)=AI(K)*V(M,LQ)-AR(K)*U(M,LC)+X1(36)*FYPP(L)                00890000  C  023:005B:1
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  100 CONTINUE                                                              00891000  C  023:0065:3
C      U/V/H ON TOP BCTTOM BOUNDARIES                                       00892000  C  023:0068:1
      L1=-1                                                                 00893000  C  023:0068:1
      L=LMAX                                                                00894000  C  023:0069:0
      DO 300 KK=1,2                                                         00895000  C  023:006A:1
      L1=-L1                                                                00896000  C  023:006B:0
      L=L1+L-L1*LMAX                                                        00897000  C  023:006C:1
      L2=2*L1                                                               00898000  C  023:006E:4
      LQ=I1(L)                                                              00899000  C  023:0070:1
      LC=I2(L)                                                              00900000  C  023:0071:4
      V(1,LQ)=(4.*V(1,LQ+1)-V(2,LQ+L2))/3.                                  00901000  C  023:0073:2
      V(NMAX,LQ)=(4.*V(NMX1,LQ+L1)-V(NMX1,LQ+L2))/3.                        00902000  C  023:007A:5
      K=DD(M,L)                                                             00903000  C  023:0084:5
      H1=-4.*DD(NMX1,L+L1)*(H(NMX1,LC+L1)-H(NMAX,LC))                       00904000  C  023:0087:4
     1  +DD(NMX1,L+L2)*(H(NMX1,LC+L2)-H(NMAX,LC))                           00905000  C  023:0090:5
      DHX=H1                                                                00906000  C  023:009A:2
      U(M,LQ)=AI(K)*U(M,LQ)-X1(1)*DHX*(BR(K)-BI(K))                         00907000  C  023:009A:5
     1  +AR(K)*V(M,LC)+X1(36)*FX(M,L)                                       00908000  C  023:00A2:5
      DO 300  N=2,NMX1                                                      00909000  C  023:00AA:1
      V(N,LQ)=(4.*(V(N-1,LQ+L1)+V(N  ,LQ+L1))-V(N-1,LQ+L2)-V(N+1,LQ+L2))    00910000  C  023:00AB:0
     1 /6.                                                                  00911000  C  023:00B9:5
      K=DD(N,L)                                                             00912000  C  023:00BA:3
      B1=H(N,LC)                                                            00913000  C  023:00BD:2
      H1=-4.*DD(N-1,L+L1)*(H(N-1,LC+L1)-B1)+DD(N-1,L+L2)*(H(N-1,LC+L2       00914000  C  023:00C0:1
     1 )-B1)                                                                00915000  C  023:00C9:4
      H2= 4.*DD(N   ,L+L1)*(H(N   ,LC+L1)-B1)-DD(N+1,L+L2)*(H(N+1,LC+L2     00916000  C  023:00CD:5
     1 )-B1)                                                                00917000  C  023:00D7:1
      DHX=H1+H2                                                             00918000  C  023:00DB:2
      DHY=-H1+H2                                                            00919000  C  023:00DC:4
      U(N,LQ)=AI(K)* U(N,LQ)-X1(1)*(BR(K)*DHX-BI(K)*DHY)                    00920000  C  023:00DE:1
     1 +AR(K)*V(N,LC)+X1(36)*FX(N,L)                                        00921000  C  023:00E6:4
      H(N,LQ)=H(N,LQ)-X1(6)*(4.*(-U(N-1,LC+L1)+U(N,LC+L1))+U(N-1,LC+L2)     00922000  C  023:00EE:0
     1 -U(N+1,LC+L2))                                                       00923000  C  023:00FA:2
  300 CONTINUE                                                              00924000  C  023:00FD:5
      RETURN                                                                00925000  C  023:0102:2
      END                                                                   00926000  C  023:0102:5
                                                                                SEGMENT 023 IS 0109 LONG

##########################################################################################################

                                                                                   START OF SEGMENT 024
      SUBROUTINE HBNDRY                                                     00927000  C  024:0000:0
      COMMON /DBD/ DD(10,151),DB(151)                                       00928000  C  024:0000:0
      COMMON  /DUMMY1/ U(10,302),V(10,302),H(10,302)                        00929000  C  024:0000:0
      COMMON /DUMMY2/ I1(151),I2(151)                                       00930000  C  024:0000:0
      COMMON /DUMMY3/ FX(10,151),FY(10,151)                                 00931000  C  024:0000:0
      COMMON /RESULT/ HT(151),LSTRM                                         00932000  C  024:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                                     00933000  C  024:0000:0
      COMMON /SCND/ AR(300),AI(300),BR(300),BI(300),CR(300),CI(300)         00934000  C  024:0000:0
      COMMON /SXTH/ NMAX,NMX1,NMX2,LMAX,LMX1,LMX2                           00935000  C  024:0000:0
      DO 100 L=3,LMX2,2                                                     00936000  C  024:0000:0
      LQ=I1(L)                                                              00937000  C  024:0001:0
      K=DD(1,L)                                                             00938000  C  024:0002:3
      K1=DD(1,L+1)                                                          00939000  C  024:0004:5
      K2=DD(2,L+2)                                                          00940000  C  024:0006:4
      K3=DD(1,L-1)                                                          00941000  C  024:0009:0
      K4=DD(2,L-2)                                                          00942000  C  024:000B:2
      H1=4.*DD(1,L+1)*H(1,LQ+1)                                             00943000  C  024:000D:4
      H2=DD(2,L+2)*H(2,LQ+2)                                                00944000  C  024:0011:5
      H3=4.*DD(1,L-1)*H(1,LQ-1)                                             00945000  C  024:0016:0
      H4=[    L-2    2,L                                                    009    0  (   24:C    4
      DHX=BR(K1)*H1-BR(K2)*H2+BR(K3)*H3-BR(K4)*H4                           00947000  C  024:001E:5
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      DHY=BI(K1)*H1-BI(K2)*H2-BI(K3)*H3+BI(K4)*H4                  00948000  C  024:0027:1
      H(1,LQ)=(DHX-DHY-X1(25)*(AR(K)*V(1,LQ)/X1(36)+FX(1,L)))/DB(L)  00949000  C  024:002F:3
  100 CONTINUE                                                     00950000  C  024:003A:4
      DO 110 L=35,115,2                                            00951000  C  024:003D:2
      LQ=I1(L)                                                     00952000  C  024:003F:0
      IF (H(1,LQ).LT.HT(L)) GO TO 110                              00953000  C  024:0040:3
      HT(L)=H(1,LQ)                                                00954000  C  024:0043:4
      HT(L+1)=HT(151)                                              00955000  C  024:0046:5
  110 CONTINUE                                                     00956000  C  024:0048:3
      L1=-1                                                        00957000  C  024:004A:5
      L=LMAX                                                       00958000  C  024:004B:4
      DO 250 I=1,2                                                 00959000  C  024:004C:5
      L1=-L1                                                       00960000  C  024:004E:0
      L=L1+L-L1*LMAX                                               00961000  C  024:004F:1
      LQ=I1(L)                                                     00962000  C  024:0051:4
      L2=2*L1                                                      00963000  C  024:0052:5
      H1=4.*DD(1,L+L1)*H(1,LQ+L1)-DD(2,L+L2)*H(2,LQ+L2)            00964000  C  024:0054:2
      DHX=H1                                                       00965000  C  024:005E:5
      K=DD(1,L)                                                    00966000  C  024:005F:2
      H(1,LQ)=(DHX*(1.-BI(K)/BR(K))-X1(25)*(AR(K)*V(1,LQ)/X1(36)    00967000  C  024:0061:4
     1 +FX(1,L))/BR(K)) /DB(L)                                     00968000  C  024:006B:4
  250 CONTINUE                                                     00969000  C  024:0071:1
      RETURN                                                       00970000  C  024:0073:2
      END                                                          00971000  C  024:0073:5
                                                                       SEGMENT 024 IS 007B LONG

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                                                                        START OF SEGMENT 025
       SUBROUTINE FORCE                                            00972000  C  025:0000:0
       COMMON /DBD/ DD(10,151),DB(151)                             00973000  C  025:0000:0
      COMMON  /DUMMY1/ U(10,302),V(10,302),H(10,302)               00974000  C  025:0000:0
      COMMON /DUMMY2/ I1(151),I2(151)                              00975000  C  025:0000:0
      COMMON /DUMY22/ XY1(151), XY3(151),FYPP(151)                 00976000  C  025:0000:0
      COMMON /DUMMY3/ FX(10,151),FY(10,151)                        00978000  C  025:0000:0
       DIMENSION Y(151),YY(151),XP(2,25)                           00979000  C  025:0000:0
      COMMON /SPLP/ IB(15)                                         00980000  C  025:0000:0
      COMMON /DUMMY4/ S(800),C(800),P(800),DELP(800)               00981000  C  025:0000:0
      COMMON /FRST/ X1(50),X12(50),TIMI                            00982000  C  025:0000:0
      COMMON /SCND/ AR(300),AI(300),BR(300),BI(300),CR(300),CI(300)  00983000  C  025:0000:0
      COMMON /FRTH/ IC12,IC19                                      00984000  C  025:0000:0
      COMMON /FFTH/ ITIME,KTIME,MHALT                              00985000  C  025:0000:0
      COMMON /SXTH/ NMAX,NMX1,NMX2,LMAX,LMX1,LMX2                  00986000  C  025:0000:0
      COMMON /EGTH/ DELS,DELT,G,COR                                00987000  C  025:0000:0
      DATA AX,AY/2*0./                                             00988000  C  025:0000:0
      COMMON /SKWL/ SKEW(151)                                      00989000  C  025:0000:0
       EQUIVALENCE (X12(9),X129),(X12(18),X1218),(X12(10),X1210),  00990000  C  025:0000:0
     1 (X12(15),X1215),(X12(17),X1217)                             00991000  C  025:0000:0
       EQUIVALENCE (X1(7),FIX2),(X1(8),OMILE)                      00992000  C  025:0000:0
C      TIMI FACTOR FOR GROWTH OF STORM                             00993000  C  025:0000:0
       IF(IC19.LT.ITIME) GO TO 158                                 00994000  C  025:0000:0
       QQ=IC19                                                     00995000  C  025:0001:4
       ANG=TIMI*(180./QQ)                                          00996000  C  025:0002:4
       BT=.5*(1.-COS(ANG*1.74532925199433E-2))                     00997000  C  025:0004:5
       GO TO 170                                                   00998000  C  025:000A:1
  158  BT=1.                                                       00999000  C  025:000A:4
C      CALCULATING FORCING TERMS                                   01000000  C  025:000B:2
  170  AX=AX+X12(11)                                               01001000  C  025:000B:2
       AY=AY+X12(12)                                               01002000  C  025:000D:0
C      CALCULATING X AND X*X SEPARATELY                            01003000  C  025:000E:4
       DO 172 N=1,NMAX                                             01004000  C  025:000E:4
      XP(1,N)=XY3(N)-AX                                            01005000  C  025:0010:0
```

```
      XP(2,N)=XP(1,N)+DELS                                   01006000  C  025:0013:4
  172 CONTINUE                                               01007000  C  025:0017:5
      DO 174 L=1,LMAX                                        01008000  C  025:001A:1
      Y(L)=XY1(L)-AY                                         01009000  C  025:001B:0
  174 YY(L)=Y(L)**2                                          01010000  C  025:001D:5
C     CALCULATING HEIGHTS ON OPEN BOUNDARY                   01011000  C  025:0023:0
      DO 178 L=1,LMAX,2                                      01012000  C  025:0023:0
      LQ=I1(L)                                               01013000  C  025:0024:0
      RSQ=(XP(1,NMAX)+SKEW(L))**2+YY(L)                      01014000  C  025:0025:3
      R1=SQRT(RSQ)*OMILE+1.                                  01015000  C  025:002A:3
      J=R1                                                   01016000  C  025:002D:1
      R2=J                                                   01017000  C  025:002D:5
      DR=R1-R2                                               01018000  C  025:002E:2
      J=MINO(J,790)                                          01019000  C  025:002F:4
      H(NMAX,LQ)=BT*(DELP(J)+DR*(DELP(J+1)-DELP(J)))         01020000  C  025:0032:5
  178 CONTINUE                                               01021000  C  025:003B:0
      ASSIGN 182 TO LEAP1                                    01022000  C  025:003D:4
      DO 250 K=1,3                                           01023000  C  025:003E:2
      NA=IB(K)                                               01024000  C  025:003F:0
      NB=IB(K+3)                                             01025000  C  025:0040:3
      LA=IB(K+6)                                             01026000  C  025:0042:1
      LB=IB(K+9)                                             01027000  C  025:0043:5
      I=IB(K+12)                                             01028000  C  025:0045:3
      IF (K.EQ.3) ASSIGN 180 TO LEAP1                        01029000  C  025:0047:1
      DO 250 N=NA,NB                                         01030000  C  025:0049:2
      DO 250 L=LA,LB,2                                       01031000  C  025:004B:0
      XY2N=XP(I,N)+SKEW(L)                                   01032000  C  025:004C:0
      RSQ=XY2N**2+YY(L)                                      01033000  C  025:004F:5
      RS=SQRT(RSQ)                                           01034000  C  025:0051:5
      R1=RS*OMILE+1.                                         01035000  C  025:0053:2
      J=R1                                                   01036000  C  025:0055:0
      R2=J                                                   01037000  C  025:0055:4
      DR=R1-R2                                               01038000  C  025:0056:1
      J=MINO(J,790)                                          01039000  C  025:0057:3
      CJ1=C(J)+DR*(C(J+1)-C(J))                              01040000  C  025:005A:4
      SJ1=S(J)+DR*(S(J+1)-S(J))                              01041000  C  025:005F:4
      A=RS*X129-X1218*(Y(L)*CJ1+XY2N*SJ1)                    01042000  C  025:0063:4
      B=RS*X1210+X1218*(XY2N*CJ1-Y(L)*SJ1)                   01043000  C  025:0068:5
      CC=1./(X1215 +RSQ)                                     01044000  C  025:006E:0
      FCT=X1217  *SQRT(A*A+B*B)*CC*CC                        01045000  C  025:0070:0
      AA=-DD(N,L)*(P(J)+DR*(P(J+1)-P(J)))                    01046000  C  025:0074:3
      PXX=AA*XY2N                                            01047000  C  025:007C:2
      PYY=AA*Y(L)                                            01048000  C  025:007D:2
      FXX=FCT*A                                              01049000  C  025:007F:2
      FYY=FCT*B                                              01050000  C  025:0080:4
      M=DD(N,L)                                              01051000  C  025:0082:0
      GO TO LEAP1  ,(180,182)                                01052000  C  025:0084:5
  180 FYPP(L)=BT*(CR(M)*FYY+CI(M)*FXX)                       01053000  C  025:0087:3
  182 FX(N,L)=BT*(BR(M)*PXX-BI(M)*PYY+CR(M)*FXX-CI(M)*FYY)   01054000  C  025:008D:3
      FY(N,L)=BT*(BR(M)*PYY+BI(M)*PXX+CR(M)*FYY+CI(M)*FXX)   01055000  C  025:0098:2
  250 CONTINUE                                               01056000  C  025:00A3:2
      RETURN                                                 01057000  C  025:00AA:0
      END                                                    01058000  C  025:00AA:3
                                                              SEGMENT 025 IS 00BC LONG

##########################################################################################################

                                                               START OF SEGMENT 026
                                                        FORMAT SEGMENT 06A IS 0051 LONG.
      SUBROUTINE FORCE1                                      01059000  C  026:0000:0
C     SUPERPOSITION OF WIND STRESS AND PRESSURE FUNCTIONS    010[illegible]  C  026:[illegible]:0
      DIMENSION [illegible]                                  01061000  C  026:0000:0
```

```
      COMMON /DUMY22/ XY1(151). XY3(151).FYPP(151)                      01063000 C  026:0000:0
      COMMON /DUMMY4/ S(800).C(800).P(800).DELP(800)                    01065000 C  026:0000:0
      COMMON /FRST/ X1(50).X12(50).TIMI                                 01066000 C  026:0000:0
      COMMON /THRD/ C1.C2.C7.C17.C19.C21.C22.C23.C24.C25                01067000 C  026:0000:0
      COMMON /FRTH/ IC12.IC19                                           01068000 C  026:0000:0
      COMMON /FFTH/ ITIME.KTIME.MHALT                                   01069000 C  026:0000:0
      COMMON /SXTH/ NMAX.NMX1.NMX2.LMAX.LMX1.LMX?                       01070000 C  026:0000:0
      COMMON /EGTH/ DELS.DELT.G.COR                                     01071000 C  026:0000:0
      COMMON  /STRMPS/ XT(50).YT(50).PT(50).RT(50).DIR(50).SP(50).      01073000 C  026:0000:0
     1 PDROP.RAD                                                        01074000 C  026:0000:0
      COMMON /STIME/ ISTM.JHR.IT.IBGNT.ITMADV                           01075000 C  026:0000:0
      COMMON /DMN/ AMON(12).IDAY.NMNTH.IYEAR.IMTH                       01076000 C  026:0000:0
      COMMON /XYLL/ XLAT(50).YLONG(50)                                  01077000 C  026:0000:0
      EQUIVALENCE (X.X12(49)).(Y.X12(50)).(VMAX.C23).(RMAX.C24)         01078000 C  026:0000:0
       INTEGER AMON                                                     01079000 C  026:0000:0
      DATA IBEG/1.111.251/.IEND/101.231.751/.IN/2.10.50/                01080000 C  026:0000:0
      DATA  RADPDG/1.74532925199433E-2/                                 01081000 C  026:0000:0
      DATA RHOA/2.298E-3/.RHOW/4905./.RHOWG/29.89/                      01082000 C  026:0000:0
      DATA EPSLN /1.E-6/                                                01083000 C  026:0000:0
       DATA IADT/0/                                                     01084000 C  026:0000:0
C     RHOA = DENSITY OF AIR IN MB HR**2 MILE**-2. RHOW = DENSITY OF WATER 01085000 C  026:0000:0
C     IN MB SEC**2 FT**-1 MILE**-1 , RHOWG = EENSIDENSITYATER TIMES ACCEL- 01086000 C  026:0000:0
C     ERATION OF GRAVITY IN MB FT**-1                                   01087000 C  026:0000:0
       DATA JSET/150/                                                   01088000 C  026:0000:0
       VEE(R)=2.*VMAX*RMAX*R/(RMAX**2+R**2)                             01089000 C  026:0000:0
       DERLNV(R)=1./R-2.*R/(RMAX**2+R**2)                               01090000 C  026:0005:1
       PRGRAD(R.V)=RHOA*V*V*(XKS/SINPHI-DERLNV(R))                      01091000 C  026:0009:3
       PYTHAG(X)=SQRT((1.-X)*(1.+X))                                    01092000 C  026:000D:4
       CORHR=3600.*COR                                                  01093000 C  026:0010:3
C     CORHR= CORIOLIS PARAMETER IN HR**-1                               01094000 C  026:0012:2
C****************************************************************** 01095000 C  026:0012:2
C*       C1=INITIAL STORM POSITION (X-COMPONENT)                        01096000 C  026:0012:2
C*       C2=INITIAL STORM POSITION (Y-COMPONENT)                        01097000 C  026:0012:2
C*       C7=SLIP COEFFICIENT                                            01098000 C  026:0012:2
C*       C17=ATMOSPHERIC DENSITY                                        01099000 C  026:0012:2
C*       C19=DRAG COEFFICIENT (3X10-6)                                  01100000 C  026:0012:2
C*       C21=SPEED OF STORM MOTION                                      01101000 C  026:0012:2
C*       C22=DIRECTION OF STORM MOTION                                  01102000 C  026:0012:2
C*       C23=MAXIMUM SUSTAINED WIND FOR STATIONARY STORM                01103000 C  026:0012:2
C*       C24=RADIUS OF MAXIMUM WINDS                                    01104000 C  026:0012:2
C*       C25=EDDY VISCOSITY COEFFICIENT                                 01105000 C  026:0012:2
C****************************************************************** 01106000 C  026:0012:2
    8  CONTINUE                                                         01107000 C  026:0012:2
       XKS=.01*SQRT(RMAX/(.3*VMAX+60.))                                 01108000 C  026:0012:2
       XKN=.01*SQRT(RMAX/(.4*VMAX+80.))                                 01109000 C  026:0019:2
       J2=MIN1(3.*RMAX.50.)                                             01110000 C  026:0020:2
       RO=JSET+50                                                       01111000 C  026:0024:1
       MMAX=JSET+9*J2+49                                                01112000 C  026:0025:3
       DELR=1.                                                          01113000 C  026:0028:0
       VEERO=VEE(RO)*RO                                                 01114000 C  026:0028:4
       COTPHI=(CORHR*RO/VEERO+XKN)/XKS                                  01115000 C  026:002A:4
       WO=VEERO*COTPHI/SQRT(1.+COTPHI*COTPHI)                           01116000 C  026:002D:3
C     DWDR=0. WITH THIS INITIAL CONDITION                               01117000 C  026:0030:4
       SINPHI=PYTHAG(WO/VEERO)                                          01118000 C  026:0030:4
       PRESS=0.                                                         01119000 C  026:0032:4
       DPDRO=PRGRAD(RO.VEERO/RO)                                        01120000 C  026:0033:2
C     RUNGE-KUTTA-HEUN-TAYLOR METHOD TO SOLVE THE EQUATION              01121000 C  026:0035:4
C     DWDR=W*XKS/SIN(PHI)-CORHR*R-XKN*V*R=G(W,R) WHERE W=V*R*COS(PHI)   01122000 C  026:0035:4
       DO 40 I=1,MMAX                                                   01123000 C  026:0035:4
       FACT=2./DELR                                                     01124000 C  026:0037:0
       SLPO=WO*XKS/SINPHI-CORHR*RO-XKN*VEERO                            01125000 C  026:0038:2
       R1=RO-DELR                                                       01126000 C  026:003C:1
```

```
      VEER1=VEE(R1)*R1                                                  01127000  C  026:003D:3
      W1=WO*(VEER1/VEERO)                                               01128000  C  026:003F:3
C     NEWON-RAPHSON METHOD TO FIND W1 SO THAT                           01129000  C  026:0041:2
C     .5*(G(W1,R1)+G(WO8RO))=(WO-W1)/NRO-R1)                            01130000  C  026:0041:2
      DO 15 K=1,75                                                      01131000  C  026:0041:2
      SINPHI=PYTHAG(W1/VEER1)                                           01132000  C  026:0042:0
      SLP1=W1*XKS/SINPHI-CORHR*R1-XKN*VEER1                             01133000  C  026:0044:0
      PADD=FACT*(WO-W1)-SLPO                                            01134000  C  026:0047:5
      DGDW=XKS/(SINPHI*SINPHI*SINPHI)                                   01135000  C  026:004A:1
      DELW=(SLP1-PADD)/(DGDW+FACT)                                      01136000  C  026:004C:2
      DELW=AMAX1(DELW,.9*(W1-VEER1))                                    01137000  C  026:004E:4
      W1=W1-DELW                                                        01138000  C  026:0053:0
      IF(W1) 99,99,7                                                    01139000  C  026:0054:2
    7 IF(ABS(DELW/VEER1)-EPSLN) 25,25,15                                01140000  C  026:0055:1
   15 CONTINUE                                                          01141000  C  026:0057:2
      PRINT 20                                                          01142000  C  026:0059:3
   20 FORMAT('OINSUFFICIENT STEPS IN NEWTON-RAPHSON LOOP')              01143000  C  026:005D:2
      STOP 999                                                          01144000  C  026:005D:2
   25 RO=R1                                                             01145000  C  026:005E:3
      K=R1+1.01                                                         01146000  C  026:005F:2
      VEERO=VEER1                                                       01147000  C  026:0061:5
      WO=W1                                                             01148000  C  026:0062:4
      C(K)=WO/VEERO                                                     01149000  C  026:0063:3
      SINPHI=PYTHAG(C(K))                                               01150000  C  026:0066:0
      S(K)=SINPHI                                                       01151000  C  026:0068:3
      DPDR1=PRGRAD(R1,VEER1/R1)                                         01152000  C  026:006A:1
      P(K)=DPDR1                                                        01153000  C  026:006C:3
      PRESS=PRESS-(DPDRO+DPDR1)/FACT                                    01154000  C  026:006E:3
      DELP(K)=PRESS                                                     01155000  C  026:0070:5
      DPDRO=DPDR1                                                       01156000  C  026:0072:5
      IF (K-J2-1) 27,27,40                                              01157000  C  026:0073:4
   27 DELR=.1                                                           01158000  C  026:0075:2
   40 CONTINUE                                                          01159000  C  026:0077:3
      DELP(1)=PRESS-DPDRO/FACT                                          01160000  C  026:0079:4
      P(1)=0.                                                           01161000  C  026:007C:1
      S(1)=0.                                                           01162000  C  026:007D:3
      C(1)=1.                                                           01163000  C  026:007E:3
      RO=JSET-1                                                         01164000  C  026:007F:5
      TERM=RO/(RMAX*RMAX+RO*RO)                                         01165000  C  026:0081:0
      PADD=2.*RHOA*((VMAX*RMAX)**2)*(XKS*(ATAN(RMAX/RO)/RMAX+TERM)/     01166000  C  026:0084:0
     1 S(JSET)+TERM*TERM)                                               01167000  C  026:008A:3
C      PADD = PRESSURE IN MB FROM RO=JSET-1 TO RO=INFINITY, ASSUMING    01168000  C  026:008D:1
C     SINPHI=S(JSET)=CONST, FROM R=JSET-1 TO INFINITY                   01169000  C  026:008D:1
      PINFT=PADD+DELP(JSET)-DELP(1)                                     01170000  C  026:008D:1
C     PINFT = PRESSURE DROP IN MB FROM R=0. TO INFINITY ON THIS ASSUMPT 01171000  C  026:0090:1
C     ION                                                               01172000  C  026:0090:1
      PRS=PDROP                                                         01173000  C  026:0090:1
       IF (ABS(PINFT-PRS)-.2) 100,100,55                                01174000  C  026:0091:3
   55 VMAX=VMAX*SQRT(PRS/PINFT)                                         01175000  C  026:0094:4
      GO TO 8                                                           01176000  C  026:0097:4
   99 PRINT 98                                                          01177000  C  026:0098:1
   98 FORMAT('OCOS(PHI).LT.O.')                                         01178000  C  026:009C:2
      STOP                                                              01179000  C  026:009C:2
  ,00 SINPHI=S(JSET-1)                                                  01180000  C  026:009D:3
      COSPHI=C(JSET-1)                                                  01181000  C  026:009F:1
      JSTP1=JSET+1                                                      01182000  C  026:00A1:0
      DO 60 K=JSTP1,IC12                                                01183000  C  026:00A2:2
      RO=K+1                                                            01184000  C  026:00A3:0
      S(K)=SINPHI                                                       01185000  C  026:00A4:1
      C(K)=COSPHI                                                       01186000  C  026:00A5:5
      P(K) ...RAD(..,VEE(..),                                           011.....  C  ..6:0....5
      DELP(K)=DELP(K-1)+.5*(P(K)+P(K-1))                                01188000  C  026:00AB:3
```

```
   60 CONTINUE                                                           C  026:00B3:2
      PRESS=PADD+DELP(JSET)                                              C  026:00B5:4
      DO 65 I=1,IC12                                                     C  026:00B8:0
      DELP(I)=(PRESS-DELP(I))/RHOWG                                      C  026:00B9:0
      P(I)=P(I)/RHOW                                                     C  026:00BD:0
   65 CONTINUE                                                           C  026:00BF:3
C       R IN FEET                                                        C  026:00C1:5
       X12(4)=C24*5280.                                                  C  026:00C1:5
C       SPEED OF STORM IN FT/SEC                                         C  026:00C4:1
      X12(7)=C21*44./30.                                                 C  026:00C4:1
C       MAX WINDS IN FT/SEC                                              C  026:00C6:5
       X12(8)=C23*44./30.                                                C  026:00C6:5
C       COMPONENT SPEED OF STORM IN FT/SEC                               C  026:00C9:3
       X12(9)=X12(7)*X12(20)                                             C  026:00C9:3
       X12(10)=X12(7)*X12(21)                                            C  026:00CC:0
C       COMPONENT MOVEMENT OF STORM FOR 1 TIMI INTERVAL                  C  026:00CE:3
       X12(11)=DELT*X12(9)                                               C  026:00CE:3
       X12(12)=DELT*X12(10)                                              C  026:00D0:5
       X12(13)=X12(8)*X12(8)*X12(4)                                      C  026:00D3:1
      A=X12(8)                                                           C  026:00D6:3
      A=A*A                                                              C  026:00D7:4
      B=X12(4)                                                           C  026:00D8:3
      B=B*B                                                              C  026:00D9:4
      X12(14)=A/B                                                        C  026:00DA:3
       X12(15)=X12(4)*X12(4)                                             C  026:00DC:2
      X12(16)=4.*A*X12(15)*C19                                           C  026:00DE:5
       X12(17)=C19*      X12(15)                                         C  026:00E2:2
       X12(18)=2.*X12(8)                                                 C  026:00E4:5
       IST=JULHR(IDAY,IMTH,IYEAR,ISTM)-13                                C  026:00E7:0
       J=IBGNT+IADT                                                      C  026:00EC:0
       IADT=IADT+1                                                       C  026:00ED:5
       WFCT(IADT)=VMAX                                                   C  026:00EF:1
       IF(J.NE.JHR) GO TO 79                                             C  026:00F0:5
       PRINT5002                                                         C  026:00F2:2
 5002  FORMAT(1H1'  STORM DATA FOR TIMI OF NEAREST APPROACH TO BASIN CEN C  026:00F6:2
     1TER')                                                              C  026:00F6:2
       DLAT=90.-XLAT(J)/RAD                                              C  026:00F6:2
       DLONG=YLONG(J)/RAD                                                C  026:00F9:2
       CALL DATEX(J  +IST,NYR,NMO,NDA,NHR,KDAYWK)                        C  026:00FC:0
       PRINT 5000,ITIME,KDAYWK,NDA,AMON(NMO),NYR,NHR,DLAT,DLONG,X12(49), C  026:0100:0
     1 X12(50),C23,C24,C21,PADD,PINFT                                    C  026:0111:2
 5000 FORMAT(///'    STORM DATA AT',I4,' DELTA TIMI, OR ',A3,', ',I3,1X, C  026:011E:2
     AA3,I5,' AT HOUR',I3,'.  STORM POSITION AT LATITUDE',F6.2,', LONGIT C  026:011E:2
     BUDE',F6.2/'    X-POINT    Y-POINT  MAX WIND    RADIUS  STRM SPD    C  026:011E:2
     C PADD PRES DROP'/7F10.3)                                           C  026:011E:2
       PRINT 74                                                          C  026:011E:2
   74  FORMAT   (//'     RADIUS     SPEED PRES DROP INFLW ANG  STC HGHT  C  026:0122:2
     1     P GRAD')                                                      C  026:0122:2
      DO 78 K=1,3                                                        C  026:0122:2
      J1=IBEG(K)                                                         C  026:0123:0
      J2=IEND(K)                                                         C  026:0124:3
      J3=IN(K)                                                           C  026:0126:0
      DO 78 I=J1,J2,J3                                                   C  026:0127:3
       J=I-1                                                             C  026:0129:0
      PHI=ARSIN(S(I))/RADPDG                                             C  026:012A:2
      PRESS=PINFT-RHOWG*DELP(I)                                          C  026:012D:0
      RO=J                                                               C  026:012F:5
      XX=VEE(RO)                                                         C  026:0130:4
      PRINT 76,J,XX,PRESS,PHI,DELP(I),P(I)                               C  026:0132:1
   78  CONTINUE                                                          C  026:0142:2
   76 FORMAT (I10,4F10.2,F11.8)                                          C  026:0146:5
   79 DO 90 I=2,IC12                                                     C  026:0146:5
```

```
      P(I)=P(I)/((I-1.)*5280.)                                01251000  C   026:0148:0
   90 CONTINUE                                                01252000  C   026:014B:3
C     TO DETERMINE (N-NO)*DELS FOR VARIABLE REGIONS          01253000  C   026:014D:5
      CFIX=(C1-1.)/2.+1.                                      01254000  C   026:014D:5
      DO 128 N=1,NMAX                                         01255000  C   026:0150:0
      A=N                                                     01256000  C   026:0151:0
      SET=A-CFIX                                              01257000  C   026:0151:5
  128 XY3(N)=SET*2.*DELS                                      01258000  C   026:0152:5
C     TO DETERMINE L-LO                                       01259000  C   026:0158:1
      DO 136 L=1,LMAX                                         01260000  C   026:0158:1
      A=L                                                     01261000  C   026:0159:0
      SET=A-C2                                                01262000  C   026:0159:5
  136 XY1(L)=SET*DELS                                         01263000  C   026:015B:0
      RETURN                                                  01264000  C   026:015F:5
      END                                                     01265000  C   026:0160:2
                                                                 FORMAT SEGMENT 027 IS 0005 LONG.
                                                                 FORMAT SEGMENT 06B IS 000F LONG.
                                                                    SEGMENT 026 IS 0179 LONG

##########################################################################################################

                                                                       START OF SEGMENT 028
                                                                       SEGMENT 033 IS 002C LONG
                                                                    SEGMENT 028 IS 0219 LONG
    NO ERRORS DETECTED.  NUMBER OF CARDS = 1207.
    COMPILATION TIME = 165 SECONDS ELAPSED.  22.78 SECONDS PROCESSING.
    D2 STACK SIZE = 118 WORDS.  FILESIZE = 2188 WORDS.  ESTIMATED CORE STORAGE REQUIREMENT = 30665 WORDS.
    TOTAL PROGRAM CODE = 3877 WORDS.  ARRAY STORAGE = 24424 WORDS.
    NUMBER OF PROGRAM SEGMENTS = 50.  NUMBER OF DISK SEGMENTS = 249.
    PROGRAM CODE FILE = STORM, COMPILER COMPILED ON 05/26/76
```

EOFILINE 00010001000100 76208 76213 0000770001331 B6500
EOF2F0002000020301000000000000000004680 00

MACHINE NO. OPERATOR SHIFT DATE COST CENTER START TIME STOP TIME

REEL NO. FILE FILE ID. LINE

REQ # 10 SF/MF: MULTI COLLATE: YES FORMS: OFF COPIES: 1

PAGES TO BIN 25

LINES TO BIN 1317

PAGES TO TRAY 0

OVERPRINTS 0

VOLUMES PROC'D 1

BLOCK COUNT 79

BLKS SKIPPED 0

EOR DISPLAY 020 LP# 0024 # MP 0

DATA (COASTAL TOPOGRAPHY) FILE

```
VOL1                        652020601                                                    1
HDR1FILEE                   00010001000100 76208 76213 000000000000 B6500
HDR2F0C02200022301000000000000000004680              00
```

FILE 2 = DATA,
UNIT = DISKPACK
RECORD = 14
BLOCKING = 30

POSITION OF COAST

139.1	143.8	148.5	151.5	151.5	147.4	139.9	130.3	119.5	108.7	98.8	90.0	82.8	77.5
74.3	72.9	72.6	72.6	72.2	70.5	67.8	64.3	60.4	56.5	52.9	49.6	46.4	43.5
40.7	37.9	34.7	31.1	26.6	21.1	15.0	9.2	4.5	2.0	2.3	4.7	8.1	11.4
13.4	13.6	12.2	9.9	7.2	4.7	2.7	1.3	0.4	0.0	0.2	0.8	1.6	2.3
2.8	2.9	2.6	1.9	0.9	-0.3	-1.5	-2.9	-4.1	-5.2	-6.0	-6.6	-7.0	-7.2
-7.5	-7.8	-8.3	-8.8	-9.4	-10.0	-7.5	-5.1	-2.9	-1.1	0.3	1.3	1.8	2.0
2.0	1.8	1.5	1.1	0.7	0.1	-0.5	-1.1	-1.6	-1.9	-1.9	-1.5	-0.9	-0.1
0.6	1.1	1.3	1.3	0.9	0.3	-0.5	-1.5	-2.1	-1.9	-0.7	2.0	5.9	10.7
16.0	21.5	26.9	32.0	37.0	41.7	46.2	50.4	54.3	58.0	61.4	64.5	67.3	69.5
70.8	71.1	70.1	68.2	65.6	62.8	60.1	57.8	55.9	54.5	53.4	52.8	52.5	51.9
50.9	48.8	45.3	40.7	35.4	29.9	24.7	20.3	16.6	13.4	10.5			

WATER DEPTH AT GRID POINTS

11X151

25.0	28.0	32.2	38.7	48.6	63.1	82.8	107.2	135.7	167.8	25.0	23.8	24.3	28.0
36.6	51.6	73.7	101.3	132.7	166.3	25.0	20.4	17.9	19.4	26.9	42.5	66.6	96.9
130.7	165.3	25.0	18.0	13.2	13.1	20.0	36.1	61.8	94.2	129.7	164.9	25.0	16.4
10.4	9.3	15.9	32.5	59.5	93.3	129.8	165.1	25.0	15.9	9.4	8.1	14.7	31.8
59.6	94.2	131.2	165.9	25.0	16.3	10.2	9.3	16.3	33.9	62.1	96.9	133.5	167.3
25.0	17.4	12.4	12.5	20.3	38.3	66.6	101.0	136.8	169.2	25.0	19.3	16.0	17.6
26.3	44.7	72.8	106.3	140.8	171.4	25.0	21.8	20.7	24.1	34.0	52.8	80.3	112.6
145.3	173.8	25.0	24.7	26.3	31.8	43.1	62.1	88.9	119.6	150.2	176.4	25.0	27.9
32.5	40.3	53.1	72.4	98.2	127.0	155.2	179.1	25.0	31.4	39.1	49.5	63.8	83.3
108.0	134.7	160.4	181.7	25.0	35.0	46.0	58.9	74.8	94.5	117.9	142.4	165.4	184.1
25.0	38.6	52.9	68.4	85.7	105.6	127.6	149.8	170.1	186.2	25.0	42.1	59.5	77.5
96.3	116.2	136.8	156.7	174.3	187.9	25.0	45.4	65.8	86.0	106.1	126.0	145.2	162.9
177.9	189.2	25.0	48.4	71.4	93.6	114.8	134.6	152.6	168.1	180.7	189.9	25.0	50.9
76.1	100.1	122.2	141.8	158.4	172.1	182.6	189.9	25.0	52.8	79.8	105.0	127.8	147.1
162.6	174.6	183.3	189.1	25.0	54.2	82.4	108.6	131.7	150.7	165.2	175.7	182.9	187.5
25.0	55.1	84.1	110.8	134.0	152.7	166.2	175.6	181.6	185.4	25.0	55.6	85.0	111.9
135.0	153.2	166.0	174.4	179.5	182.6	25.0	55.7	85.1	111.9	134.8	152.5	164.6	172.2
176.7	179.5	25.0	55.5	84.6	111.1	133.5	150.7	162.2	169.3	173.4	176.0	25.0	54.9
83.5	109.4	131.4	148.0	159.0	165.7	169.6	172.3	25.0	54.1	82.0	107.2	128.5	144.6
155.2	161.6	165.5	168.4	25.0	53.2	80.1	104.5	125.1	140.7	150.9	157.2	161.2	164.4
25.0	52.1	77.9	101.4	121.2	136.3	146.3	152.6	156.9	160.6	25.0	50.9	75.6	98.1
117.2	131.8	141.6	148.0	152.6	156.8	25.0	49.6	73.2	94.7	113.0	127.2	136.9	143.6
148.6	153.4	25.0	48.4	70.9	91.4	109.0	122.8	132.5	139.4	144.8	150.2	25.0	47.3
68.6	88.2	105.2	118.6	128.4	135.6	141.6	147.6	25.0	46.2	66.6	85.4	101.8	115.0
124.8	132.4	138.9	145.4	25.0	45.3	64.8	82.9	98.9	111.9	121.9	129.8	136.7	143.8
25.0	44.5	63.3	80.8	96.3	109.2	119.4	127.7	135.1	142.7	25.0	43.8	61.9	78.9
94.1	107.0	117.3	126.0	133.9	142.0	25.0	43.2	60.8	77.3	92.3	105.1	115.7	124.8
133.1	141.6	25.0	42.6	59.7	75.9	90.6	103.5	114.3	123.8	132.6	141.4	25.0	42.1
58.8	74.7	89.2	102.1	113.2	123.0	132.2	141.4	25.0	41.7	58.0	73.6	88.0	100.9
112.3	122.4	132.0	141.4	25.0	41.3	57.3	72.6	86.9	99.9	111.4	121.9	131.8	141.6
25.0	40.9	56.6	71.6	85.8	98.8	110.6	121.4	131.6	141.6	25.0	40.6	55.9	70.7
84.8	97.8	109.8	120.9	131.3	141.5	25.0	40.2	55.2	69.8	83.7	96.8	108.8	120.1
130.9	141.2	25.0	39.9	54.5	68.9	82.6	95.6	107.8	119.2	130.1	140.7	25.0	39.5
53.8	67.8	81.3	94.2	106.4	118.0	129.1	139.8	25.0	39.1	53.0	66.6	79.9	92.7
104.8	116.4	127.6	138.4	25.0	38.6	52.1	65.4	78.3	90.8	102.9	114.5	125.8	136.7
25.0	38.1	51.1	64.0	76.6	88.9	100.7	112.3	123.5	134.6	25.0	37.6	50.2	62.6
74.8	86.8	98.4	109.8	121.1	132.2	25.0	37.1	49.2	61.2	73.0	84.6	96.0	107.3
118.4	129.5	25.0	36.7	48.3	59.8	71.2	82.5	93.6	104.6	115.6	126.8	25.0	36.2
47.4	58.5	69.6	80.4	91.2	102.0	112.9	124.0	25.0	35.8	46.6	57.4	68.0	78.5
89.0	99.4	110.1	121.2	25.0	35.5	46.0	56.4	66.7	76.8	86.9	97.1	107.5	118.5
25.0	35.3	45.5	55.6	65.6	75.4	85.1	94.9	105.1	116.0	25.0	35.1	45.1	55.1
64.8	74.3	83.6	93.1	103.0	113.8	25.0	35.0	45.0	54.8	64.4	73.6	82.6	91.7
101.3	111.8	25.0	35.1	45.1	54.9	64.3	73.3	82.0	90.7	100.0	110.3	25.0	35.3
45.5	[illegible]	64.8	73.6	[illegible]	[illegible]	[illegible]	109.3	25.0	35.6	46.1	[illegible]	65.7	74.5
[illegible]	[illegible]	[illegible]	[illegible]	25.0	[illegible]	[illegible]	57.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	108.9
25.0	36.8	48.2	59.1	69.1	77.9	85.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

71.4	80.3	87.9	94.9	102.2	110.7	25.0	38.3	51.1	63.1	73.9	83.0	90.5	97.2
104.1	112.3	25.0	39.1	52.7	65.4	76.6	85.9	93.3	99.8	106.4	114.2	25.0	39.9
54.3	67.7	79.3	88.9	96.3	102.6	108.9	116.5	25.0	40.8	55.9	69.9	82.1	91.9
99.3	105.5	111.6	119.0	25.0	41.6	57.5	72.1	84.8	94.8	102.3	108.4	114.4	121.6
25.0	42.3	58.9	74.1	87.2	97.6	105.1	111.2	117.2	124.4	25.0	42.9	60.1	75.8
89.4	100.0	107.7	113.8	119.8	127.3	25.0	43.4	61.1	77.3	91.1	102.0	109.9	116.1
122.4	130.1	25.0	43.8	61.8	78.3	92.4	103.5	111.6	118.1	124.7	132.9	25.0	44.0
62.2	78.8	93.2	104.5	112.8	119.6	126.6	135.6	25.0	43.9	62.1	78.8	93.3	104.7
113.3	120.5	128.2	138.1	25.0	43.7	61.7	78.2	92.6	104.2	113.0	120.8	129.3	140.3
25.0	43.2	60.8	77.0	91.3	102.9	112.1	120.5	129.9	142.3	25.0	42.6	59.6	75.4
89.4	101.1	110.5	119.6	130.1	144.0	25.0	41.8	58.2	73.4	87.1	98.7	108.5	118.3
129.9	145.4	25.0	41.0	56.5	71.1	84.4	96.0	106.0	116.5	129.3	146.4	25.0	40.0
54.7	68.6	81.5	92.9	103.2	114.4	128.4	147.1	25.0	39.0	52.8	66.0	78.3	89.6
100.2	112.1	127.1	147.4	25.0	38.0	50.8	63.3	75.1	86.2	97.0	109.5	125.5	147.2
25.0	37.0	48.9	60.6	71.9	82.8	93.7	106.7	123.7	146.7	25.0	36.1	47.1	58.0
68.8	79.4	90.5	103.9	121.6	145.6	25.0	35.2	45.4	55.6	65.9	76.3	87.3	101.0
119.2	144.0	25.0	34.4	43.9	53.5	63.3	73.4	84.4	98.2	116.7	142.0	25.0	33.8
42.7	51.8	61.2	70.9	81.7	95.4	114.0	139.4	25.0	33.3	41.8	50.5	59.5	68.9
79.4	92.9	111.2	136.2	25.0	33.1	41.3	49.7	58.3	67.4	77.6	90.5	108.2	132.4
25.0	33.0	41.1	49.3	57.8	66.5	76.1	88.4	105.1	128.1	25.0	33.1	41.3	49.4
57.7	66.1	75.1	86.5	102.0	123.4	25.0	33.3	41.7	49.9	58.0	66.0	74.4	84.8
98.9	118.4	25.0	33.7	42.3	50.6	58.7	66.3	74.0	83.3	95.8	113.2	25.0	34.1
43.0	51.6	59.6	66.9	73.8	81.9	92.7	107.8	25.0	34.6	43.9	52.7	60.7	67.7
73.9	80.7	89.7	102.5	25.0	35.1	44.9	53.9	62.0	68.6	74.0	79.6	86.9	97.2
25.0	35.6	45.9	55.2	63.2	69.5	74.3	78.7	84.2	92.1	25.0	36.2	46.8	56.4
64.5	70.5	74.6	77.9	81.7	87.3	25.0	36.6	47.7	57.5	65.6	71.4	74.9	77.1
79.4	83.0	25.0	37.0	48.4	58.5	66.6	72.2	75.1	76.4	77.4	79.1	25.0	37.3
49.0	59.2	67.4	72.7	75.2	75.8	75.7	75.8	25.0	37.5	49.3	59.6	67.8	73.0
75.2	75.3	74.3	73.2	25.0	37.6	49.4	59.7	67.8	73.0	75.0	74.8	73.3	71.5
25.0	37.5	49.2	59.4	67.5	72.6	74.6	74.3	72.6	70.5	25.0	37.2	48.8	58.9
66.9	72.0	74.1	73.9	72.4	70.4	25.0	36.9	48.2	58.1	66.0	71.2	73.5	73.7
72.5	70.9	25.0	36.5	47.5	57.1	64.9	70.2	72.9	73.6	73.1	72.2	25.0	36.1
46.6	56.0	63.7	69.2	72.3	73.7	74.0	74.2	25.0	35.6	45.8	54.9	62.6	68.2
71.8	74.0	75.4	76.8	25.0	35.1	44.9	53.8	61.4	67.3	71.5	74.6	77.2	79.9
25.0	34.7	44.0	52.7	60.3	66.6	71.4	75.5	79.3	83.7	25.0	34.3	43.3	51.7
59.4	66.0	71.6	76.7	82.0	87.9	25.0	33.9	42.6	51.0	58.8	65.8	72.2	78.4
85.0	92.6	25.0	33.6	42.2	50.4	58.4	65.9	73.1	80.4	88.5	97.7	25.0	33.5
41.9	50.2	58.4	66.5	74.5	82.9	92.4	103.3	25.0	33.4	41.9	50.3	58.9	67.5
76.4	85.9	96.7	109.2	25.0	33.5	42.1	50.9	59.9	69.1	78.8	89.5	101.5	115.4
25.0	33.8	42.7	51.9	61.3	71.2	81.8	93.5	106.7	121.9	25.0	34.2	43.5	53.2
63.2	73.8	85.3	97.9	112.1	128.4	25.0	34.7	44.6	54.8	65.4	76.8	89.0	102.5
117.7	135.0	25.0	35.3	45.7	56.6	67.9	80.0	93.0	107.3	123.3	141.4	25.0	35.9
47.0	58.5	70.5	83.2	97.0	112.0	128.8	147.6	25.0	36.6	48.3	60.4	73.1	86.5
101.0	116.7	134.0	153.4	25.0	37.2	49.6	62.4	75.7	89.7	104.7	121.0	138.9	158.6
25.0	37.8	50.9	64.2	78.1	92.7	108.2	125.0	143.2	163.2	25.0	38.4	52.0	65.9
80.3	95.4	111.3	128.4	146.9	167.0	25.0	38.9	53.0	67.4	82.2	97.6	113.9	131.2
149.8	170.0	25.0	39.3	53.7	68.5	83.6	99.3	115.8	133.2	151.8	171.9	25.0	39.6
54.2	69.2	84.5	100.4	116.9	134.3	152.8	72.6	25.0	39.7	54.4	69.4	84.8	100.6
117.1	134.4	152.6	172.1	25.0	39.6	54.2	69.1	84.4	100.0	116.3	133.3	151.2	170.1
25.0	39.3	53.7	68.3	83.2	98.5	114.4	131.0	148.4	166.8	25.0	38.8	52.7	66.9
81.3	96.2	111.6	127.6	144.4	162.1	25.0	38.2	51.5	65.1	78.9	93.1	107.9	123.3
139.4	156.3	25.0	37.5	50.1	62.9	76.0	89.5	103.6	118.2	133.5	149.6	25.0	36.7
48.5	60.4	72.8	85.5	98.8	112.6	127.0	142.2	25.0	35.8	46.7	57.8	69.2	81.1
93.5	106.5	120.1	134.3	25.0	34.9	44.8	55.0	65.6	76.6	88.1	100.1	112.8	126.0
25.0	33.9	43.0	52.2	61.9	71.9	82.5	93.7	105.3	117.6	25.0	33.0	41.1	49.5
58.2	67.3	77.0	87.2	98.0	109.2	25.0	32.1	39.4	46.9	54.7	62.9	71.7	81.0
90.8	101.1	25.0	31.3	37.8	44.4	51.4	58.8	66.7	75.1	84.0	93.4	25.0	30.6
36.3	42.3	48.5	55.1	62.2	69.8	77.8	86.3	25.0	30.0	35.2	40.5	46.0	52.0
58.3	65.1	72.3	80.0	25.0	29.6	34.3	39.1	44.1	49.5	55.2	61.3	67.8	74.7
25.0	29.3	33.7	38.2	42.9	47.8	53.0	58.5	64.3	70.6	25.0	29.2	33.5	37.8
42.3	46.8	51.6	56.6	61.9	67.6	25.0	29.3	33.6	37.9	42.2	46.6	51.0	55.5

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VOL1                         652020601                                      1
HDR1LINE                     00010001000100 76209 76214 000000000000 B6500
HDR2F0002200022301000000000000000000004680          00
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SAMPLE INPUT DATA

```
    STORMRESEARCH  PLOT
  CAPE  MAY
   38.64      74.9  NORTH  -20
 27.5 38.6
  37.         77.
  36.75       75.25
  36.5        73.5
  36.25       71.75
  36.         70.
 30.
 44.
 40.
 40.
1200
 6
MARCH
1962
```

OUTPUT: MARCH 1962 STORM

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VOL1                                                                     1
HDR1FILE6           652020601
                    0001000100100 76205 76210 0000000000000 36500
HDR2F0002200022301000000000000000000004680  00
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SAMPLE OUTPUT

THESE ARE THE 5 STORM POSITIONS READ IN BY THE COMP UTER
PLEASE CHECH TIMES, LATITUDES, LONGTITUDES, PRESSURE DROPS AND STORM SIZES FOR AGREEMENT AND CONSISTENCY

HOUR	DAY	MNTH	YEAR	LATITUDE	LONGITUDE	PRS DROP	STRM SIZE	LENGTH	AZIMUTH	X-CORD	Y-CORD
12	6	MAR	1962	37.00	77.00	30.00	40.00	139.98	198.48	-11.67	37.07
18	6	MAR	1962	36.75	75.25	32.19	40.00	114.63	160.94	11.69	44.04
0	7	MAR	1962	36.50	73.50	37.00	40.00	144.66	124.66	34.99	51.49
6	7	MAR	1962	36.25	71.75	41.81	40.00	207.60	105.23	58.23	59.41
12	7	MAR	1962	36.00	70.00	44.00	40.00	282.51	95.11	81.40	67.81

MINIMUM DISTANCE OF STORM FROM BASIN CENTER IS 132.0 MILES AT HOUR 18, TUE 6 MAR 1962

BASIN CENTER IS -20 MILES TO THE NORTH OF CAPE MAY. OBSERVER IS ON SEA AND FACING LAND .

HOURLY VALUES OF (SMOOTHED) STORM POSITIONS, SPEE D AND DIRECTION (MATHEMATICAL) OF MOTION, PRESSURE DROP, AND SIZE

ΔP

	HOUR	DAY	MNTH	YEAR	LATITDE	LONGTDE	X-PT	Y-PT	SPEED	STRM DR	DELP	SIZE	
	0	6	MAR	1962	37.44	80.61	-58.46	23.51	16.36	16.16	30.00	40.00	
	1	6	MAR	1962	37.41	80.32	-54.56	24.64	16.36	16.16	30.00	40.00	
	2	6	MAR	1962	37.38	80.02	-50.66	25.77	16.36	16.16	30.00	40.00	
	3	6	MAR	1962	37.34	79.72	-46.76	26.90	16.36	16.16	30.00	40.00	
	4	6	MAR	1962	37.31	79.43	-42.87	28.03	16.36	16.16	30.00	40.00	
	5	6	MAR	1962	37.27	79.13	-38.97	29.16	16.36	16.16	30.00	40.00	
INITLZE COMPTTNS	6	6	MAR	1962	37.23	78.83	-35.07	30.29	16.36	16.16	30.00	40.00	INITLZE COMPTTNS
	7	6	MAR	1962	37.20	78.53	-31.17	31.42	16.36	16.16	30.00	40.00	
	8	6	MAR	1962	37.16	78.24	-27.27	32.55	16.36	16.16	30.00	40.00	
	9	6	MAR	1962	37.12	77.94	-23.37	33.68	16.36	16.16	30.00	40.00	
	10	6	MAR	1962	37.08	77.64	-19.47	34.81	16.36	16.16	30.00	40.00	
	11	6	MAR	1962	37.04	77.34	-15.57	35.94	16.36	16.16	30.00	40.00	
	12	6	MAR	1962	37.00	77.05	-11.67	37.07	16.36	16.16	30.00	40.00	
	13	6	MAR	1962	36.96	76.75	-7.78	38.20	16.37	16.35	30.07	40.00	
	14	6	MAR	1962	36.92	76.45	-3.88	39.34	16.38	16.53	30.28	40.00	
	15	6	MAR	1962	36.88	76.15	0.02	40.50	16.39	16.72	30.60	40.00	
	16	6	MAR	1962	36.83	75.86	3.91	41.67	16.39	16.90	31.04	40.00	
	17	6	MAR	1962	36.79	75.56	7.80	42.85	16.40	17.08	31.57	40.00	
NEAREST APPROACH TO BASIN CENTER	18	6	MAR	1962	36.75	75.26	11.69	44.04	16.41	17.27	32.19	40.00	NEAREST APPROACH TO BASIN CENTER
	19	6	MAR	1962	36.71	74.96	15.58	45.25	16.42	17.45	32.88	40.00	
	20	6	MAR	1962	36.67	74.66	19.47	46.48	16.43	17.64	33.63	40.00	
	21	6	MAR	1962	36.62	74.36	23.35	47.71	16.44	17.82	34.43	40.00	
	22	6	MAR	1962	36.58	74.06	27.23	48.96	16.45	18.00	35.27	40.00	
	23	6	MAR	1962	36.54	73.76	31.12	50.22	16.46	18.19	36.13	40.00	
TERMNTE COMPTTNS	0	7	MAR	1962	36.50	73.46	34.99	51.49	16.47	18.37	37.00	40.00	TERMNTE COMPTTNS
	1	7	MAR	1962	36.46	73.16	38.87	52.78	16.48	18.55	37.87	40.00	
	2	7	MAR	1962	36.42	72.86	42.75	54.08	16.49	18.73	38.73	40.00	
	3	7	MAR	1962	36.37	72.55	46.62	55.40	16.50	18.92	39.57	40.00	
	4	7	MAR	1962	36.33	72.25	50.49	56.72	16.51	19.10	40.37	40.00	
	5	7	MAR	1962	36.29	71.95	54.36	58.06	16.52	19.28	41.12	40.00	
	6	7	MAR	1962	36.25	71.65	58.23	59.41	16.53	19.46	41.81	40.00	
	7	7	MAR	1962	36.21	71.34	62.10	60.78	16.54	19.64	42.43	40.00	
	8	7	MAR	1962	36.17	71.04	65.96	62.16	16.55	19.82	42.96	40.00	
	9	7	MAR	1962	36.13	70.74	69.82	63.55	16.56	20.01	43.40	40.00	
	10	7	MAR	1962	36.08	70.43	73.68	64.96	16.57	20.19	43.72	40.00	
	11	7	MAR	1962	36.04	70.13	77.54	66.38	16.58	20.37	43.93	40.00	
	12	7	MAR	1962	36.00	69.82	81.40	67.81	16.58	20.37	44.00	40.00	

13	7	MAR	1962	35.96	69.52	85.25	69.24	16.58	20.37	44.00	40.00
14	7	MAR	1962	35.91	69.21	89.11	70.67	16.58	20.37	44.00	40.00
15	7	MAR	1962	35.87	68.91	92.97	72.10	16.58	20.37	44.00	40.00
16	7	MAR	1962	35.83	68.61	96.82	73.53	16.58	20.37	44.00	40.00
17	7	MAR	1962	35.78	68.30	100.68	74.97	16.58	20.37	44.00	40.00
18	7	MAR	1962	35.74	68.00	104.53	76.40	16.58	20.37	44.00	40.00
19	7	MAR	1962	35.69	67.69	108.39	77.83	16.58	20.37	44.00	40.00
20	7	MAR	1962	35.64	67.39	112.25	79.26	16.58	20.37	44.00	40.00
21	7	MAR	1962	35.59	67.08	116.10	80.69	16.58	20.37	44.00	40.00
22	7	MAR	1962	35.54	66.78	119.96	82.12	16.58	20.37	44.00	40.00
23	7	MAR	1962	35.49	66.47	123.81	83.56	16.58	20.37	44.00	40.00
0	8	MAR	1962	35.44	66.17	127.67	84.99	16.58	20.37	44.00	40.00

X-GRID	Y-GRID	STOP PGM	FRCE DST	STM GRWTH
10	151	432	795	100

CORIOLIS	GRID SPACE	TIMI INCRM	SLIP COER	DNSTY ATM	DRAG COEF	VISCOSITY
0.00009099	21280.7	150.0	0.0060000	0.00115000	0.00000300	0.25000000

INTL LATTD	INTL LONGT
37.23	78.83

← STORM CENTER

DEPTH FIELD IN FEET, GRID DISTANCES ARE 4 STAT MI LES (3.5 NM) APART, POINT 75 : ON ORDINATE IS CENTER OF BASIN

FROM DATA FILE 2 INPUT →

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
79	25.		43.		60.		75.		89.		101.		111.		120.		130.		144.
78		25.		43.		61.		77.		91.		103.		112.		121.		130.	
77	25.		44.		62.		78.		93.		104.		113.		121.		129.		140.
76		25.		44.		62.		79.		93.		105.		113.		121.		128.	
75	25.		44.		62.		79.		93.		105.		113.		120.		127.		136.
74		25.		44.		62.		78.		92.		104.		112.		118.		125.	
73	25.		43.		61.		77.		91.		102.		110.		116.		122.		130.
72		25.		43.		60.		76.		89.		100.		108.		114.		120.	

STORM DATA FOR TIMI OF NEAREST APPROACH TO BASIN CENTER

STORM DATA AT 288 DELTA TIMI, OR TUE, 6 MAR 1962 AT HOUR 18. STORM POSITION AT LATITUDE 36.75, LONGITUDE 75.26

X-POINT	Y-POINT	MAX WIND	RADIUS	STRM SPD	PADD	PRES DROP
11.693	44.045	59.752	40.000	16.411	7.647	32.053

RADIUS	SPEED	PRES DROP	INFLW ANG	STC HGHT	P GRAD
0	0.00	0.00	0.00	1.07	0.00000000
2	5.96	0.05	0.39	1.07	0.00000934
4	11.83	0.18	0.78	1.07	0.00001862
6	17.53	0.41	1.17	1.06	0.00002757
8	22.98	0.72	1.57	1.05	0.00003597
10	28.12	1.11	1.99	1.04	0.00004361
12	32.89	1.58	2.43	1.02	0.00005035
14	37.26	2.10	2.89	1.00	0.00005609
16	41.21	2.67	3.38	0.98	0.00006080
18	44.72	3.29	3.89	0.96	0.00006447
20	47.80	3.93	4.43	0.94	0.00006714
22	50.46	4.60	5.01	0.92	0.00006889
24	52.72	5.28	5.62	0.90	0.00006981
26	54.61	5.97	6.26	0.87	0.00007000
28	56.14	6.65	6.94	0.85	0.00006956
30	57.36	7.33	7.65	0.83	0.00006860
32	58.29	8.00	8.39	0.80	0.00006722
34	58.97	8.65	9.17	0.78	0.00006550
36	59.42	9.28	9.99	0.76	0.00006353
38	59.67	9.90	10.83	0.74	0.00006138
40	59.75	10.49	11.70	0.72	0.00005912
42	59.68	11.06	12.58	0.70	0.00005681
44	59.48	11.60	13.48	0.68	0.00005452
46	59.17	12.13	14.37	0.67	0.00005229
48	58.77	12.63	15.25	0.65	0.00005017
50	58.29	13.11	16.09	0.63	0.00004816
52	57.75	13.57	16.88	0.62	0.00004627
54	57.16	14.02	17.62	0.60	0.00004450
56	56.52	14.45	18.30	0.59	0.00004282
58	55.85	14.86	18.92	0.58	0.00004124
60	55.16	15.26	19.49	0.56	0.00003975
62	54.44	15.64	20.00	0.55	0.00003832
64	53.71	16.01	20.46	0.54	0.00003696
66	52.97	16.36	20.86	0.52	0.00003566
68	52.23	16.71	21.23	0.51	0.00003442
70	51.48	17.04	21.55	0.50	0.00003322
72	50.73	17.36	21.83	0.49	0.00003208
74	49.99	17.67	22.08	0.48	0.00003098
76	49.25	17.97	22.29	0.47	0.00002993
78	48.52	18.26	22.48	0.46	0.00002892
80	47.80	18.54	22.64	0.45	0.00002796
82	47.09	18.81	22.77	0.44	0.00002703
84	46.39	19.07	22.88	0.43	0.00002614
86	45.70	19.32	22.97	0.43	0.00002529
88	45.02	19.56	23.05	0.42	0.00002447
90	44.35	19.80	23.10	0.41	0.00002369
92	43.70	20.03	23.14	0.40	0.00002294
94	43.06	20.25	23.17	0.39	0.00002222
96	42.43	20.46	23.18	0.39	0.00002153
98	41.81	20.67	23.19	0.38	0.00002087
100	41.21	20.87	23.18	0.37	0.00002024
110	38.38	21.80	23.01	0.34	0.00001746

← WIND FIELD

120	35.85	22.59	22.70	0.32	0.00001520
130	33.59	23.29	22.28	0.29	0.00001335
140	31.57	23.91	21.81	0.27	0.00001183
150	29.75	24.46	21.42	0.25	0.00001027
160	28.12	24.93	21.42	0.24	0.00000909
170	26.34	25.35	21.42	0.22	0.00000809
180	25.31	25.73	21.42	0.21	0.00000724
190	24.09	26.06	21.42	0.20	0.00000651
200	22.98	26.37	21.42	0.19	0.00000588
210	21.97	26.64	21.42	0.18	0.00000533
220	21.03	26.89	21.42	0.17	0.00000486
230	20.17	27.12	21.42	0.17	0.00000444
250	18.64	27.52	21.42	0.15	0.00000375
300	15.66	28.28	21.42	0.13	0.00000259
350	13.48	28.83	21.42	0.11	0.00000189
400	11.83	29.23	21.42	0.09	0.00000143
450	10.54	29.54	21.42	0.08	0.00000112
500	9.50	29.79	21.42	0.08	0.00000091
550	8.65	29.99	21.42	0.07	0.00000074
600	7.93	30.16	21.42	0.06	0.00000062
650	7.33	30.30	21.42	0.06	0.00000053
700	6.81	30.42	21.42	0.05	0.00000045
750	6.36	30.52	21.42	0.05	0.00000039

SURGE HEIGHT IN FEET

1	0.0	-0.0	-0.0	-0.1	-0.1	-0.2	-0.5	-0.9	-1.4	-1.7	-1.9	-2.1	-2.1	-2.0	-2.1	-2.0	-2.0	-1.9	0.0
2	0.0	0.0	0.0	0.0	-0.0	-0.2	-0.6	-1.1	-1.4	-1.7	-2.0	-2.2	-2.1	-2.0	-1.9	-1.8	-1.7	0.0	0.0
3	0.0	0.0	0.1	0.1	0.2	0.1	-0.1	-0.6	-1.1	-1.4	-1.8	-2.2	-2.2	-1.9	-1.8	-1.5	-1.5	-1.3	0.0
4	0.0	0.1	0.2	0.3	0.4	0.3	0.0	-0.5	-1.1	-1.6	-2.2	-2.3	-2.0	-1.7	-1.4	-1.4	-1.2	0.0	0.0
5	0.0	0.1	0.2	0.4	0.6	0.6	0.5	0.2	-0.4	-1.2	-1.9	-2.4	-2.0	-1.6	-1.3	-1.2	-1.2	-1.0	0.0
6	0.0	0.2	0.4	0.6	0.7	0.8	0.7	0.4	-0.4	-1.3	-1.9	-2.0	-1.7	-1.3	-1.1	-1.2	-1.1	0.0	0.0
7	0.0	0.1	0.2	0.5	0.7	0.8	0.9	0.9	0.5	-0.4	-1.1	-1.5	-1.5	-1.3	-1.1	-1.2	-1.3	-0.9	0.0
8	0.0	0.1	0.3	0.6	0.8	0.9	1.0	1.0	0.6	-0.1	-0.5	-0.6	-0.8	-0.8	-1.2	-1.4	-1.2	0.0	0.0
9	0.0	0.1	0.2	0.4	0.7	0.8	1.0	1.1	1.1	0.9	0.5	0.4	0.2	-0.3	-0.8	-1.4	-1.4	-1.0	0.0
10	0.0	0.1	0.3	0.6	0.8	0.9	1.1	1.3	1.5	1.5	1.5	1.3	0.9	-0.1	-1.1	-1.5	-1.2	0.0	0.0
11	0.0	0.1	0.2	0.5	0.7	0.9	1.1	1.3	1.6	2.0	2.4	2.3	1.9	1.1	-0.4	-1.3	-1.3	-0.8	0.0
12	0.0	0.1	0.4	0.6	0.9	1.1	1.4	1.7	2.2	2.9	3.1	2.8	2.1	0.5	-0.8	-1.2	-0.9	0.0	0.0
13	0.0	0.1	0.2	0.6	0.9	1.2	1.4	1.8	2.3	3.0	3.6	3.4	2.9	1.5	-0.0	-0.9	-0.9	-0.5	0.0
14	0.0	0.2	0.4	0.8	1.2	1.5	1.8	2.3	3.0	3.6	3.8	3.3	2.3	0.8	-0.4	-0.7	-0.4	0.0	0.0
15	0.0	0.1	0.3	0.7	1.1	1.5	1.8	2.2	2.8	3.5	3.9	3.7	2.8	1.6	0.4	-0.4	-0.4	0.0	0.0
16	0.1	0.2	0.5	1.0	1.4	1.8	2.1	2.6	3.2	3.7	3.8	3.3	2.2	1.1	0.1	-0.3	-0.0	0.0	0.0
17	0.0	0.1	0.4	0.8	1.3	1.7	2.0	2.4	2.9	3.4	3.7	3.5	2.8	1.8	0.8	0.1	0.0	0.3	0.0
18	0.1	0.2	0.6	1.1	1.5	1.9	2.2	2.6	3.1	3.5	3.6	3.2	2.3	1.4	0.6	0.1	0.3	0.0	0.0
19	[illegible]	0.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.2	[illegible]	[illegible]	2.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0

20	0.1	0.2	0.6	1.1	1.5	1.9	2.1	2.5	2.9	3.3	3.4	3.2	2.5	1.7	0.9	0.4	0.6	0.0	0.0
21	0.0	0.1	0.4	0.8	1.3	1.7	2.0	2.2	2.5	3.0	3.3	3.4	2.9	2.2	1.3	0.7	0.5	0.8	0.0
22	0.1	0.2	0.6	1.0	1.5	1.8	2.0	2.3	2.7	3.1	3.3	3.2	2.6	1.8	1.0	0.6	0.7	0.0	0.0
23	0.0	0.1	0.4	0.8	1.3	1.7	1.9	2.1	2.4	2.8	3.2	3.3	2.9	2.2	1.4	0.8	0.6	0.9	0.0
24	0.0	0.2	0.5	1.0	1.5	1.8	2.0	2.2	2.5	2.9	3.2	3.1	2.6	1.8	1.0	0.7	0.7	0.0	0.0
25	0.0	0.1	0.4	0.8	1.3	1.7	1.9	2.0	2.2	2.6	2.9	3.1	2.8	2.1	1.3	0.8	0.7	0.9	0.0
26	0.0	0.2	0.6	1.0	1.5	1.8	1.9	2.0	2.3	2.6	2.9	2.9	2.4	1.7	1.0	0.7	0.8	0.0	0.0
27	0.0	0.1	0.4	0.8	1.3	1.7	1.8	1.9	2.0	2.3	2.6	2.8	2.5	2.0	1.3	0.8	0.7	0.9	0.0
28	0.1	0.2	0.6	1.0	1.5	1.7	1.8	1.9	2.0	2.3	2.5	2.5	2.1	1.5	0.9	0.7	0.8	0.0	0.0
29	0.0	0.1	0.4	0.8	1.3	1.6	1.7	1.8	1.8	2.0	2.2	2.4	2.2	1.7	1.2	0.8	0.7	1.0	0.0
30	0.1	0.2	0.6	1.0	1.5	1.7	1.7	1.7	1.8	2.0	2.1	2.2	1.9	1.4	0.9	0.7	0.8	0.0	0.0
31	0.0	0.1	0.4	0.8	1.3	1.6	1.6	1.6	1.6	1.7	1.9	2.0	1.9	1.6	1.1	0.8	0.7	1.0	0.0
32	0.1	0.2	0.6	1.0	1.4	1.6	1.5	1.5	1.5	1.7	1.8	1.9	1.7	1.3	0.9	0.7	0.9	0.0	0.0
33	0.0	0.1	0.4	0.8	1.2	1.5	1.5	1.4	1.3	1.4	1.6	1.7	1.7	1.4	1.0	0.8	0.8	1.1	0.0
34	0.1	0.2	0.6	1.0	1.3	1.4	1.4	1.3	1.3	1.4	1.6	1.6	1.5	1.2	0.9	0.7	0.9	0.0	0.0
35	0.0	0.1	0.4	0.8	1.1	1.4	1.4	1.2	1.2	1.2	1.4	1.5	1.5	1.3	1.0	0.8	0.8	1.1	0.0
36	0.1	0.2	0.5	0.9	1.2	1.3	1.2	1.1	1.1	1.2	1.4	1.5	1.4	1.1	0.9	0.8	0.9	0.0	0.0
37	0.0	0.1	0.4	0.7	1.1	1.3	1.2	1.1	1.0	1.1	1.2	1.4	1.4	1.2	1.0	0.8	0.8	1.0	0.0
38	0.1	0.2	0.5	0.9	1.1	1.2	1.1	1.0	0.9	1.1	1.2	1.3	1.3	1.1	0.9	0.8	0.9	0.0	0.0
39	0.0	0.1	0.3	0.7	1.0	1.2	1.1	1.0	0.9	0.9	1.1	1.2	1.3	1.2	1.0	0.8	0.8	1.0	0.0
40	0.0	0.2	0.5	0.8	1.1	1.1	1.0	0.9	0.8	0.9	1.1	1.2	1.2	1.1	0.9	0.8	0.9	0.0	0.0
41	0.0	0.1	0.3	0.6	0.9	1.1	1.0	0.9	0.8	0.8	1.0	1.1	1.2	1.1	1.0	0.8	0.8	1.0	0.0
42	0.0	0.2	0.4	0.7	1.0	1.0	0.9	0.8	0.7	0.8	1.0	1.2	1.2	1.1	0.9	0.8	0.9	0.0	0.0
43	0.0	0.1	0.3	0.6	0.8	1.0	0.9	0.8	0.7	0.7	0.9	1.1	1.2	1.1	1.0	0.9	0.9	1.0	0.0
44	0.0	0.2	0.4	0.7	0.9	1.0	0.8	0.7	0.7	0.8	1.0	1.1	1.2	1.1	0.9	0.9	0.9	0.0	0.0
45	0.0	0.1	0.2	0.5	0.8	0.9	0.9	0.8	0.7	0.7	0.9	1.0	1.2	1.1	1.0	0.9	0.9	1.0	0.0
46	0.0	0.1	0.4	0.6	0.9	0.9	0.8	0.7	0.7	0.8	0.9	1.1	1.2	1.1	1.0	0.9	0.9	0.0	0.0
47	0.0	0.1	0.2	0.5	0.7	0.9	0.9	0.7	0.6	0.7	0.8	1.0	1.1	1.1	1.0	0.9	0.9	1.0	0.0
48	0.0	0.1	0.3	0.6	0.8	0.9	0.8	0.7	0.6	0.7	0.9	1.1	1.1	1.1	1.0	0.9	0.9	0.0	0.0
49	0.0	0.1	0.2	0.4	0.7	0.9	0.8	0.7	0.6	0.6	0.8	1.0	1.1	1.1	1.0	0.9	0.9	0.9	0.0
50	0.0	0.1	0.3	0.6	0.8	0.9	0.8	0.6	0.6	0.7	0.9	1.0	1.1	1.1	0.9	0.9	0.9	0.0	0.0

51	0.0	0.1	0.2	0.4	0.7	0.8	0.8	0.7	0.6	0.6	0.7	0.9	1.1	1.1	1.0	0.9	0.8	0.9	0.0
52	0.0	0.1	0.3	0.5	0.7	0.8	0.8	0.6	0.6	0.6	0.8	1.0	1.1	1.0	0.9	0.8	0.8	0.0	0.0
53	0.0	0.1	0.2	0.4	0.6	0.8	0.8	0.7	0.6	0.6	0.7	0.9	1.0	1.0	1.0	0.9	0.8	0.8	0.0
54	0.0	0.1	0.3	0.5	0.7	0.8	0.7	0.6	0.6	0.6	0.8	0.9	1.0	1.0	0.9	0.8	0.8	0.0	0.0
55	0.0	0.1	0.2	0.4	0.6	0.8	0.8	0.7	0.6	0.5	0.6	0.8	0.9	1.0	0.9	0.8	0.8	0.8	0.0
56	0.0	0.1	0.3	0.5	0.7	0.8	0.7	0.6	0.5	0.6	0.7	0.9	0.9	0.9	0.9	0.8	0.8	0.0	0.0
57	0.0	0.1	0.2	0.4	0.6	0.7	0.7	0.6	0.5	0.5	0.6	0.8	0.9	0.9	0.9	0.8	0.7	0.8	0.0
58	0.0	0.1	0.2	0.5	0.6	0.7	0.7	0.6	0.5	0.5	0.6	0.8	0.9	0.9	0.8	0.7	0.7	0.0	0.0
59	0.0	0.1	0.2	0.3	0.5	0.7	0.7	0.6	0.5	0.5	0.5	0.7	0.8	0.9	0.8	0.8	0.7	0.7	0.0
60	0.0	0.1	0.2	0.4	0.6	0.7	0.6	0.5	0.5	0.5	0.6	0.7	0.8	0.8	0.8	0.7	0.7	0.0	0.0
61	0.0	0.1	0.1	0.3	0.5	0.6	0.7	0.6	0.5	0.4	0.5	0.6	0.8	0.8	0.8	0.7	0.7	0.7	0.0
62	0.0	0.1	0.2	0.4	0.6	0.7	0.6	0.5	0.4	0.4	0.5	0.7	0.8	0.8	0.7	0.7	0.6	0.0	0.0
63	0.0	0.0	0.1	0.3	0.5	0.6	0.6	0.5	0.4	0.4	0.4	0.6	0.7	0.8	0.8	0.7	0.6	0.6	0.0
64	0.0	0.1	0.2	0.4	0.5	0.6	0.6	0.5	0.4	0.4	0.5	0.6	0.7	0.7	0.7	0.6	0.6	0.0	0.0
65	0.0	0.0	0.1	0.3	0.5	0.6	0.6	0.5	0.4	0.4	0.4	0.5	0.6	0.7	0.7	0.7	0.6	0.6	0.0
66	0.0	0.1	0.2	0.4	0.5	0.6	0.5	0.4	0.4	0.4	0.4	0.6	0.7	0.7	0.7	0.6	0.6	0.0	0.0
67	0.0	0.0	0.1	0.3	0.4	0.5	0.5	0.5	0.4	0.3	0.4	0.5	0.6	0.7	0.7	0.6	0.6	0.5	0.0
68	0.0	0.1	0.2	0.3	0.5	0.5	0.5	0.4	0.3	0.3	0.4	0.5	0.6	0.7	0.6	0.6	0.5	0.0	0.0
69	0.0	0.0	0.1	0.3	0.4	0.5	0.5	0.5	0.4	0.3	0.3	0.4	0.6	0.6	0.6	0.6	0.5	0.5	0.0
70	0.0	0.1	0.2	0.3	0.4	0.5	0.5	0.4	0.3	0.3	0.4	0.5	0.6	0.6	0.6	0.5	0.5	0.0	0.0
71	0.0	0.0	0.1	0.2	0.4	0.5	0.5	0.4	0.3	0.3	0.3	0.4	0.5	0.6	0.6	0.5	0.5	0.5	0.0
72	0.0	0.1	0.2	0.3	0.4	0.5	0.4	0.4	0.3	0.3	0.3	0.4	0.5	0.6	0.5	0.5	0.4	0.0	0.0
73	0.0	0.0	0.1	0.2	0.4	0.4	0.4	0.4	0.3	0.2	0.3	0.3	0.5	0.5	0.5	0.5	0.4	0.4	0.0
74	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.3	0.3	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.4	0.0	0.0
75	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.3	0.2	0.2	0.3	0.4	0.5	0.5	0.5	0.4	0.4	0.0
76	0.0	0.1	0.1	0.3	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.4	0.4	0.0	0.0
77	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.3	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.4	0.4	0.4	0.0
78	0.0	0.0	0.1	0.2	0.3	0.4	0.3	0.3	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.4	0.4	0.0	0.0
79	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.4	0.4	0.4	0.0
80	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.0	0.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

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EOF1FILE6               00010001000100 76205 76210 000015000273 B6500
EOF2F000220002230100000000000000000004680          00
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OUTPUT: SEPTEMBER 14, 1944, HURRICANE, NO. 1

THESE ARE THE 5 STORM POSITIONS READ IN BY THE COMP UTER
PLEASE CHECK TIMES, LATITUDES, LONGTITUDES, PRESSURE DROPS AND STORM SIZES FOR AGREEMENT AND CONSISTENCY

HOUR	DAY	MNTH	YEAR	LATITUDE	LONGITUDE	PRS DROP	STRM SIZE	LENGTH	AZIMUTH	X-CORD	Y-CORD
12	14	SEP	1944	34.40	75.70	95.00	20.00	259.75	159.08	27.50	5.68
18	14	SEP	1944	36.80	74.80	86.41	22.34	114.90	145.29	19.69	48.01
0	15	SEP	1944	39.80	73.20	67.50	27.50	110.23	25.12	14.37	103.52
6	15	SEP	1944	42.30	70.80	48.59	32.66	291.90	13.37	20.28	156.14
12	15	SEP	1944	42.30	70.80	40.00	35.00	291.90	13.37	20.28	156.14

MINIMUM DISTANCE OF STORM FROM BASIN CENTER IS 63.2 MILES AT HOUR 21, THU 14 SEP 1944

BASIN CENTER IS -20 ILES TO THE NORTH OF CAPE MAY, OBSERVER IS ON SEA AND FACING LAND .

HOURLY VALUES OF (SMOOTHED) STORM POSITIONS, SPEE D AND DIRECTION (MATHEMATICAL) OF MOTION, PRESSURE DROP, AND SIZE

	HOUR	DAY	MNTH	YEAR	LATITDE	LONGTDE	X-PT	Y-PT	SPEED	STRM DR	DELP	SIZE	
	0	14	SEP	1944	31.28	75.42	56.03	-39.94	18.15	121.41	95.00	20.00	
	1	14	SEP	1944	31.54	75.44	53.69	-36.10	18.15	121.41	95.00	20.00	
	2	14	SEP	1944	31.80	75.46	51.34	-32.26	18.15	121.41	95.00	20.00	
	3	14	SEP	1944	32.06	75.49	48.99	-28.42	18.15	121.41	95.00	20.00	
	4	14	SEP	1944	32.32	75.51	46.65	-24.58	18.15	121.41	95.00	20.00	
	5	14	SEP	1944	32.59	75.53	44.30	-20.73	18.15	121.41	95.00	20.00	
	6	14	SEP	1944	32.85	75.56	41.95	-16.89	18.15	121.41	95.00	20.00	
	7	14	SEP	1944	33.11	75.58	39.61	-13.05	18.15	121.41	95.00	20.00	
	8	14	SEP	1944	33.37	75.60	37.26	-9.21	18.15	121.41	95.00	20.00	
INITLZE COMPTINS	9	14	SEP	1944	33.63	75.62	34.91	-5.36	18.15	121.41	95.00	20.00	INITLZE COMPTINS
	10	14	SEP	1944	33.89	75.65	32.57	-1.52	18.15	121.41	95.00	20.00	
	11	14	SEP	1944	34.15	75.67	30.22	2.32	18.15	121.41	95.00	20.00	
	12	14	SEP	1944	34.42	75.69	27.87	6.16	18.15	121.41	95.00	20.00	
	13	14	SEP	1944	34.68	75.72	25.53	10.00	22.38	111.40	94.72	20.08	
	14	14	SEP	1944	35.00	75.67	23.50	15.17	26.50	105.21	93.92	20.30	
	15	14	SEP	1944	35.37	75.57	21.78	21.52	30.26	101.08	92.64	20.64	
	16	14	SEP	1944	35.79	75.41	20.33	28.89	33.55	98.16	90.93	21.11	
	17	14	SEP	1944	36.25	75.20	19.15	37.13	36.31	95.98	88.83	21.68	
	18	14	SEP	1944	36.74	74.96	18.21	46.09	38.50	94.29	86.41	22.34	
	19	14	SEP	1944	37.25	74.68	17.50	55.61	40.11	92.95	83.69	23.08	
	20	14	SEP	1944	37.78	74.37	16.99	65.55	41.14	91.84	80.74	23.89	
NEAREST APPROACH	21	14	SEP	1944	38.31	74.04	16.66	75.75	41.56	90.90	77.60	24.75	NEAREST APPROACH
TO BASIN CENTER	22	14	SEP	1944	38.85	73.69	16.50	86.06	41.38	90.09	74.31	25.64	TO BASIN CENTER
	23	14	SEP	1944	39.37	73.34	16.48	96.33	40.60	89.38	70.93	26.56	
	0	15	SEP	1944	39.89	72.98	16.59	106.40	39.21	88.73	67.50	27.50	
	1	15	SEP	1944	40.38	72.63	16.81	116.13	37.20	88.12	64.07	28.44	
	2	15	SEP	1944	40.84	72.30	17.11	125.36	34.59	87.52	60.69	29.36	

TERMNTE COMPTTNS

3	15	SEP 1944	41,26	71,98	17,48	133,93	31,36	86,91	57,40	30,25	TERMNTE COMPTTNS
4	15	SEP 1944	41,64	71,68	17,90	141,70	27,52	86,24	54,26	31,11	
5	15	SEP 1944	41,97	71,42	18,35	148,51	23,06	85,42	51,31	31,92	
6	15	SEP 1944	42,25	71,19	18,80	154,21	18,00	84,25	48,59	32,66	
7	15	SEP 1944	42,46	71,01	19,25	158,66	12,32	82,15	46,17	33,32	
8	15	SEP 1944	42,60	70,88	19,67	161,69	6,08	75,87	44,07	33,89	

YOUR DIRECTION OF STORM MOTION IS CHANGING BY MORE HAN 15 DEGREES/HOUR.
THIS SUGGESTS YOUR 5 STORM POSITIONS ARE NOT PROPERLY PUNCHED, OR CONSISTENT

9	15	SEP 1944	42,66	70,80	20,04	163,15	1,59	319,64	42,36	34,36

YOUR DIRECTION OF STORM MOTION IS CHANGING BY MORE HAN 15 DEGREES/HOUR.
THIS SUGGESTS YOUR 5 STORM POSITIONS ARE NOT PROPERLY PUNCHED, OR CONSISTENT

10	15	SEP 1944	42,64	70,79	20,34	162,89	8,61	275,70	41,08	34,70
11	15	SEP 1944	42,52	70,85	20,55	160,77	16,72	271,45	40,28	34,92
12	15	SEP 1944	42,31	70,98	20,65	156,62	16,72	271,45	40,00	35,00
13	15	SEP 1944	42,10	71,12	20,76	152,47	16,72	271,45	40,00	35,00
14	15	SEP 1944	41,89	71,26	20,86	148,32	16,72	271,45	40,00	35,00
15	15	SEP 1944	41,68	71,39	20,97	144,18	16,72	271,45	40,00	35,00
16	15	SEP 1944	41,47	71,53	21,07	140,03	16,72	271,45	40,00	35,00
17	15	SEP 1944	41,25	71,66	21,18	135,88	16,72	271,45	40,00	35,00
18	15	SEP 1944	41,04	71,80	21,28	131,73	16,72	271,45	40,00	35,00
19	15	SEP 1944	40,83	71,93	21,39	127,58	16,72	271,45	40,00	35,00
20	15	SEP 1944	40,61	72,07	21,49	123,44	16,72	271,45	40,00	35,00
21	15	SEP 1944	40,40	72,21	21,60	119,29	16,72	271,45	40,00	35,00
22	15	SEP 1944	40,19	72,34	21,70	115,14	16,72	271,45	40,00	35,00
23	15	SEP 1944	39,97	72,48	21,80	110,99	16,72	271,45	40,00	35,00
0	16	SEP 1944	39,76	72,61	21,91	106,84	16,72	271,45	40,00	35,00

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X-GRID  Y-GRID  STOP PGM  FRCE DST  STM GRWTH
   10     151      432       795        52

COPIOLIS    GRID SPACE  TIMI INCRM   SLIP COEF   DNSTY ATM   DRAG COEF   VISCOSITY
0,00005119    21250,7       150,0    0,0060000   0,00115000  0,00000300  0,25000000

INTL LATTD  INTL LONGT
   33,63       75,62
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DEPTH FIELD IN FEET, GRID DISTANCES ARE 4 STAT MI LES (3.5 NM) APART, POINT 752 ON ORDINATE IS CENTER OF BASIN

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
79	25.		43.		60.		75.		89.		101.		111.		120.		130.		144.
78		25.		43.		61.		77.		91.		103.		112.		121.		130.	
77	25.		44.		62.		78.		93.		104.		113.		121.		129.		140.
76		25.		44.		62.		79.		93.		105.		113.		121.		128.	
75	25.		44.		62.		79.		93.		105.		113.		120.		127.		136.
74		25.		44.		62.		78.		92.		104.		112.		118.		125.	
73	25.		43.		61.		77.		91.		102.		110.		116.		122.		130.
72		25.		43.		60.		76.		89.		100.		108.		114.		120.	

STORM DATA FOR TIMI OF NEAREST APPROACH TO BASIN CENTER

STORM DATA AT 288 DELTA TIMI, OR THU, 14 SEP 1944 AT HOUR 21, STORM POSITION AT LATITUDE 38,31, LONGITUDE 74,04

X-POINT	Y-POINT	MAX WIND	RADIUS	STRM SPD	PADD	PRES DROP
16,659	75,753	110,877	24,746	41,561	8,422	77,708

RADIUS	SPEED	PRES DROP	INFLW ANG	STC HGHT	P GRAD
0	0,00	0,00	0,00	2,60	0,00000000
2	17,81	0,40	0,29	2,59	0,00007767
4	34,93	1,53	0,59	2,55	0,00015083
6	50,78	3,33	0,91	2,49	0,00021051
8	64,91	5,69	1,25	2,41	0,00026537
10	77,03	8,49	1,63	2,32	0,00030199
12	87,06	11,57	2,06	2,21	0,00032467
14	95,04	14,82	2,55	2,10	0,00033494
16	101,11	18,11	3,09	1,99	0,00033502
18	105,49	21,37	3,70	1,89	0,00032730
20	108,41	24,51	4,38	1,78	0,00031403
22	110,11	27,51	5,13	1,68	0,00029714
24	110,82	30,34	5,96	1,58	0,00027813
26	110,74	32,97	6,88	1,50	0,00025815
28	110,04	35,40	7,88	1,42	0,00023797
30	108,85	37,64	9,00	1,34	0,00021797
32	107,31	39,68	10,26	1,27	0,00019837
34	105,51	41,53	11,68	1,21	0,00017986
36	103,52	43,22	13,18	1,15	0,00016342
38	101,40	44,75	14,65	1,10	0,00014941
40	99,22	46,15	16,01	1,06	0,00013758
42	96,99	47,45	17,24	1,01	0,00012746
44	94,75	48,66	18,30	0,97	0,00011863
46	92,52	49,78	19,23	0,93	0,00011077
48	90,32	50,83	20,02	0,90	0,00010369
50	88,16	51,82	20,69	0,87	0,00009725
52	86,04	52,74	21,26	0,84	0,00009135
54	83,98	53,61	21,74	0,81	0,00008591
56	81,98	54,43	22,14	0,78	0,00008089
58	80,04	55,20	22,48	0,75	0,00007625
60	78,16	55,93	22,76	0,73	0,00007195
62	76,35	56,62	22,98	0,71	0,00006797
64	74,59	57,26	23,17	0,68	0,00006427
66	72,90	57,88	23,31	0,66	0,00006083
68	71,26	58,46	23,42	0,64	0,00005763
70	69,68	59,01	23,50	0,63	0,00005466
72	68,16	59,53	23,56	0,61	0,00005190
74	66,70	60,03	23,59	0,59	0,00004932
76	65,28	60,50	23,61	0,58	0,00004692
78	63,92	60,95	23,60	0,56	0,00004468
80	62,60	61,38	23,58	0,55	0,00004259
82	61,34	61,78	23,55	0,53	0,00004063
84	60,11	62,17	23,50	0,52	0,00003880
86	58,93	62,55	23,45	0,51	0,00003709
88	57,79	62,90	23,38	0,50	0,00003548
90	56,69	63,24	23,30	0,48	0,00003398
92	55,62	63,57	23,22	0,47	0,00003257
94	54,59	63,88	23,13	0,46	0,00003124

96	53,60	64,18	23,04	0,45	0,00002999
98	52,64	64,47	22,94	0,44	0,00002882
100	51,71	64,75	22,83	0,43	0,00002771
110	47,48	65,99	22,26	0,39	0,00002304
120	43,86	67,03	21,63	0,36	0,00001949
130	40,74	67,91	20,99	0,33	0,00001674
140	38,01	68,68	20,34	0,30	0,00001457
150	35,61	69,35	19,83	0,28	0,00001241
160	33,50	69,92	19,83	0,26	0,00001082
170	31,61	70,41	19,83	0,24	0,00000950
180	29,92	70,85	19,83	0,23	0,00000841
190	28,40	71,24	19,83	0,22	0,00000749
200	27,02	71,59	19,83	0,20	0,00000671
210	25,77	71,90	19,83	0,19	0,00000604
220	24,63	72,18	19,83	0,18	0,00000547
230	23,59	72,44	19,83	0,18	0,00000497
250	21,74	72,89	19,83	0,16	0,00000416
300	18,17	73,72	19,83	0,13	0,00000282
350	15,60	74,31	19,83	0,11	0,00000203
400	13,67	74,74	19,83	0,10	0,00000153
450	12,16	75,07	19,83	0,09	0,00000119
500	10,95	75,34	19,83	0,08	0,00000096
550	9,96	75,55	19,83	0,07	0,00000078
600	9,13	75,72	19,83	0,07	0,00000065
650	8,43	75,87	19,83	0,06	0,00000055
700	7,83	76,00	19,83	0,06	0,00000047
750	7,31	76,11	19,83	0,05	0,00000041

1	0,1	0,8	2,1	3,3	4,0	5,5	10,7	9,6	0,7	-0,2	-5,7	-4,3	-3,7	-1,2	0,5	-1,4	0,1	0,1	0,0
2	0,3	1,1	2,5	3,3	3,8	5,6	10,1	4,5	2,0	-4,9	-4,8	-4,3	-2,6	-0,0	-0,9	-0,8	0,5	0,0	0,0
3	0,1	0,5	1,5	2,7	3,0	3,4	4,9	6,6	4,0	-1,4	-5,8	-4,8	-3,7	-0,9	0,2	-1,4	0,4	0,2	0,0
4	0,2	0,8	2,0	2,8	2,9	3,2	5,1	6,8	2,9	-5,8	-4,7	-4,5	-2,5	-0,4	-0,5	-0,5	0,6	0,0	0,0
5	0,1	0,4	1,2	2,4	2,7	2,8	3,6	6,2	7,6	-2,6	-5,8	-4,7	-3,9	-1,0	0,0	-0,7	0,7	0,1	0,0
6	0,2	0,7	1,8	2,7	2,8	3,0	4,6	8,8	2,8	-6,2	-4,8	-5,1	-2,4	-0,5	-0,3	-0,1	1,0	0,0	0,0
7	0,1	0,4	1,1	2,3	2,8	2,8	3,7	6,7	8,8	-4,0	-6,0	-4,7	-4,1	-1,3	-0,0	-0,2	0,8	0,1	0,0
8	0,2	0,7	1,7	2,6	2,9	3,1	5,0	9,6	2,9	-6,0	-4,8	-5,7	-2,7	-0,7	0,2	0,5	1,2	0,0	0,0
9	0,1	0,4	1,0	2,2	2,8	2,9	3,9	7,3	8,6	-2,0	-5,8	-5,2	-4,6	-1,2	0,0	-0,0	1,2	0,5	0,0
10	0,2	0,7	1,5	2,5	2,8	3,1	4,9	9,3	4,5	-4,3	-4,9	-6,0	-3,1	-0,8	0,8	0,8	1,2	0,0	0,0
11	0,1	0,4	0,9	2,0	2,6	2,8	3,4	6,1	8,8	1,3	-4,6	-5,2	-5,2	-1,5	0,1	0,7	1,8	0,6	0,0
12	0,2	0,6	1,3	2,2	2,7	2,7	3,8	6,9	6,0	-0,4	-5,2	-6,9	-3,4	-0,6	1,2	1,1	1,6	0,0	0,0
13	0,1	0,3	0,8	1,7	2,4	2,5	2,7	4,0	6,3	4,9	-2,9	-5,8	-6,1	-1,9	0,3	1,3	2,0	0,4	0,0
14	0,2	0,5	1,1	2,0	2,4	2,3	2,7	4,1	6,1	3,4	-4,9	-7,7	-3,8	-0,5	1,4	1,7	2,0	0,0	0,0
15	0,0	0,3	0,7	1,5	2,1	2,3	2,2	2,8	4,3	6,3	1,0	-6,9	-7,3	-2,2	0,8	1,9	2,3	1,0	0,0
16	0,1	0,4	1,0	1,7	2,2	2,1	2,2	2,9	5,2	6,4	-3,5	-8,9	-4,6	-0,4	1,8	2,3	2,2	0,0	0,0

17	0,0	0,3	0,6	1,3	1,9	2,2	2,0	2,3	3,3	6,5	4,2	-7,9	-8,4	-2,2	1,0	2,3	2,7	1,0	0,0
18	0,1	0,4	0,9	1,6	2,0	2,0	2,0	2,5	4,2	7,5	-0,7	-10,4	-5,5	-0,4	2,2	2,8	2,4	0,0	0,0
19	0,0	0,2	0,6	1,2	1,7	2,1	1,9	2,1	3,0	5,5	6,7	-7,1	-9,8	-2,8	1,4	3,0	3,1	1,1	0,0
20	0,1	0,4	0,8	1,4	1,9	2,0	1,9	2,4	3,6	6,9	2,4	-11,4	-6,6	-0,2	2,5	3,3	2,7	0,0	0,0
21	0,0	0,2	0,6	1,1	1,6	2,0	1,9	2,0	2,8	4,6	7,2	-5,0	-11,4	-3,4	2,0	3,7	3,1	1,2	0,0
22	0,1	0,4	0,8	1,4	1,7	1,9	1,8	2,2	3,3	5,5	4,5	-10,6	-8,2	-0,3	3,1	4,0	2,8	0,0	0,0
23	0,0	0,2	0,5	1,1	1,5	1,8	1,9	1,9	2,6	3,7	6,1	-1,3	-12,6	-4,1	2,5	3,9	3,2	1,3	0,0
24	0,1	0,4	0,8	1,3	1,6	1,8	1,8	2,1	2,9	4,1	5,3	-8,0	-10,1	-0,4	3,9	4,3	2,6	0,0	0,0
25	0,0	0,2	0,5	1,0	1,4	1,7	1,8	1,8	2,3	3,0	4,5	1,7	-12,2	-5,4	2,9	4,4	3,5	1,1	0,0
26	0,1	0,3	0,7	1,2	1,5	1,7	1,7	1,8	2,4	3,0	4,8	-3,9	-11,9	-0,5	4,8	4,3	2,2	0,0	0,0
27	0,0	0,2	0,5	0,9	1,3	1,6	1,6	1,6	1,9	2,5	3,1	3,8	-9,8	-7,1	3,0	4,6	3,5	1,0	0,0
28	0,1	0,3	0,7	1,1	1,4	1,5	1,5	1,6	2,0	2,3	3,9	0,0	-12,5	-0,9	5,4	4,1	2,0	0,0	0,0
29	0,0	0,2	0,4	0,9	1,2	1,4	1,5	1,5	1,6	2,1	2,4	4,3	-6,2	-8,8	3,2	5,2	3,2	0,8	0,0
30	0,1	0,3	0,6	1,0	1,2	1,4	1,4	1,4	1,7	2,0	3,0	2,7	-11,3	-1,6	5,4	3,7	1,7	0,0	0,0
31	0,0	0,2	0,4	0,8	1,1	1,3	1,3	1,3	1,4	1,8	2,0	4,0	-2,1	-10,2	2,7	5,4	2,8	0,8	0,0
32	0,1	0,3	0,6	0,9	1,1	1,2	1,2	1,3	1,5	1,8	2,4	4,0	-8,7	-2,6	4,8	3,4	1,4	0,0	0,0
33	0,0	0,2	0,4	0,8	1,0	1,1	1,2	1,2	1,3	1,6	1,9	3,4	0,8	-10,0	2,2	5,2	2,4	1,0	0,0
34	0,1	0,2	0,6	0,9	1,0	1,1	1,1	1,2	1,4	1,7	2,1	4,1	-5,1	-3,8	3,6	3,3	1,2	0,0	0,0
35	0,0	0,1	0,4	0,7	0,9	1,0	1,1	1,1	1,2	1,5	1,6	2,8	2,9	-8,6	0,9	4,5	2,0	1,0	0,0
36	0,1	0,2	0,5	0,8	1,0	1,0	1,0	1,1	1,3	1,7	1,9	3,8	-1,7	-4,7	1,9	3,0	1,3	0,0	0,0
37	0,0	0,1	0,3	0,7	0,9	1,0	1,0	1,0	1,1	1,4	1,8	2,4	3,8	-6,1	-0,5	3,3	1,9	1,1	0,0
38	0,1	0,2	0,5	0,8	0,9	0,9	1,0	1,0	1,2	1,6	1,8	3,4	1,2	-5,1	0,2	2,7	1,4	0,0	0,0
39	0,0	0,1	0,3	0,7	0,8	0,9	0,9	0,9	1,1	1,4	1,7	2,2	4,3	-3,2	-2,1	1,5	1,7	1,5	0,0
40	0,1	0,2	0,5	0,7	0,9	0,9	0,9	1,0	1,2	1,5	1,9	3,2	3,2	-5,0	-1,4	2,0	1,7	0,0	0,0
41	0,0	0,1	0,3	0,6	0,8	0,8	0,9	0,9	1,0	1,3	1,8	2,3	4,5	-0,7	-3,4	-0,1	1,6	1,7	0,0
42	0,1	0,2	0,5	0,7	0,8	0,8	0,9	0,9	1,2	1,6	2,1	3,2	4,4	-4,4	-2,6	0,8	1,9	0,0	0,0
43	0,0	0,1	0,3	0,6	0,8	0,8	0,8	0,9	1,0	1,4	2,0	2,6	4,4	1,3	-4,8	-2,0	1,2	2,3	0,0
44	0,1	0,2	0,5	0,7	0,8	0,8	0,8	0,9	1,2	1,7	2,4	3,3	4,7	-3,6	-3,8	-0,6	1,8	0,0	0,0
45	0,0	0,1	0,3	0,6	0,7	0,8	0,8	0,9	1,1	1,5	2,1	2,9	4,1	2,2	-5,3	-3,1	0,5	2,6	0,0
46	0,1	0,2	0,5	0,7	0,8	0,8	0,8	0,9	1,3	1,8	2,6	3,3	4,3	-2,4	-4,8	-2,0	1,5	0,0	0,0

47	0,0	0,1	0,3	0,6	0,7	0,8	0,8	0,9	1,1	1,5	2,2	3,0	3,6	2,8	-5,2	-4,0	-0,6	2,4	0,0
48	0,1	0,2	0,4	0,7	0,8	0,8	0,8	0,9	1,3	1,9	2,7	3,2	3,8	-1,0	-5,5	-3,0	0,7	0,0	0,0
49	0,0	0,1	0,3	0,6	0,7	0,8	0,8	0,9	1,1	1,5	2,2	3,0	3,3	2,9	-4,2	-4,7	-1,7	1,9	0,0
50	0,1	0,2	0,4	0,7	0,8	0,8	0,8	0,9	1,2	1,8	2,6	3,1	3,3	0,4	-5,6	-3,6	-0,4	0,0	0,0
51	0,0	0,1	0,3	0,6	0,7	0,8	0,8	0,8	1,0	1,5	2,1	2,9	3,0	2,9	-2,4	-5,3	-2,8	1,0	0,0
52	0,1	0,2	0,4	0,6	0,7	0,8	0,8	0,9	1,2	1,7	2,5	3,0	2,9	1,6	-4,8	-4,2	-1,6	0,0	0,0
53	0,0	0,1	0,3	0,5	0,7	0,8	0,8	0,8	1,0	1,4	2,0	2,8	2,8	2,8	-0,6	-5,5	-3,4	-0,4	0,0
54	0,1	0,2	0,4	0,6	0,7	0,7	0,8	0,8	1,1	1,6	2,3	2,9	2,6	2,4	-3,0	-4,9	-2,8	0,0	0,0
55	0,0	0,1	0,3	0,5	0,7	0,7	0,7	0,8	0,9	1,3	1,9	2,6	2,7	2,6	1,4	-5,0	-4,2	-1,8	0,0
56	0,1	0,2	0,4	0,6	0,7	0,7	0,7	0,8	1,0	1,5	2,1	2,7	2,5	2,8	-0,8	-5,6	-3,6	0,0	0,0
57	0,0	0,1	0,2	0,5	0,6	0,7	0,7	0,7	0,9	1,2	1,7	2,4	2,7	2,5	2,7	-3,7	-5,0	-3,2	0,0
58	0,1	0,2	0,3	0,6	0,7	0,7	0,7	0,8	0,9	1,4	2,0	2,5	2,5	3,0	1,4	-6,0	-4,3	0,0	0,0
59	0,0	0,1	0,2	0,5	0,6	0,7	0,7	0,7	0,8	1,1	1,6	2,2	2,6	2,5	3,5	-1,9	-6,3	-4,2	0,0
60	0,1	0,2	0,3	0,6	0,6	0,7	0,7	0,7	0,9	1,3	1,8	2,4	2,6	3,0	2,9	-5,8	-5,1	0,0	0,0
61	0,0	0,1	0,2	0,4	0,6	0,6	0,6	0,7	0,7	1,0	1,5	2,1	2,6	2,7	3,7	-0,2	-7,4	-5,0	0,0
62	0,0	0,2	0,3	0,5	0,6	0,6	0,6	0,7	0,8	1,2	1,7	2,3	2,8	3,0	3,7	-4,9	-6,4	0,0	0,0
63	0,0	0,1	0,2	0,4	0,6	0,6	0,6	0,6	0,7	0,9	1,4	2,0	2,6	2,8	3,5	1,2	-7,9	-6,2	0,0
64	0,0	0,2	0,3	0,5	0,6	0,6	0,6	0,6	0,8	1,1	1,6	2,3	2,9	2,9	3,6	-3,5	-8,2	0,0	0,0
65	0,0	0,1	0,2	0,4	0,5	0,6	0,6	0,6	0,7	0,9	1,3	1,9	2,6	2,9	3,1	1,8	-7,6	-7,8	0,0
66	0,0	0,1	0,3	0,5	0,6	0,6	0,6	0,6	0,7	1,0	1,5	2,2	2,8	2,8	3,1	-1,9	-9,9	0,0	0,0
67	0,0	0,1	0,2	0,4	0,5	0,6	0,6	0,6	0,6	0,8	1,2	1,8	2,5	2,8	2,6	2,2	-6,7	-10,2	0,0
68	0,0	0,1	0,3	0,5	0,5	0,6	0,5	0,6	0,7	0,9	1,4	2,0	2,6	2,5	2,6	-0,5	-11,2	0,0	0,0
69	0,0	0,1	0,2	0,4	0,5	0,5	0,5	0,5	0,6	0,7	1,1	1,6	2,2	2,6	2,1	2,3	-5,8	-12,4	0,0
70	0,0	0,1	0,3	0,4	0,5	0,5	0,5	0,5	0,6	0,8	1,2	1,8	2,4	2,2	2,2	0,3	-12,0	0,0	0,0
71	0,0	0,1	0,2	0,4	0,5	0,5	0,5	0,5	0,5	0,7	1,0	1,4	2,0	2,3	1,9	2,3	-5,1	-13,9	0,0
72	0,0	0,1	0,3	0,4	0,5	0,5	0,5	0,5	0,5	0,8	1,1	1,6	2,1	2,1	2,0	0,4	-12,2	0,0	0,0
73	0,0	0,1	0,2	0,3	0,4	0,5	0,5	0,5	0,5	0,6	0,9	1,3	1,8	2,1	2,0	1,9	-5,5	-13,5	0,0
74	0,0	0,1	0,2	0,4	0,5	0,5	0,4	0,4	0,5	0,7	1,0	1,4	1,9	2,2	1,9	-0,9	-11,3	0,0	0,0
75	0,0	0,1	0,2	0,3	0,4	0,5	0,5	0,4	0,4	0,5	0,8	1,2	1,6	2,1	2,3	0,7	-6,4	-12,6	0,0
76	0,0	0,1	0,2	0,4	0,4	0,5	0,4	0,4	0,4	0,6	0,9	1,4	1,9	2,4	1,7	-3,6	-9,6	0,0	0,0

77	0,0	0,1	0,2	0,3	0,4	0,5	0,4	0,4	0,4	0,5	0,7	1,1	1,6	2,2	2,6	-1,0	-7,1	-11,1	0,0
78	0,0	0,1	0,2	0,4	0,4	0,4	0,4	0,4	0,4	0,6	0,9	1,3	1,9	2,8	1,7	-5,8	-7,6	0,0	0,0
79	0,0	0,1	0,2	0,3	0,4	0,4	0,4	0,4	0,4	0,5	0,7	1,0	1,5	2,3	3,7	-2,1	-5,8	-8,9	0,0
80	0,0	0,1	0,2	0,4	0,4	0,4	0,4	0,4	0,4	0,5	0,8	1,2	1,8	2,9	3,2	-2,7	-4,6	0,0	0,0
81	0,0	0,1	0,2	0,3	0,4	0,4	0,4	0,3	0,3	0,4	0,6	0,9	1,4	2,1	3,6	2,9	-1,5	-5,4	0,0

OUTPUT: SEPTEMBER 14, 1944, HURRICANE, NO. 2

THESE ARE THE 5 STORM POSITIONS READ IN BY THE COMP UTER
PLEASE CHECK TIMES, LATITUDES, LONGITITUDES, PRESSURE DROPS AND STORM SIZES FOR AGREEMENT AND CONSISTENCY

HOUR	DAY	MNTH	YEAR	LATITUDE	LONGITUDE	PRS DROP	STRM SIZE	LENGTH	AZIMUTH	X-CORD	Y-CORD
12	14	SEP	1944	37.00	71.60	90.00	30.00	184.82	93.65	53.70	71.63
18	14	SEP	1944	37.50	72.10	90.00	30.00	148.92	88.98	43.54	75.76
0	15	SEP	1944	38.00	73.40	90.00	30.00	80.38	90.57	23.96	74.77
6	15	SEP	1944	51.36	74.90	90.00	30.00	0.00	0.00	1.00	75.00
12	15	SEP	1944	39.40	76.68	90.00	30.00	94.69	271.85	-26.04	75.87

MINIMUM DISTANCE OF STORM FROM BASIN CENTER IS 2.2 MILES AT HOUR 6, FRI 15 SEP 1944

BASIN CENTER IS -20 ILES TO THE NORTH OF CAPE MAY, OBSERVER IS ON SEA AND FACING LAND .

HOURLY VALUES OF (SMOOTHED) STORM POSITIONS, SPEE D AND DIRECTION (MATHEMATICAL) OF MOTION, PRESSURE DROP, AND SIZE

	HOUR	DAY	MNTH	YEAR	LATITDE	LONGTDE	X-PT	Y-PT	SPEED	STRM DR	DELP	SIZE	
	0	14	SEP	1944	36.02	71.04	67.05	59.97	5.95	138.44	90.00	30.00	
	1	14	SEP	1944	36.11	71.08	65.95	60.95	5.95	138.44	90.00	30.00	
	2	14	SEP	1944	36.19	71.12	64.84	61.93	5.95	138.44	90.00	30.00	
	3	14	SEP	1944	36.27	71.16	63.74	62.91	5.95	138.44	90.00	30.00	
	4	14	SEP	1944	36.35	71.20	62.63	63.89	5.95	138.44	90.00	30.00	
	5	14	SEP	1944	36.43	71.24	61.53	64.87	5.95	138.44	90.00	30.00	
	6	14	SEP	1944	36.51	71.28	60.42	65.85	5.95	138.44	90.00	30.00	
	7	14	SEP	1944	36.59	71.32	59.32	66.83	5.95	138.44	90.00	30.00	
	8	14	SEP	1944	36.68	71.36	58.21	67.81	5.95	138.44	90.00	30.00	
	9	14	SEP	1944	36.76	71.40	57.11	68.79	5.95	138.44	90.00	30.00	
	10	14	SEP	1944	36.84	71.44	56.00	69.77	5.95	138.44	90.00	30.00	
	11	14	SEP	1944	36.92	71.48	54.90	70.75	5.95	138.44	90.00	30.00	
	12	14	SEP	1944	37.00	71.52	53.79	71.73	5.95	138.44	90.00	30.00	
	13	14	SEP	1944	37.08	71.56	52.69	72.71	6.48	149.68	90.00	30.00	
	14	14	SEP	1944	37.16	71.62	51.30	73.52	7.20	158.38	90.00	30.00	
	15	14	SEP	1944	37.25	71.71	49.64	74.18	8.01	164.92	90.00	30.00	
	16	14	SEP	1944	37.33	71.82	47.72	74.70	8.87	169.80	90.00	30.00	
	17	14	SEP	1944	37.41	71.95	45.56	75.09	9.73	173.46	90.00	30.00	
INITLZE COMPTTNS	18	14	SEP	1944	37.49	72.10	43.16	75.36	10.59	176.20	90.00	30.00	INITLZE COMPTTNS
	19	14	SEP	1944	37.57	72.26	40.54	75.54	11.41	178.25	90.00	30.00	
	20	14	SEP	1944	37.66	72.45	37.71	75.63	12.20	179.77	90.00	30.00	
	21	14	SEP	1944	37.74	72.65	34.68	75.64	12.95	180.87	90.00	30.00	
	22	14	SEP	1944	37.83	72.86	31.47	75.59	13.64	181.63	90.00	30.00	
	23	14	SEP	1944	37.92	73.09	28.08	75.49	14.29	182.11	90.00	30.00	
	0	15	SEP	1944	38.01	73.33	24.54	75.36	14.89	182.35	90.00	30.00	
	1	15	SEP	1944	38.11	73.58	20.85	75.21	15.43	182.38	90.00	30.00	
	2	15	SEP	1944	38.21	73.84	17.02	75.05	15.93	182.23	90.00	30.00	
	3	15	SEP	1944	38.31	74.10	13.07	74.90	16.37	181.90	90.00	30.00	
	4	15	SEP	1944	38.41	74.38	9.02	74.76	16.76	181.41	90.00	30.00	
	5	15	SEP	1944	38.52	74.66	4.86	74.66	17.10	180.76	90.00	30.00	
NEAREST APPROACH	6	15	SEP	1944	38.63	74.94	0.62	74.61	17.39	179.97	90.00	30.00	NEAREST APPROACH
TO BASIN CENTER	7	15	SEP	1944	38.75	75.22	-3.70	74.61	17.64	179.02	90.00	30.00	TO BASIN CENTER
	8	15	SEP	1944	38.87	75.51	-8.08	74.68	17.85	177.92	90.00	30.00	
	9	15	SEP	1944	38.99	75.80	-12.50	74.84	18.01	176.67	90.00	30.00	
	10	15	SEP	1944	39.12	76.09	-16.96	75.10	18.14	175.26	90.00	30.00	
	11	15	SEP	1944	39.26	76.37	-21.45	75.47	18.23	173.69	90.00	30.00	

TERMNTE COMPTINS	12	15	SEP 1944	39,40	76,65	-25,94	75,97	18,23	173,69	90,00	30,00	TERMNTE COMPTINS
	13	15	SEP 1944	39,54	76,93	-30,44	76,47	18,23	173,69	90,00	30,00	
	14	15	SEP 1944	39,69	77,21	-34,94	76,97	18,23	173,69	90,00	30,00	
	15	15	SEP 1944	39,83	77,49	-39,43	77,46	18,23	173,69	90,00	30,00	
	16	15	SEP 1944	39,97	77,77	-43,93	77,96	18,23	173,69	90,00	30,00	
	17	15	SEP 1944	40,11	78,05	-48,42	78,46	18,23	173,69	90,00	30,00	
	18	15	SEP 1944	40,24	78,33	-52,92	78,96	18,23	173,69	90,00	30,00	
	19	15	SEP 1944	40,38	78,62	-57,42	79,45	18,23	173,69	90,00	30,00	
	20	15	SEP 1944	40,52	78,90	-61,91	79,95	18,23	173,69	90,00	30,00	
	21	15	SEP 1944	40,66	79,18	-66,41	80,45	18,23	173,69	90,00	30,00	
	22	15	SEP 1944	40,79	79,46	-70,90	80,95	18,23	173,69	90,00	30,00	
	23	15	SEP 1944	40,93	79,74	-75,40	81,44	18,23	173,69	90,00	30,00	
	0	16	SEP 1944	41,06	80,02	-79,90	81,94	18,23	173,69	90,00	30,00	

X-GRID	Y-GRID	STOP PGM	FRCE DST	STM GRWTH
10	151	432	795	100

CORIOLIS	GRID SPACE	TIMI INCRM	SLIP COER	DNSTY ATM	DRAG COEF	VISCOSITY
0,00009099	21280,7	150,0	0,0060000	0,00115000	0,00000300	0,25000000

INTL LATTD	INTL LONGT
37,49	72,10

DEPTH FIELD IN FEET, GRID DISTANCES ARE 4 STAT MI LFS (3.5 NM) APART, POINT 752 ON ORDINATE IS CENTER OF BASIN

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
79	25.		43.		60.		75.		89.		101.		111.		120.		130.		144.
78		25.		43.		61.		77.		91.		103.		112.		121.		130.	
77	25.		44.		62.		78.		93.		104.		113.		121.		129.		140.
76		25.		44.		62.		79.		93.		105.		113.		121.		128.	
75	25.		44.		62.		79.		93.		105.		113.		120.		127.		136.
74		25.		44.		62.		78.		92.		104.		112.		118.		125.	
73	25.		43.		61.		77.		91.		102.		110.		116.		122.		130.
72		25.		43.		60.		76.		89.		100.		108.		114.		120.	

STORM DATA FOR TIMT OF NEAREST APPROACH TO BASIN CENTER

STORM DATA AT 288 DELTA TIMT, OR EFI, 15 SEP 1944 AT HOUR 6, STORM POSITION AT LATITUDE 38.63, LONGITUDE 74.94

X-POINT	Y-POINT	MAX WIND	RADIUS	STRM SPD	RADD	PRES DROP
0.616	74.605	115.989	30.000	17.395	12.646	89.973

RADIUS	SPEED	PRES DROP	INFLW ANG	STC HGHT	P GRAD
0	0.00	0.00	0.00	3.01	0.00000000
2	15.40	0.29	0.32	3.00	0.00005844
4	30.39	1.15	0.64	2.97	0.00011493
6	44.61	2.53	0.97	2.93	0.00016675
8	57.75	4.40	1.32	2.86	0.00021171
10	69.59	6.66	1.70	2.79	0.00024842
12	79.99	9.24	2.11	2.70	0.00027631
14	88.90	12.05	2.57	2.61	0.00029549
16	96.32	15.01	3.06	2.51	0.00030664
18	102.34	18.05	3.60	2.41	0.00031078
20	107.07	21.09	4.20	2.30	0.00030909
22	110.63	24.10	4.85	2.20	0.00030279
24	113.16	27.02	5.57	2.11	0.00029299
26	114.81	29.84	6.34	2.01	0.00028068
28	115.71	32.52	7.19	1.92	0.00026668
30	115.99	35.06	8.10	1.84	0.00025163
32	115.75	37.46	9.10	1.76	0.00023593
34	115.09	39.69	10.20	1.68	0.00021981
36	114.09	41.77	11.44	1.61	0.00020355
38	112.82	43.69	12.79	1.55	0.00018793
40	111.35	45.46	14.21	1.49	0.00017376
42	109.72	47.10	15.62	1.43	0.00016141
44	107.97	48.63	16.94	1.38	0.00015079
46	106.14	50.07	18.14	1.34	0.00014156
48	104.26	51.41	19.24	1.29	0.00013342
50	102.34	52.69	20.21	1.25	0.00012610
52	100.41	53.89	21.05	1.21	0.00011944
54	98.48	55.03	21.79	1.17	0.00011330
56	96.56	56.12	22.44	1.13	0.00010760
58	94.66	57.14	23.00	1.10	0.00010227
60	92.79	58.12	23.49	1.07	0.00009728
62	90.95	59.05	23.91	1.03	0.00009260
64	89.15	59.94	24.27	1.00	0.00008819
66	87.39	60.79	24.58	0.98	0.00008404
68	85.67	61.59	24.84	0.95	0.00008013
70	83.99	62.36	25.06	0.92	0.00007645
72	82.36	63.09	25.25	0.90	0.00007299
74	80.77	63.79	25.41	0.88	0.00006972
76	79.23	64.46	25.54	0.85	0.00006664
78	77.72	65.10	25.64	0.83	0.00006373
80	76.27	65.71	25.72	0.81	0.00006099
82	74.85	66.30	25.78	0.79	0.00005841
84	73.48	66.86	25.82	0.77	0.00005597
86	72.14	67.39	25.85	0.76	0.00005367
88	70.85	67.91	25.86	0.74	0.00005149
90	69.59	68.41	25.86	0.72	0.00004944
92	68.37	68.88	25.84	0.71	0.00004750
94	67.19	69.34	25.82	0.69	0.00004566

96	66,04	69,78	25,78	0,68	0,00004393
98	64,93	70,20	25,74	0,66	0,00004228
100	63,85	70,61	25,69	0,65	0,00004073
110	58,89	72,43	25,35	0,59	0,00003407
120	54,58	73,97	24,90	0,54	0,00002891
130	50,83	75,29	24,39	0,49	0,00002486
140	47,53	76,43	23,84	0,45	0,00002162
150	44,61	77,42	23,39	0,42	0,00001843
160	42,02	78,26	23,39	0,39	0,00001611
170	39,70	79,01	23,39	0,37	0,00001419
180	37,62	79,66	23,39	0,34	0,00001258
190	35,74	80,24	23,39	0,33	0,00001122
200	34,03	80,77	23,39	0,31	0,00001006
210	32,48	81,23	23,39	0,29	0,00000907
220	31,06	81,66	23,39	0,28	0,00000822
230	29,75	82,04	23,39	0,27	0,00000748
250	27,44	82,71	23,39	0,24	0,00000626
300	22,97	83,98	23,39	0,20	0,00000425
350	19,74	84,86	23,39	0,17	0,00000306
400	17,30	85,52	23,39	0,15	0,00000231
450	15,40	86,02	23,39	0,13	0,00000180
500	13,87	86,41	23,39	0,12	0,00000144
550	12,62	86,73	23,39	0,11	0,00000118
600	11,57	87,00	23,39	0,10	0,00000099
650	10,68	87,22	23,39	0,09	0,00000083
700	9,92	87,41	23,39	0,09	0,00000072
750	9,26	87,57	23,39	0,08	0,00000062

1	-0,0	-0,3	-0,6	-0,9	-1,2	-1,5	-1,7	-1,8	-1,7	-1,7	-1,7	-1,8	-1,7	-1,5	-1,1	-0,9	-1,1	-1,7	0,0
2	-0,1	-0,4	-0,8	-1,1	-1,4	-1,7	-1,8	-1,8	-1,8	-1,8	-1,9	-1,9	-1,7	-1,3	-1,0	-1,0	-1,5	0,0	0,0
3	-0,0	-0,2	-0,6	-1,0	-1,3	-1,7	-1,9	-2,0	-1,9	-1,9	-2,0	-2,0	-1,9	-1,6	-1,1	-1,0	-1,4	-2,0	0,0
4	-0,1	-0,5	-0,8	-1,2	-1,6	-1,9	-2,1	-2,1	-2,0	-2,1	-2,1	-2,1	-1,8	-1,3	-1,0	-1,1	-1,8	0,0	0,0
5	-0,0	-0,3	-0,7	-1,1	-1,5	-1,9	-2,2	-2,2	-2,2	-2,1	-2,2	-2,1	-1,9	-1,5	-1,1	-1,0	-1,5	-2,3	0,0
6	-0,1	-0,5	-1,0	-1,5	-1,9	-2,2	-2,3	-2,3	-2,2	-2,2	-2,2	-2,0	-1,6	-1,1	-0,9	-1,2	-2,0	0,0	0,0
7	-0,0	-0,3	-0,9	-1,4	-1,8	-2,2	-2,4	-2,4	-2,3	-2,2	-2,2	-2,1	-1,7	-1,2	-0,8	-0,9	-1,7	-2,6	0,0
8	-0,2	-0,6	-1,2	-1,7	-2,1	-2,4	-2,5	-2,4	-2,2	-2,1	-2,0	-1,8	-1,3	-0,9	-0,7	-1,3	-2,3	0,0	0,0
9	-0,1	-0,4	-1,0	-1,5	-2,0	-2,3	-2,5	-2,4	-2,2	-2,1	-2,0	-1,8	-1,5	-1,0	-0,7	-1,0	-1,9	-2,8	0,0
10	-0,2	-0,7	-1,3	-1,8	-2,2	-2,4	-2,5	-2,3	-2,1	-2,0	-1,9	-1,6	-1,1	-0,7	-0,8	-1,6	-2,7	0,0	0,0
11	-0,1	-0,4	-1,0	-1,5	-1,9	-2,3	-2,5	-2,3	-2,1	-2,0	-1,9	-1,7	-1,3	-0,8	-0,7	-1,3	-2,4	-3,2	0,0
12	-0,2	-0,6	-1,2	-1,7	-2,1	-2,4	-2,3	-2,1	-2,0	-1,9	-1,8	-1,5	-1,0	-0,7	-1,0	-2,1	-3,2	0,0	0,0
13	-0,0	-0,3	-0,9	-1,4	-1,9	-2,2	-2,3	-2,2	-2,0	-2,0	-1,9	-1,7	-1,2	-0,8	-0,8	-1,7	-3,1	-3,4	0,0
14	-0,1	-0,6	-1,2	-1,6	-2,0	-2,3	-2,2	-2,0	-1,9	-2,0	-1,8	-1,4	-0,9	-0,8	-1,4	-2,7	-3,7	0,0	0,0
15	-0,0	-0,3	-0,8	-1,4	-1,8	-2,1	-2,3	-2,1	-1,9	-2,0	-1,9	-1,6	-1,1	-0,7	-1,1	-2,3	-3,7	-3,5	0,0
16	-0,1	-0,5	-1,1	-1,6	-2,0	-2,2	-2,1	-2,0	-1,9	-2,0	-1,8	-1,3	-0,8	-0,8	-1,8	-3,4	-4,1	0,0	0,0

17	-0,0	-0,3	-0,8	-1,3	-1,8	-2,1	-2,2	-2,0	-1,9	-2,0	-1,9	-1,4	-0,9	-0,7	-1,3	-2,9	-4,2	-3,5	0,0
18	-0,1	-0,5	-1,1	-1,6	-2,0	-2,2	-2,1	-1,9	-1,9	-1,9	-1,6	-0,9	-0,5	-0,9	-2,3	-4,0	-4,2	0,0	0,0
19	-0,0	-0,3	-0,8	-1,4	-1,8	-2,1	-2,2	-2,0	-1,9	-1,9	-1,7	-1,0	-0,4	-0,4	-1,6	-3,5	-4,6	-3,2	0,0
20	-0,1	-0,5	-1,1	-1,7	-2,0	-2,2	-2,1	-1,9	-1,9	-1,7	-1,1	-0,3	-0,1	-0,6	-2,8	-4,5	-4,1	0,0	0,0
21	-0,0	-0,3	-0,8	-1,4	-1,9	-2,1	-2,1	-1,9	-1,8	-1,7	-1,2	-0,3	0,3	-0,2	-1,9	-4,1	-4,7	-2,8	0,0
22	-0,1	-0,5	-1,2	-1,7	-2,1	-2,1	-1,9	-1,7	-1,5	-1,2	-0,3	0,6	0,5	-0,9	-3,5	-5,0	-3,8	0,0	0,0
23	-0,0	-0,3	-0,9	-1,5	-1,9	-2,1	-1,9	-1,6	-1,4	-1,1	-0,3	0,9	1,2	0,1	-2,5	-4,9	-4,8	-2,5	0,0
24	-0,1	-0,6	-1,2	-1,7	-1,9	-1,9	-1,6	-1,2	-0,9	-0,2	1,0	1,8	1,0	-1,4	-4,3	-5,4	-3,6	0,0	0,0
25	-0,0	-0,3	-0,9	-1,5	-1,8	-1,8	-1,5	-1,0	-0,6	-0,0	1,1	2,2	2,0	-0,1	-3,4	-5,6	-4,6	-2,3	0,0
26	-0,1	-0,6	-1,2	-1,6	-1,7	-1,4	-1,0	-0,4	0,2	1,2	2,5	2,9	1,3	-2,1	-5,3	-5,6	-3,3	0,0	0,0
27	-0,0	-0,3	-0,8	-1,3	-1,5	-1,3	-0,9	-0,2	0,5	1,3	2,6	3,6	2,7	-0,5	-4,5	-6,1	-4,5	-2,2	0,0
28	-0,1	-0,5	-1,0	-1,3	-1,2	-0,8	-0,1	0,7	1,5	2,7	4,1	4,0	1,3	-3,2	-6,1	-5,5	-3,1	0,0	0,0
29	-0,0	-0,3	-0,7	-1,1	-1,1	-0,7	-0,0	0,8	1,8	2,9	4,3	5,0	3,1	-1,3	-5,5	-6,3	-4,1	-2,1	0,0
30	-0,1	-0,4	-0,9	-1,0	-0,6	0,0	0,9	1,9	3,0	4,4	5,7	5,0	1,0	-4,1	-6,6	-5,1	-2,8	0,0	0,0
31	-0,0	-0,2	-0,6	-0,8	-0,6	0,0	0,9	2,0	3,2	4,5	6,0	6,4	3,6	-1,9	-6,1	-5,9	-3,6	-2,2	0,0
32	-0,1	-0,4	-0,7	-0,6	-0,0	0,8	1,9	3,2	4,6	6,1	7,2	5,9	0,9	-4,7	-6,3	-4,4	-2,3	0,0	0,0
33	-0,0	-0,2	-0,5	-0,5	-0,1	0,7	1,7	3,1	4,6	6,2	7,6	7,6	3,9	-2,2	-5,9	-5,0	-2,8	-2,0	0,0
34	-0,1	-0,3	-0,5	-0,2	0,5	1,6	2,8	4,4	6,1	7,7	8,6	6,8	1,4	-4,3	-5,1	-3,2	-1,8	0,0	0,0
35	-0,0	-0,2	-0,4	-0,3	0,3	1,3	2,5	4,1	5,9	7,7	9,1	8,9	5,1	-1,0	-4,4	-3,5	-1,6	-2,0	0,0
36	-0,1	-0,3	-0,3	0,1	1,1	2,3	3,7	5,6	7,5	9,2	10,1	8,1	3,1	-2,0	-3,2	-1,6	-1,3	0,0	0,0
37	-0,0	-0,1	-0,3	-0,0	0,8	1,9	3,3	5,1	7,2	9,2	10,5	10,3	6,8	1,7	-1,5	-1,3	-0,5	-1,8	0,0
38	-0,1	-0,2	-0,1	0,5	1,6	2,9	4,6	6,7	8,9	10,6	11,4	9,7	5,8	2,0	-0,3	0,3	-0,7	0,0	0,0
39	-0,0	-0,1	-0,2	0,3	1,2	2,5	4,0	6,1	8,5	10,6	11,9	11,6	8,9	5,6	2,7	1,5	0,5	-1,3	0,0
40	-0,1	-0,1	0,1	0,8	2,0	3,5	5,5	8,0	10,5	12,3	12,7	10,9	8,1	6,1	3,6	2,3	0,0	0,0	0,0
41	-0,0	-0,1	-0,0	0,5	1,6	3,1	4,8	7,2	10,0	12,5	13,6	12,6	9,8	8,1	7,0	4,5	1,7	-0,6	0,0
42	-0,0	-0,1	0,3	1,2	2,5	4,2	6,5	9,3	12,3	14,5	14,3	11,3	9,6	9,5	8,0	4,1	0,8	0,0	0,0
43	-0,0	-0,0	0,1	0,8	2,0	3,6	5,6	8,4	11,7	14,8	16,0	13,6	10,6	11,1	11,1	7,3	2,6	-0,1	0,0
44	-0,0	0,0	0,5	1,5	2,9	4,8	7,3	10,6	14,3	17,0	16,4	13,1	12,7	13,1	10,7	4,7	0,8	0,0	0,0
45	-0,0	-0,0	0,2	0,9	2,2	3,9	6,1	9,3	13,1	17,0	18,5	16,2	14,5	15,4	13,0	7,4	2,1	-0,4	0,0
46	-0,0	0,0	0,5	1,6	3,1	5,1	7,8	11,5	15,9	19,4	19,3	17,1	16,7	15,1	10,2	3,9	0,2	0,0	0,0

47	-0.0	-0.0	0.2	0.9	2.3	4.1	6.4	9.7	14.1	18.8	21.1	20.1	18.6	16.8	12.3	6.5	1.1	-0.9	0.0
48	-0.0	0.0	0.5	1.5	3.1	5.2	8.0	11.9	16.9	21.2	22.2	20.7	18.3	14.5	8.8	3.2	-0.3	0.0	0.0
49	-0.0	-0.0	0.1	0.9	2.3	4.1	6.4	9.8	14.4	19.6	22.9	22.7	20.1	16.1	10.9	5.4	0.9	-1.1	0.0
50	-0.0	0.0	0.4	1.5	3.1	5.2	7.9	11.8	16.9	21.7	23.6	21.9	17.9	13.1	7.7	2.9	-0.6	0.0	0.0
51	-0.0	-0.0	0.1	0.8	2.2	4.1	6.4	9.6	13.9	19.1	22.9	23.1	19.8	15.1	10.1	4.9	1.0	-1.1	0.0
52	-0.0	0.0	0.4	1.4	3.1	5.1	7.7	11.3	16.0	20.6	23.0	21.4	17.2	12.1	7.2	2.8	-0.3	0.0	0.0
53	-0.0	-0.0	0.1	0.8	2.2	4.0	6.2	9.2	13.1	17.6	21.4	21.9	19.0	14.1	9.3	4.7	1.2	-0.9	0.0
54	-0.0	0.0	0.4	1.4	3.1	5.1	7.4	10.6	14.6	18.7	21.1	20.1	16.1	11.3	6.8	2.7	0.1	0.0	0.0
55	-0.0	0.0	0.1	0.8	2.2	4.0	6.1	8.7	12.0	15.8	19.1	20.0	17.5	13.2	8.6	4.6	1.4	-0.5	0.0
56	0.0	0.1	0.4	1.5	3.1	5.0	7.1	9.9	13.1	16.5	18.7	18.1	14.8	10.3	6.3	2.9	0.5	0.0	0.0
57	0.0	0.0	0.2	0.9	2.3	4.0	6.0	8.2	10.9	14.0	16.7	17.6	15.8	12.0	7.8	4.4	1.5	0.0	0.0
58	0.0	0.1	0.5	1.6	3.1	5.0	6.9	9.1	11.7	14.4	16.2	15.9	13.2	9.4	5.7	2.9	0.8	0.0	0.0
59	0.0	0.1	0.3	1.0	2.4	4.1	5.9	7.7	9.9	12.3	14.3	15.1	13.8	10.6	7.0	4.1	1.8	0.3	0.0
60	0.0	0.2	0.6	1.7	3.2	5.0	6.6	8.5	10.5	12.5	13.8	13.6	11.5	8.3	5.1	2.7	1.0	0.0	0.0
61	0.0	0.1	0.4	1.1	2.5	4.1	5.7	7.4	9.1	10.8	12.3	12.8	11.8	9.3	6.1	3.5	1.8	0.6	0.0
62	0.0	0.2	0.7	1.8	3.3	4.9	6.4	7.9	9.4	10.8	11.7	11.5	9.8	7.1	4.4	2.4	1.1	0.0	0.0
63	0.0	0.1	0.4	1.3	2.6	4.1	5.6	7.0	8.3	9.6	10.6	10.8	10.0	7.6	5.3	3.1	1.7	0.7	0.0
64	0.0	0.2	0.8	1.9	3.3	4.8	6.2	7.4	8.5	9.4	10.0	9.7	8.3	6.2	3.8	2.1	1.2	0.0	0.0
65	0.0	0.1	0.5	1.4	2.6	4.0	5.4	6.6	7.6	8.4	9.1	9.2	8.5	6.8	4.6	2.6	1.5	0.9	0.0
66	0.0	0.3	0.9	2.0	3.3	4.6	5.8	6.8	7.5	8.2	8.5	8.3	7.2	5.3	3.3	1.8	1.1	0.0	0.0
67	0.0	0.1	0.5	1.4	2.6	3.9	5.1	6.1	6.8	7.4	7.8	7.8	7.2	5.9	4.1	2.3	1.4	1.0	0.0
68	0.0	0.3	0.9	1.9	3.1	4.4	5.4	6.1	6.6	7.0	7.2	7.0	6.2	4.8	3.0	1.7	1.2	0.0	0.0
69	0.0	0.1	0.5	1.3	2.5	3.6	4.7	5.5	6.0	6.3	6.6	6.6	6.2	5.2	3.7	2.2	1.3	1.1	0.0
70	0.0	0.3	0.8	1.8	2.9	4.0	4.8	5.4	5.7	5.9	6.1	6.0	5.4	4.3	2.8	1.6	1.2	0.0	0.0
71	0.0	0.1	0.5	1.3	2.3	3.4	4.3	4.9	5.2	5.3	5.5	5.5	5.3	4.5	3.4	2.1	1.3	1.2	0.0
72	0.0	0.3	0.8	1.8	2.8	3.7	4.4	4.7	4.8	4.9	5.0	5.0	4.6	3.8	2.7	1.6	1.1	0.0	0.0
73	0.0	0.1	0.5	1.3	2.2	3.1	3.9	4.3	4.4	4.4	4.5	4.5	4.4	3.9	3.1	1.9	1.2	1.1	0.0
74	0.1	0.3	0.9	1.7	2.6	3.4	4.0	4.1	4.1	4.0	4.0	4.1	3.9	3.3	2.4	1.4	1.0	0.0	0.0
75	0.0	0.2	0.6	1.3	2.2	3.0	3.6	3.9	3.8	3.7	3.6	3.6	3.6	3.3	2.6	1.8	1.1	1.0	0.0
76	0.1	0.4	1.0	1.8	2.6	3.3	3.6	3.7	3.4	3.3	3.2	3.3	3.2	2.7	2.0	1.2	0.8	0.0	0.0

77	0.0	0.2	0.7	1.4	2.2	2.9	3.4	3.5	3.3	3.0	2.9	2.9	2.9	2.7	2.2	1.4	0.8	0.7	0.0
78	0.1	0.5	1.1	1.8	2.6	3.1	3.4	3.2	2.9	2.6	2.5	2.6	2.6	2.3	1.7	0.9	0.6	0.0	0.0
79	0.0	0.3	0.8	1.5	2.2	2.8	3.2	3.2	2.8	2.5	2.3	2.3	2.3	2.2	1.8	1.1	0.6	0.5	0.0
80	0.1	0.5	1.2	1.9	2.5	3.0	3.1	2.8	2.4	2.1	2.0	2.0	2.1	1.8	1.3	0.7	0.4	0.0	0.0
81	0.0	0.3	0.8	1.5	2.1	2.7	2.9	2.8	2.4	2.0	1.7	1.7	1.8	1.8	1.5	0.9	0.4	0.3	0.0

OUTPUT: SEPTEMBER 14, 1944, HURRICANE, NO. 3

THESE ARE THE 5 STORM POSITIONS READ IN BY THE COMP UTER
PLEASE CHECK TIMES, LATITUDES, LONGITITUDES, PRESSURE DROPS AND STORM SIZES FOR AGREEMENT AND CONSISTENCY

HOUR	DAY	MNTH	YEAR	LATITUDE	LONGITUDE	PRS DROP	STRM SIZE	LENGTH	AZIMUTH	X-CORD	Y-CORD
12	14	SEP	1944	37.00	71.60	90.00	15.00	184.82	93.65	53.70	71.63
18	14	SEP	1944	37.50	72.10	90.00	15.00	148.92	88.98	43.54	75.76
0	15	SEP	1944	38.00	73.40	90.00	15.00	80.38	90.57	23.96	74.77
6	15	SEP	1944	51.36	74.90	90.00	15.00	0.00	0.00	1.00	75.00
12	15	SEP	1944	39.40	76.68	90.00	15.00	94.69	271.85	-26.04	75.87

MINIMUM DISTANCE OF STORM FROM BASIN CENTER IS 2.2 MILES AT HOUR 6, FRI 15 SEP 1944

BASIN CENTER IS -20 ILES TO THE NORTH OF CAPE MAY, OBSERVER IS ON SEA AND FACING LAND .

HOURLY VALUES OF (SMOOTHED) STORM POSITIONS, SPEE D AND DIRECTION (MATHEMATICAL) OF MOTION, PRESSURE DROP, AND SIZE

	HOUR	DAY	MNTH	YEAR	LATITDE	LONGTDE	X-PT	Y-PT	SPEED	STRM DR	DELP	SIZE	
	0	14	SEP	1944	36.02	71.04	67.05	59.97	5.95	138.44	90.00	15.00	
	1	14	SEP	1944	36.11	71.08	65.95	60.95	5.95	138.44	90.00	15.00	
	2	14	SEP	1944	36.19	71.12	64.84	61.93	5.95	138.44	90.00	15.00	
	3	14	SEP	1944	36.27	71.16	63.74	62.91	5.95	138.44	90.00	15.00	
	4	14	SEP	1944	36.35	71.20	62.63	63.89	5.95	138.44	90.00	15.00	
	5	14	SEP	1944	36.43	71.24	61.53	64.87	5.95	138.44	90.00	15.00	
	6	14	SEP	1944	36.51	71.28	60.42	65.85	5.95	138.44	90.00	15.00	
	7	14	SEP	1944	36.59	71.32	59.32	66.83	5.95	138.44	90.00	15.00	
	8	14	SEP	1944	36.68	71.36	58.21	67.81	5.95	138.44	90.00	15.00	
	9	14	SEP	1944	36.76	71.40	57.11	68.79	5.95	138.44	90.00	15.00	
	10	14	SEP	1944	36.84	71.44	56.00	69.77	5.95	138.44	90.00	15.00	
	11	14	SEP	1944	36.92	71.48	54.90	70.75	5.95	138.44	90.00	15.00	
	12	14	SEP	1944	37.00	71.52	53.79	71.73	5.95	138.44	90.00	15.00	
	13	14	SEP	1944	37.08	71.56	52.69	72.71	6.48	149.68	90.00	15.00	
	14	14	SEP	1944	37.16	71.62	51.30	73.52	7.20	158.38	90.00	15.00	
	15	14	SEP	1944	37.25	71.71	49.64	74.18	8.01	164.92	90.00	15.00	
	16	14	SEP	1944	37.33	71.82	47.72	74.70	8.87	169.80	90.00	15.00	
	17	14	SEP	1944	37.41	71.95	45.56	75.09	9.73	173.46	90.00	15.00	
INITLZE COMPTINS	18	14	SEP	1944	37.49	72.10	43.16	75.36	10.59	176.20	90.00	15.00	INITLZE COMPTINS
	19	14	SEP	1944	37.57	72.26	40.54	75.54	11.41	178.25	90.00	15.00	
	20	14	SEP	1944	37.66	72.45	37.71	75.63	12.20	179.77	90.00	15.00	
	21	14	SEP	1944	37.74	72.65	34.68	75.64	12.95	180.87	90.00	15.00	
	22	14	SEP	1944	37.83	72.86	31.47	75.59	13.64	181.63	90.00	15.00	
	23	14	SEP	1944	37.92	73.09	28.08	75.49	14.29	182.11	90.00	15.00	
	0	15	SEP	1944	38.01	73.33	24.54	75.36	14.89	182.35	90.00	15.00	
	1	15	SEP	1944	38.11	73.58	20.85	75.21	15.43	182.38	90.00	15.00	
	2	15	SEP	1944	38.21	73.84	17.02	75.05	15.93	182.23	90.00	15.00	
	3	15	SEP	1944	38.31	74.10	13.07	74.90	16.37	181.90	90.00	15.00	
	4	15	SEP	1944	38.41	74.38	9.02	74.76	16.76	181.41	90.00	15.00	
	5	15	SEP	1944	38.52	74.66	4.86	74.66	17.10	180.76	90.00	15.00	
NEAREST APPROACH	6	15	SEP	1944	38.63	74.94	0.62	74.61	17.39	179.97	90.00	15.00	NEAREST APPROACH
TO BASIN CENTER	7	15	SEP	1944	38.75	75.22	-3.70	74.61	17.64	179.02	90.00	15.00	TO BASIN CENTER
	8	15	SEP	1944	38.87	75.51	-8.08	74.68	17.85	177.92	90.00	15.00	
	9	15	SEP	1944	38.99	75.80	-12.50	74.84	18.01	176.67	90.00	15.00	
	10	15	SEP	1944	39.12	76.09	-16.96	75.10	18.14	175.26	90.00	15.00	
	11	15	SEP	1944	39.26	76.37	-21.45	75.47	18.23	173.69	90.00	15.00	

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TERMNTE  COMPTTNS  12   15  SEP 1944   39,40   76,65  -25,94   75,97   18,23  173,69   90,00   15,00  TERMNTE  COMPTTNS
                   13   15  SEP 1944   39,54   76,93  -30,44   76,47   18,23  173,69   90,00   15,00
                   14   15  SEP 1944   39,69   77,21  -34,94   76,97   18,23  173,69   90,00   15,00
                   15   15  SEP 1944   39,83   77,49  -39,43   77,46   18,23  173,69   90,00   15,00
                   16   15  SEP 1944   39,97   77,77  -43,93   77,96   18,23  173,69   90,00   15,00
                   17   15  SEP 1944   40,11   78,05  -48,42   78,46   18,23  173,69   90,00   15,00
                   18   15  SEP 1944   40,24   78,33  -52,92   78,96   18,23  173,69   90,00   15,00

                   19   15  SEP 1944   40,38   78,62  -57,42   79,45   18,23  173,69   90,00   15,00
                   20   15  SEP 1944   40,52   78,90  -61,91   79,95   18,23  173,69   90,00   15,00
                   21   15  SEP 1944   40,66   79,18  -66,41   80,45   18,23  173,69   90,00   15,00
                   22   15  SEP 1944   40,79   79,46  -70,90   80,95   18,23  173,69   90,00   15,00
                   23   15  SEP 1944   40,93   79,74  -75,40   81,44   18,23  173,69   90,00   15,00
                    0   16  SEP 1944   41,06   80,02  -79,90   81,94   18,23  173,69   90,00   15,00

X-GRID  Y-GRID  STOP PGM  FRCE DST STM GRWTH
  10      151      432       795       68

 CORIOLIS   GRID SPACE  TIMI INCRM   SLIP COEF    DNSTY ATM   DRAG COEF    VISCOSITY
0,00009099    21280,7       150,0    0,0060000  0,00115000  0,00000300  0,25000000

 INTL LATTD  INTL LONGT
   37,47        72,10

 DEPTH FIELD IN FEET, GRID DISTANCES ARE 4 STAT MI LES (3.5 NM) APART, POINT 752 ON ORDINATE IS CENTER OF BASIN

     1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19

79  25.       43.       60.       75.       89.      101.      111.      120.      130.      144.

78       25.       43.       61.       77.       91.      103.      112.      121.      130.

77  25.       44.       62.       78.       93.      104.      113.      121.      129.      140.

76       25.       44.       62.       79.       93.      105.      113.      121.      128.

75  25.       44.       62.       79.       93.      105.      113.      120.      127.      136.

74       25.       44.       62.       78.       92.      104.      112.      118.      125.

73  25.       43.       61.       77.       91.      102.      110.      116.      122.      130.

72       25.       43.       60.       76.       89.      100.      108.      114.      120.
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STORM DATA FOR TIME OF NEAREST APPROACH TO BASIN CENTER

STORM DATA AT 288 DELTA TIME, OR FRI, 15 SEP 1944 AT HOUR 6, STORM POSITION AT LATITUDE 38.63, LONGITUDE 74.94

X-POINT	Y-POINT	MAX WIND	RADIUS	STRM SPD	PADD	PRES DROP
0.616	74.605	127.728	15.000	17.395	4.586	89.843

RADIUS	SPEED	PRES DROP	INFLW ANG	STC HGHT	P GRAD
0	0.00	0.00	0.00	3.01	0.00000000
2	33.47	1.46	0.22	2.96	0.00027212
4	63.60	5.24	0.47	2.83	0.00048992
6	88.09	10.81	0.76	2.64	0.00063160
8	106.07	17.36	1.11	2.42	0.00069268
10	117.90	24.19	1.55	2.20	0.00069067
12	124.61	30.78	2.08	1.98	0.00064866
14	127.42	36.85	2.73	1.77	0.00058646
16	127.46	42.27	3.50	1.59	0.00051772
18	125.63	47.01	4.40	1.43	0.00045042
20	122.62	51.12	5.45	1.30	0.00038847
22	118.90	54.66	6.66	1.18	0.00033316
24	114.81	57.68	8.10	1.08	0.00028388
26	110.57	60.25	9.87	0.99	0.00024086
28	106.33	62.43	11.76	0.92	0.00020636
30	102.18	64.32	13.50	0.85	0.00017971
32	98.17	65.98	14.96	0.80	0.00015858
34	94.34	67.45	16.15	0.75	0.00014123
36	90.69	68.76	17.09	0.71	0.00012658
38	87.24	69.94	17.84	0.67	0.00011401
40	83.99	71.00	18.42	0.63	0.00010310
42	80.91	71.96	18.86	0.60	0.00009356
44	78.02	72.84	19.20	0.57	0.00008518
46	75.29	73.64	19.45	0.54	0.00007779
48	72.73	74.37	19.63	0.52	0.00007125
50	70.31	75.04	19.75	0.50	0.00006544
52	68.03	75.66	19.82	0.47	0.00006027
54	65.88	76.22	19.84	0.46	0.00005565
56	63.84	76.75	19.84	0.44	0.00005152
58	61.92	77.24	19.80	0.42	0.00004781
60	60.11	77.69	19.74	0.41	0.00004447
62	58.39	78.11	19.66	0.39	0.00004145
64	56.75	78.50	19.56	0.38	0.00003873
66	55.21	78.87	19.45	0.37	0.00003626
68	53.74	79.22	19.33	0.36	0.00003401
70	52.34	79.54	19.20	0.34	0.00003197
72	51.01	79.84	19.06	0.33	0.00003010
74	49.74	80.13	18.91	0.32	0.00002839
76	48.53	80.40	18.76	0.32	0.00002683
78	47.37	80.66	18.60	0.31	0.00002539
80	46.27	80.90	18.44	0.30	0.00002407
82	45.22	81.13	18.28	0.29	0.00002286
84	44.21	81.35	18.11	0.28	0.00002173
86	43.24	81.56	17.94	0.28	0.00002069
88	42.31	81.75	17.78	0.27	0.00001973
90	41.43	81.94	17.61	0.26	0.00001883
92	40.57	82.12	17.44	0.26	0.00001800
94	39.75	82.30	17.27	0.25	0.00001722

96	38,96	82,46	17,10	0,25	0,00001650
98	38,21	82,62	16,94	0,24	0,00001583
100	37,48	82,77	16,77	0,24	0,00001520
110	34,20	83,45	15,96	0,21	0,00001258
120	31,44	84,02	15,19	0,19	0,00001065
130	29,09	84,50	14,46	0,18	0,00000917
140	27,06	84,92	13,79	0,16	0,00000802
150	25,29	85,29	13,28	0,15	0,00000685
160	23,74	85,61	13,28	0,14	0,00000594
170	22,37	85,88	13,28	0,13	0,00000520
180	21,14	86,12	13,28	0,12	0,00000459
190	20,04	86,33	13,28	0,12	0,00000408
200	19,05	86,52	13,28	0,11	0,00000365
210	18,15	86,69	13,28	0,11	0,00000328
220	17,34	86,84	13,28	0,10	0,00000297
230	16,59	86,98	13,28	0,10	0,00000270
250	15,27	87,22	13,28	0,09	0,00000225
300	12,74	87,68	13,28	0,07	0,00000152
350	10,93	87,99	13,28	0,06	0,00000110
400	9,57	88,23	13,28	0,05	0,00000083
450	8,51	88,41	13,28	0,05	0,00000065
500	7,66	88,55	13,28	0,04	0,00000052
550	6,96	88,66	13,28	0,04	0,00000042
600	6,38	88,76	13,28	0,04	0,00000035
650	5,89	88,84	13,28	0,03	0,00000030
700	5,47	88,91	13,28	0,03	0,00000026
750	5,11	88,97	13,28	0,03	0,00000022

1	-0,0	-0,1	-0,2	-0,2	-0,3	-0,4	-0,3	-0,4	-0,3	-0,3	-0,4	-0,4	-0,4	-0,2	-0,0	0,2	0,0	-0,5	0,0
2	-0,1	-0,2	-0,2	-0,3	-0,4	-0,4	-0,4	-0,4	-0,3	-0,4	-0,5	-0,4	-0,3	-0,1	0,1	0,1	-0,3	0,0	0,0
3	-0,0	-0,1	-0,2	-0,2	-0,3	-0,4	-0,4	-0,4	-0,4	-0,4	-0,5	-0,5	-0,4	-0,2	0,1	0,2	-0,2	-0,7	0,0
4	-0,1	-0,2	-0,3	-0,3	-0,4	-0,4	-0,4	-0,4	-0,4	-0,5	-0,5	-0,5	-0,3	-0,0	0,2	0,1	-0,5	0,0	0,0
5	-0,0	-0,1	-0,3	-0,3	-0,4	-0,5	-0,4	-0,5	-0,4	-0,4	-0,6	-0,6	-0,4	-0,2	0,2	0,2	-0,2	-0,9	0,0
6	-0,1	-0,3	-0,3	-0,3	-0,5	-0,5	-0,5	-0,5	-0,5	-0,5	-0,6	-0,5	-0,2	0,1	0,3	-0,0	-0,7	0,0	0,0
7	-0,0	-0,2	-0,4	-0,4	-0,5	-0,6	-0,5	-0,5	-0,5	-0,5	-0,6	-0,5	-0,4	0,1	0,2	0,2	-0,4	-1,2	0,0
8	-0,1	-0,3	-0,4	-0,4	-0,6	-0,6	-0,5	-0,5	-0,5	-0,5	-0,6	-0,4	-0,1	0,3	0,3	-0,1	-0,9	0,0	0,0
9	-0,0	-0,2	-0,4	-0,4	-0,5	-0,6	-0,5	-0,5	-0,5	-0,5	-0,5	-0,5	-0,2	0,0	0,5	0,2	-0,7	-1,6	0,0
10	-0,1	-0,3	-0,4	-0,4	-0,6	-0,6	-0,5	-0,5	-0,4	-0,5	-0,5	-0,3	0,0	0,3	0,4	-0,3	-1,3	0,0	0,0
11	-0,0	-0,2	-0,4	-0,4	-0,5	-0,6	-0,5	-0,4	-0,4	-0,4	-0,5	-0,5	-0,1	0,4	0,4	-0,1	-0,9	-1,9	0,0
12	-0,1	-0,3	-0,4	-0,4	-0,5	-0,5	-0,4	-0,4	-0,4	-0,5	-0,5	-0,3	0,1	0,5	0,3	-0,7	-1,8	0,0	0,0
13	-0,0	-0,2	-0,4	-0,4	-0,4	-0,5	-0,4	-0,3	-0,4	-0,5	-0,5	-0,4	-0,0	0,3	0,4	-0,2	-1,5	-2,4	0,0
14	-0,1	-0,3	-0,4	-0,4	-0,5	-0,5	-0,3	-0,4	-0,4	-0,5	-0,5	-0,2	0,2	0,5	0,0	-1,0	-2,3	0,0	0,0
15	-0,0	-0,2	-0,4	-0,4	-0,4	-0,5	-0,3	-0,3	-0,4	-0,5	-0,5	-0,4	0,1	0,5	0,3	-0,7	-2,1	-2,6	0,0
16	-0,1	-0,3	-0,4	-0,3	-0,4	-0,4	-0,3	-0,3	-0,5	-0,5	-0,5	-0,2	0,4	0,5	-0,2	-1,6	-2,8	0,0	0,0

17	-0.0	-0.1	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.4	-0.5	-0.6	-0.3	0.1	0.6	0.1	-1.1	-2.6	-2.7	0.0
18	-0.1	-0.2	-0.3	-0.3	-0.4	-0.4	-0.2	-0.3	-0.5	-0.6	-0.5	0.0	0.5	0.5	-0.6	-2.3	-3.2	0.0	0.0
19	-0.0	-0.1	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.4	-0.6	-0.5	-0.2	0.5	0.6	-0.1	-1.7	-3.4	-2.4	0.0
20	-0.1	-0.2	-0.3	-0.3	-0.4	-0.3	-0.2	-0.3	-0.5	-0.5	-0.3	0.2	0.8	0.3	-1.1	-3.0	-3.3	0.0	0.0
21	-0.0	-0.1	-0.3	-0.4	-0.3	-0.4	-0.2	-0.2	-0.4	-0.6	-0.4	0.1	0.6	0.8	-0.5	-2.6	-3.7	-1.8	0.0
22	-0.1	-0.2	-0.4	-0.3	-0.3	-0.3	-0.1	-0.3	-0.5	-0.4	-0.0	0.7	1.0	0.2	-1.8	-3.8	-3.0	0.0	0.0
23	-0.0	-0.1	-0.3	-0.4	-0.3	-0.3	-0.2	-0.1	-0.3	-0.4	-0.1	0.5	1.2	0.7	-1.1	-3.4	-4.0	-0.9	0.0
24	-0.1	-0.2	-0.4	-0.3	-0.3	-0.2	-0.0	-0.1	-0.3	-0.1	0.4	1.1	1.2	-0.3	-2.9	-4.4	-2.4	0.0	0.0
25	-0.0	-0.1	-0.3	-0.3	-0.3	-0.2	-0.0	0.1	-0.1	-0.1	0.4	1.1	1.3	0.5	-2.0	-4.5	-3.8	-0.0	0.0
26	-0.1	-0.2	-0.4	-0.3	-0.2	-0.0	0.2	0.1	0.0	0.3	1.0	1.6	1.1	-1.1	-4.1	-4.8	-1.5	0.0	0.0
27	-0.0	-0.1	-0.3	-0.3	-0.1	-0.0	0.2	0.3	0.3	0.4	0.9	1.7	1.6	-0.0	-3.4	-5.5	-3.0	0.3	0.0
28	-0.1	-0.2	-0.3	-0.1	0.0	0.2	0.5	0.5	0.6	1.0	1.6	1.9	0.7	-2.2	-5.4	-4.7	-0.5	0.0	0.0
29	-0.0	-0.1	-0.3	-0.2	0.0	0.2	0.5	0.7	0.8	1.1	1.8	2.1	1.6	-1.1	-4.9	-5.8	-2.2	0.2	0.0
30	-0.1	-0.2	-0.2	0.0	0.3	0.5	0.8	1.0	1.2	1.8	2.4	2.1	0.3	-3.8	-6.6	-3.8	-0.1	0.0	0.0
31	-0.0	-0.1	-0.2	-0.1	0.2	0.5	0.8	1.2	1.4	1.9	2.5	2.8	1.4	-2.2	-6.4	-5.8	-0.9	-0.3	0.0
32	-0.0	-0.2	-0.1	0.2	0.5	0.8	1.2	1.5	2.0	2.7	3.1	2.4	-0.5	-5.5	-7.0	-2.6	-0.3	0.0	0.0
33	-0.0	-0.1	-0.2	0.1	0.4	0.7	1.1	1.6	2.0	2.7	3.5	3.1	1.3	-3.7	-7.6	-4.6	-0.3	-1.1	0.0
34	-0.0	-0.1	-0.0	0.3	0.7	1.1	1.5	2.0	2.7	3.6	3.9	2.7	-1.1	-6.8	-6.6	-1.4	-0.5	0.0	0.0
35	-0.0	-0.1	-0.1	0.2	0.6	0.9	1.4	2.0	2.6	3.6	4.3	3.9	1.4	-4.5	-7.6	-2.7	-0.5	-1.5	0.0
36	-0.0	-0.1	0.1	0.5	0.9	1.3	1.9	2.5	3.5	4.5	4.8	3.4	-0.8	-7.0	-4.9	-0.4	-0.9	0.0	0.0
37	-0.0	-0.0	-0.0	0.3	0.8	1.1	1.7	2.4	3.2	4.5	5.3	4.7	2.3	-3.0	-6.3	-1.1	-0.6	-1.3	0.0
38	-0.0	-0.0	0.2	0.6	1.0	1.5	2.2	3.0	4.2	5.5	5.7	4.6	1.8	-4.2	-2.0	-0.0	-1.2	0.0	0.0
39	-0.0	-0.0	0.1	0.5	0.9	1.3	2.0	2.8	3.9	5.4	6.5	5.7	4.8	2.3	-2.5	0.2	-0.3	-1.5	0.0
40	-0.0	-0.0	0.3	0.8	1.2	1.8	2.5	3.6	5.1	6.7	7.1	6.1	5.5	2.7	1.3	0.2	-0.8	0.0	0.0
41	-0.0	-0.0	0.1	0.6	1.1	1.5	2.3	3.2	4.6	6.6	7.9	7.7	6.3	7.4	4.1	1.8	-0.2	-1.5	0.0
42	-0.0	0.0	0.4	0.9	1.4	2.0	2.9	4.2	6.1	8.3	9.2	7.7	7.3	10.7	4.1	0.4	-0.5	0.0	0.0
43	-0.0	0.0	0.2	0.7	1.2	1.8	2.6	3.7	5.4	7.8	10.2	9.9	7.3	11.5	9.7	1.9	-0.1	-1.2	0.0
44	0.0	0.1	0.5	1.0	1.5	2.2	3.2	4.7	7.0	9.9	11.6	9.8	9.3	13.3	4.9	0.2	-0.8	0.0	0.0
45	0.0	0.0	0.3	0.8	1.3	1.9	2.8	4.0	6.0	9.0	11.8	12.1	9.8	12.3	9.5	0.6	-1.1	-1.1	0.0
46	0.0	0.1	0.5	1.1	1.6	2.3	3.4	5.0	7.6	11.0	13.1	11.4	10.8	10.5	4.2	-1.1	-1.3	0.0	0.0

47	0.0	0.1	0.3	0.8	1.4	1.9	2.8	4.1	6.2	9.4	12.8	12.7	11.1	5.5	7.1	0.4	-1.6	-1.8	0.0
48	0.0	0.1	0.5	1.1	1.6	2.3	3.4	5.0	7.6	11.2	13.2	11.7	9.5	7.4	3.8	-1.8	-1.8	0.0	0.0
49	0.0	0.0	0.2	0.8	1.4	1.9	2.8	4.0	6.0	9.1	12.1	12.5	9.8	7.6	5.1	0.8	-2.3	-1.7	0.0
50	0.0	0.1	0.5	1.1	1.6	2.3	3.3	4.7	7.2	10.4	12.2	10.6	8.2	5.6	3.1	-1.3	-2.2	0.0	0.0
51	0.0	0.0	0.2	0.7	1.3	1.9	2.7	3.8	5.6	8.3	11.0	10.9	8.9	6.4	4.0	1.2	-2.5	-1.8	0.0
52	0.0	0.1	0.4	1.0	1.6	2.2	3.1	4.4	6.5	9.1	10.5	9.5	7.2	4.7	2.4	-0.5	-2.5	0.0	0.0
53	0.0	0.0	0.2	0.7	1.3	1.9	2.6	3.5	5.0	7.3	9.2	9.8	7.9	5.6	3.1	1.2	-1.7	-2.1	0.0
54	0.0	0.1	0.4	1.0	1.6	2.2	2.9	4.0	5.7	7.8	9.1	8.4	6.4	4.1	1.9	0.1	-2.4	0.0	0.0
55	0.0	0.1	0.2	0.7	1.3	1.8	2.5	3.3	4.5	6.2	8.0	8.2	7.0	5.0	2.7	0.8	-0.8	-2.2	0.0
56	0.0	0.1	0.4	1.0	1.6	2.1	2.7	3.6	4.9	6.6	7.6	7.3	5.7	3.5	1.5	0.2	-1.6	0.0	0.0
57	0.0	0.1	0.2	0.7	1.3	1.8	2.3	3.0	4.0	5.3	6.6	7.0	6.2	4.3	2.4	0.6	-0.4	-2.0	0.0
58	0.0	0.1	0.4	1.0	1.6	2.0	2.6	3.3	4.3	5.5	6.4	6.1	4.9	3.2	1.2	0.1	-0.8	0.0	0.0
59	0.0	0.1	0.2	0.7	1.3	1.8	2.3	2.8	3.5	4.5	5.6	5.8	5.0	3.8	2.0	0.6	-0.2	-1.2	0.0
60	0.0	0.2	0.5	1.0	1.6	2.0	2.4	3.0	3.7	4.6	5.2	5.0	4.2	2.7	1.1	-0.0	-0.3	0.0	0.0
61	0.0	0.1	0.3	0.7	1.3	1.8	2.2	2.6	3.1	3.9	4.5	4.7	4.4	3.1	1.7	0.3	-0.1	-0.5	0.0
62	0.0	0.2	0.5	1.0	1.5	1.9	2.3	2.7	3.2	3.9	4.3	4.2	3.4	2.3	0.9	-0.0	-0.2	0.0	0.0
63	0.0	0.1	0.3	0.8	1.3	1.7	2.1	2.4	2.8	3.3	3.8	4.0	3.4	2.6	1.5	0.3	-0.3	-0.2	0.0
64	0.0	0.2	0.5	1.0	1.5	1.9	2.2	2.5	2.8	3.3	3.6	3.4	2.8	1.9	0.7	-0.1	-0.1	0.0	0.0
65	0.0	0.1	0.3	0.8	1.3	1.7	2.0	2.2	2.5	2.8	3.2	3.2	3.0	2.2	1.2	0.2	-0.2	-0.1	0.0
66	0.0	0.2	0.5	1.0	1.4	1.8	2.0	2.2	2.4	2.8	3.0	2.9	2.4	1.6	0.7	-0.1	-0.2	0.0	0.0
67	0.0	0.1	0.3	0.8	1.2	1.6	1.9	2.0	2.2	2.4	2.7	2.8	2.4	1.8	1.2	0.2	-0.2	0.0	0.0
68	0.0	0.2	0.5	1.0	1.4	1.7	1.8	2.0	2.1	2.3	2.5	2.4	2.0	1.4	0.6	-0.1	-0.2	0.0	0.0
69	0.0	0.1	0.3	0.7	1.1	1.5	1.7	1.8	1.9	2.0	2.2	2.2	2.1	1.7	1.0	0.3	-0.2	-0.0	0.0
70	0.0	0.2	0.5	0.9	1.3	1.5	1.6	1.7	1.8	1.9	2.1	2.1	1.8	1.3	0.6	-0.0	-0.1	0.0	0.0
71	0.0	0.1	0.3	0.7	1.1	1.3	1.5	1.6	1.6	1.6	1.8	2.0	1.8	1.4	0.9	0.3	-0.1	0.0	0.0
72	0.0	0.2	0.5	0.9	1.2	1.4	1.5	1.4	1.4	1.5	1.7	1.7	1.5	1.1	0.6	0.1	-0.1	0.0	0.0
73	0.0	0.1	0.3	0.7	1.0	1.2	1.4	1.4	1.3	1.3	1.5	1.5	1.5	1.3	0.9	0.3	-0.1	0.1	0.0
74	0.0	0.2	0.5	0.8	1.1	1.3	1.3	1.2	1.2	1.2	1.4	1.4	1.3	1.0	0.6	0.1	-0.1	0.0	0.0
75	0.0	0.1	0.3	0.6	0.9	1.2	1.2	1.2	1.1	1.0	1.1	1.3	1.3	1.0	0.7	0.4	-0.0	-0.0	0.0
76	0.1	0.2	0.5	0.8	1.0	1.2	1.2	1.1	1.0	1.0	1.1	1.2	1.1	0.8	0.5	0.1	-0.1	0.0	0.0

77	0.0	0.2	0.4	0.6	0.9	1.1	1.1	1.0	0.9	0.8	0.9	1.0	1.0	0.9	0.6	0.2	-0.1	-0.1	0.0
78	0.1	0.3	0.5	0.8	1.0	1.1	1.0	0.9	0.8	0.7	0.8	0.9	0.9	0.7	0.4	0.1	-0.1	0.0	0.0
79	0.0	0.2	0.4	0.6	0.9	1.0	1.0	0.9	0.7	0.6	0.7	0.8	0.9	0.7	0.4	0.2	-0.0	-0.1	0.0
80	0.1	0.3	0.5	0.8	1.0	1.0	0.9	0.7	0.6	0.5	0.6	0.7	0.7	0.5	0.3	0.0	-0.1	0.0	0.0
81	0.0	0.2	0.4	0.6	0.9	1.0	0.9	0.7	0.6	0.5	0.5	0.6	0.6	0.6	0.4	0.1	-0.1	-0.2	0.0

OUTPUT: SEPTEMBER 1944 HURRICANE, NO. 4

THESE ARE THE 5 STORM POSITIONS READ IN BY THE COMP UTER
PLEASE CHECK TIMES, LATITUDES, LONGTITUDES, PRESSURE DROPS AND STORM SIZES FOR AGREEMENT AND CONSISTENCY

HOUR	DAY	MNTH	YEAR	LATITUDE	LONGITUDE	PRS DROP	STRM SIZE	LENGTH	AZIMUTH	X-CORD	Y-CORD
12	14	SEP	1944	37.00	71.60	60.00	15.00	184.82	93.65	53.70	71.63
18	14	SEP	1944	37.50	72.10	60.00	15.00	148.92	88.98	43.54	75.76
0	15	SEP	1944	38.00	73.40	60.00	15.00	80.38	90.57	23.96	74.77
6	15	SEP	1944	51.36	74.90	60.00	15.00	0.00	0.00	1.00	75.00
12	15	SEP	1944	39.40	76.68	60.00	15.00	94.69	271.85	-26.04	75.87

MINIMUM DISTANCE OF STORM FROM BASIN CENTER IS 2.2 MILES AT HOUR 6, FRI 15 SEP 1944

BASIN CENTER IS -20 ILES TO THE NORTH OF CAPE MAY. OBSERVER IS ON SEA AND FACING LAND .

HOURLY VALUES OF (SMOOTHED) STORM POSITIONS, SPEE D AND DIRECTION (MATHEMATICAL) OF MOTION, PRESSURE DROP, AND SIZE

	HOUR	DAY	MNTH	YEAR	LATITDE	LONGTDE	X-PT	Y-PT	SPEED	STRM DR	DELP	SIZE	
	0	14	SEP	1944	36.02	71.04	67.05	59.97	5.95	138.44	60.00	15.00	
	1	14	SEP	1944	36.11	71.08	65.95	60.95	5.95	138.44	60.00	15.00	
	2	14	SEP	1944	36.19	71.12	64.84	61.93	5.95	138.44	60.00	15.00	
	3	14	SEP	1944	36.27	71.16	63.74	62.91	5.95	138.44	60.00	15.00	
	4	14	SEP	1944	36.35	71.20	62.63	63.89	5.95	138.44	60.00	15.00	
	5	14	SEP	1944	36.43	71.24	61.53	64.87	5.95	138.44	60.00	15.00	
	6	14	SEP	1944	36.51	71.28	60.42	65.85	5.95	138.44	60.00	15.00	
	7	14	SEP	1944	36.59	71.32	59.32	66.83	5.95	138.44	60.00	15.00	
	8	14	SEP	1944	36.68	71.36	58.21	67.81	5.95	138.44	60.00	15.00	
	9	14	SEP	1944	36.76	71.40	57.11	68.79	5.95	138.44	60.00	15.00	
	10	14	SEP	1944	36.84	71.44	56.00	69.77	5.95	138.44	60.00	15.00	
	11	14	SEP	1944	36.92	71.48	54.90	70.75	5.95	138.44	60.00	15.00	
	12	14	SEP	1944	37.00	71.52	53.79	71.73	5.95	138.44	60.00	15.00	
	13	14	SEP	1944	37.08	71.56	52.69	72.71	6.48	149.68	60.00	15.00	
	14	14	SEP	1944	37.16	71.62	51.30	73.52	7.20	158.38	60.00	15.00	
	15	14	SEP	1944	37.25	71.71	49.64	74.18	8.01	164.92	60.00	15.00	
	16	14	SEP	1944	37.33	71.82	47.72	74.70	8.87	169.80	60.00	15.00	
	17	14	SEP	1944	37.41	71.95	45.56	75.09	9.73	173.46	60.00	15.00	
INITLZE COMPTTNS	18	14	SEP	1944	37.49	72.10	43.16	75.36	10.59	176.20	60.00	15.00	INITLZE COMPTTNS
	19	14	SEP	1944	37.57	72.26	40.54	75.54	11.41	178.25	60.00	15.00	
	20	14	SEP	1944	37.66	72.45	37.71	75.63	12.20	179.77	60.00	15.00	
	21	14	SEP	1944	37.74	72.65	34.68	75.64	12.95	180.87	60.00	15.00	
	22	14	SEP	1944	37.83	72.86	31.47	75.59	13.64	181.63	60.00	15.00	
	23	14	SEP	1944	37.92	73.09	28.08	75.49	14.29	182.11	60.00	15.00	
	0	15	SEP	1944	38.01	73.33	24.54	75.36	14.89	182.35	60.00	15.00	
	1	15	SEP	1944	38.11	73.58	20.85	75.21	15.43	182.38	60.00	15.00	
	2	15	SEP	1944	38.21	73.84	17.02	75.05	15.93	182.23	60.00	15.00	
	3	15	SEP	1944	38.31	74.10	13.07	74.90	16.37	181.90	60.00	15.00	
	4	15	SEP	1944	38.41	74.38	9.02	74.76	16.76	181.41	60.00	15.00	
	5	15	SEP	1944	38.52	74.66	4.86	74.66	17.10	180.76	60.00	15.00	
NEAREST APPROACH	6	15	SEP	1944	38.63	74.94	0.62	74.61	17.39	179.97	60.00	15.00	NEAREST APPROACH
TO BASIN CENTER	7	15	SEP	1944	38.75	75.22	-3.70	74.61	17.64	179.02	60.00	15.00	TO BASIN CENTER
	8	15	SEP	1944	38.87	75.51	-8.08	74.68	17.85	177.92	60.00	15.00	
	9	15	SEP	1944	38.99	75.80	-12.50	74.84	18.01	176.67	60.00	15.00	
	10	15	SEP	1944	39.12	76.09	-16.95	75.10	18.14	175.26	60.00	15.00	
	11	15	SEP	1944	39.26	76.37	-21.45	75.47	18.23	173.69	60.00	15.00	

TERMNTE COMPTTNS	12	15	SEP 1944	39.40	76.65	-25.94	75.97	18.23	173.69	60.00	15.00	TERMNTE COMPTTNS
	13	15	SEP 1944	39.54	76.93	-30.44	76.47	18.23	173.69	60.00	15.00	
	14	15	SEP 1944	39.69	77.21	-34.94	76.97	18.23	173.69	60.00	15.00	
	15	15	SEP 1944	39.83	77.49	-39.43	77.46	18.23	173.69	60.00	15.00	
	16	15	SEP 1944	39.97	77.77	-43.93	77.96	18.23	173.69	60.00	15.00	
	17	15	SEP 1944	40.11	78.05	-48.42	78.46	18.23	173.69	60.00	15.00	
	18	15	SEP 1944	40.24	78.33	-52.92	78.96	18.23	173.69	60.00	15.00	

19	15	SEP 1944	40.38	78.62	-57.42	79.45	18.23	173.69	60.00	15.00
20	15	SEP 1944	40.52	78.90	-61.91	79.95	18.23	173.69	60.00	15.00
21	15	SEP 1944	40.66	79.18	-66.41	80.45	18.23	173.69	60.00	15.00
22	15	SEP 1944	40.79	79.46	-70.90	80.95	18.23	173.69	60.00	15.00
23	15	SEP 1944	40.93	79.74	-75.40	81.44	18.23	173.69	60.00	15.00
0	16	SEP 1944	41.06	80.02	-79.90	81.94	18.23	173.69	60.00	15.00

X-GRID	Y-GRID	STOP PGM	FRCE DST	STM GRWTH
10	151	432	795	68

CORIOLIS	GRID SPACE	TIME INCRM	SLIP COEF	DNSTY AIR	DRAG COEF	VISCOSITY
0.00003093	21280.7	150.0	0.0060000	0.00115000	0.00000300	0.25000000

INTL LATTD	INTL LONGT
37.49	72.10

DEPTH FIELD IN FEET, GRID DISTANCES ARE 4 STAT MILES (3.5 NM) APART, POINT 752 ON ORDINATE IS CENTER OF BASIN

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
79	25.		43.		60.		75.		89.		101.		111.		120.		130.		144.
78		25.		43.		61.		77.		91.		103.		112.		121.		130.	
77	25.		44.		62.		78.		93.		104.		113.		121.		129.		140.
76		25.		44.		62.		79.		93.		105.		113.		121.		128.	
75	25.		44.		62.		79.		93.		105.		113.		120.		127.		136.
74		25.		44.		62.		78.		92.		104.		112.		118.		125.	
73	25.		43.		61.		77.		91.		102.		110.		116.		122.		130.
72		25.		43.		60.		76.		89.		100.		108.		114.		120.	

STORM DATA FOR TIME OF NEAREST APPROACH TO BASIN CENTER

STORM DATA AT 288 DELTA TIME, OR FRI, 15 SEP 1944 AT HOUR 6, STORM POSITION AT LATITUDE 38.63, LONGITUDE 74.94

X-POINT	Y-POINT	MAX WIND	RADIUS	STRM SPD	PADD	PRES DROP
0.616	74.605	102.861	15.000	17.395	3.435	60.067

RADIUS	SPEED	PRES DROP	INFLW ANG	STC HGHT	P GRAD
0	0.00	-0.00	0.00	2.01	0.00000000
2	26.95	1.00	0.23	1.98	0.00017514
4	51.22	3.46	0.49	1.89	0.00031942
6	70.94	7.10	0.79	1.77	0.00041205
8	85.42	11.38	1.15	1.63	0.00045223
10	94.95	15.83	1.60	1.48	0.00045130
12	100.35	20.14	2.15	1.34	0.00042426
14	102.62	24.12	2.81	1.20	0.00038400
16	102.65	27.66	3.60	1.08	0.00033941
18	101.17	30.78	4.51	0.98	0.00029569
20	98.75	33.48	5.56	0.89	0.00025544
22	95.75	35.80	6.76	0.81	0.00021956
24	92.46	37.80	8.15	0.74	0.00018798
26	89.05	39.51	9.73	0.69	0.00016084
28	85.63	40.97	11.37	0.64	0.00013876
30	82.29	42.24	12.89	0.60	0.00012124
32	79.06	43.36	14.17	0.56	0.00010714
34	75.97	44.35	15.22	0.53	0.00009547
36	73.04	45.24	16.06	0.50	0.00008560
38	70.26	46.04	16.71	0.47	0.00007713
40	67.63	46.75	17.21	0.45	0.00006979
42	65.16	47.41	17.60	0.42	0.00006330
44	62.83	48.00	17.88	0.40	0.00005776
46	60.64	48.55	18.08	0.39	0.00005280
48	58.57	49.04	18.21	0.37	0.00004841
50	56.62	49.50	18.29	0.35	0.00004452
52	54.78	49.92	18.33	0.34	0.00004106
54	53.05	50.30	18.32	0.33	0.00003796
56	51.41	50.66	18.29	0.31	0.00003519
58	49.87	51.00	18.22	0.30	0.00003271
60	48.40	51.31	18.14	0.29	0.00003047
62	47.02	51.59	18.04	0.28	0.00002845
64	45.71	51.86	17.92	0.27	0.00002662
66	44.46	52.12	17.79	0.27	0.00002497
68	43.27	52.36	17.65	0.26	0.00002346
70	42.15	52.58	17.51	0.25	0.00002209
72	41.08	52.79	17.35	0.24	0.00002083
74	40.05	52.99	17.19	0.24	0.00001969
76	39.08	53.18	17.03	0.23	0.00001864
78	38.15	53.35	16.86	0.22	0.00001767
80	37.26	53.52	16.69	0.22	0.00001678
82	36.41	53.68	16.52	0.21	0.00001596
84	35.60	53.84	16.35	0.21	0.00001520

86	34.82	53.98	16.18	0.20	0.00001450
88	34.08	54.12	16.01	0.20	0.00001385
90	33.36	54.25	15.84	0.19	0.00001324
92	32.67	54.38	15.67	0.19	0.00001268
94	32.01	54.50	15.50	0.19	0.00001216
96	31.38	54.62	15.33	0.18	0.00001167
98	30.77	54.73	15.16	0.18	0.00001121
100	30.18	54.84	14.99	0.17	0.00001078
110	27.54	55.32	14.19	0.16	0.00000900
120	25.32	55.73	13.44	0.15	0.00000767
130	23.43	56.08	12.75	0.13	0.00000666
140	21.79	56.39	12.11	0.12	0.00000586
150	20.37	56.66	11.64	0.11	0.00000504
160	19.12	56.89	11.64	0.11	0.00000438
170	18.01	57.09	11.64	0.10	0.00000384
180	17.03	57.27	11.64	0.09	0.00000340
190	16.14	57.42	11.64	0.09	0.00000302
200	15.34	57.56	11.64	0.08	0.00000271
210	14.62	57.69	11.64	0.08	0.00000244
220	13.96	57.80	11.64	0.08	0.00000221
230	13.36	57.91	11.64	0.07	0.00000201
250	12.30	58.09	11.64	0.07	0.00000168
300	10.25	58.43	11.64	0.05	0.00000114
350	8.80	58.66	11.64	0.05	0.00000082
400	7.70	58.84	11.64	0.04	0.00000062
450	6.85	58.97	11.64	0.04	0.00000049
500	6.17	59.08	11.64	0.03	0.00000039
550	5.61	59.17	11.64	0.03	0.00000032
600	5.14	59.24	11.64	0.03	0.00000027
650	4.74	59.30	11.64	0.03	0.00000023
700	4.41	59.35	11.64	0.02	0.00000020
750	4.11	59.40	11.64	0.02	0.00000017

1	-0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	0.0	0.2	0.1	-0.3	0.0
2	-0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	0.0	0.1	0.1	-0.2	0.0	0.0
3	-0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.2	-0.1	0.1	0.2	-0.1	-0.4	0.0
4	-0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.2	-0.2	0.0	0.2	0.1	-0.3	0.0	0.0
5	-0.0	-0.1	-0.2	-0.2	-0.2	-0.3	-0.2	-0.3	-0.2	-0.2	-0.3	-0.3	-0.2	-0.1	0.2	0.2	-0.1	-0.6	0.0
6	-0.0	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	-0.3	-0.2	-0.1	0.1	0.2	0.0	-0.4	0.0	0.0
7	-0.0	-0.1	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	-0.3	-0.2	0.1	0.2	0.2	-0.2	-0.8	0.0
8	-0.1	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	-0.3	-0.2	-0.0	0.2	0.3	-0.0	-0.6	0.0	0.0
9	-0.0	-0.1	-0.3	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.3	-0.2	-0.0	0.1	0.4	0.2	-0.4	-1.0	0.0
10	-0.1	-0.2	-0.3	-0.2	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	0.1	0.3	0.3	-0.1	-0.8	0.0	0.0
11	-0.0	-0.1	-0.3	-0.2	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	0.0	0.3	0.3	0.0	-0.6	-1.2	0.0
12	-0.1	-0.2	-0.2	-0.2	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	0.2	0.4	0.2	-0.4	-1.1	0.0	0.0
13	-0.0	-0.1	-0.2	-0.2	-0.2	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	0.1	0.3	0.4	-0.1	-0.9	-1.6	0.0

14	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2	-0.2	-0.2	-0.2	-0.0	0.3	0.4	0.1	-0.6	-1.5	0.0	0.0
15	-0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2	-0.2	-0.2	-0.2	0.2	0.4	0.3	-0.4	-1.3	-1.7	0.0
16	-0.0	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.2	-0.2	-0.2	0.0	0.4	0.4	-0.1	-1.0	-1.8	0.0	0.0
17	-0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1	0.2	0.5	0.1	-0.7	-1.7	-1.7	0.0
18	-0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.2	-0.2	-0.2	0.2	0.5	0.4	-0.4	-1.5	-2.1	0.0	0.0
19	-0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.0	-0.2	-0.2	-0.2	-0.0	0.5	0.5	0.0	-1.1	-2.2	-1.6	0.0
20	-0.0	-0.1	-0.2	-0.2	-0.2	-0.1	-0.0	-0.1	-0.2	-0.2	-0.0	0.3	0.6	0.3	-0.7	-1.9	-2.2	0.0	0.0
21	-0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.0	-0.2	-0.2	-0.1	0.3	0.6	0.6	-0.3	-1.7	-2.4	-1.2	0.0
22	-0.0	-0.1	-0.2	-0.2	-0.1	-0.1	0.0	-0.1	-0.2	-0.1	0.1	0.6	0.7	0.2	-1.2	-2.5	-2.0	0.0	0.0
23	-0.0	-0.1	-0.2	-0.2	-0.1	-0.1	-0.0	0.0	-0.1	-0.1	0.1	0.5	0.9	0.5	-0.7	-2.2	-2.6	-0.7	0.0
24	-0.0	-0.2	-0.2	-0.1	-0.1	-0.0	0.1	0.0	-0.1	0.1	0.5	0.9	0.9	-0.1	-1.9	-2.9	-1.6	0.0	0.0
25	-0.0	-0.1	-0.2	-0.2	-0.1	-0.0	0.1	0.1	0.0	0.1	0.5	0.9	1.0	0.4	-1.3	-3.0	-2.5	-0.1	0.0
26	-0.0	-0.1	-0.2	-0.1	-0.0	0.1	0.2	0.2	0.2	0.4	0.9	1.2	0.8	-0.7	-2.6	-3.2	-1.0	0.0	0.0
27	-0.0	-0.1	-0.2	-0.1	-0.0	0.1	0.2	0.3	0.3	0.4	0.8	1.3	1.2	0.1	-2.2	-3.6	-2.0	0.1	0.0
28	-0.0	-0.1	-0.2	-0.0	0.1	0.2	0.4	0.5	0.5	0.8	1.3	1.4	0.6	-1.4	-3.5	-3.1	-0.4	0.0	0.0
29	-0.0	-0.1	-0.2	-0.1	0.1	0.2	0.4	0.6	0.6	0.9	1.4	1.6	1.2	-0.6	-3.2	-3.8	-1.5	0.1	0.0
30	-0.0	-0.1	-0.1	0.1	0.2	0.4	0.6	0.8	0.9	1.3	1.8	1.6	0.3	-2.4	-4.3	-2.6	-0.1	0.0	0.0
31	-0.0	-0.1	-0.1	0.0	0.2	0.4	0.6	0.9	1.0	1.4	1.8	2.1	1.1	-1.3	-4.2	-3.9	-0.7	-0.3	0.0
32	-0.0	-0.1	-0.1	0.2	0.4	0.6	0.9	1.1	1.4	1.9	2.3	1.8	-0.2	-3.5	-4.6	-1.8	-0.3	0.0	0.0
33	-0.0	-0.0	-0.1	0.1	0.4	0.6	0.8	1.1	1.4	2.0	2.5	2.3	1.1	-2.3	-4.9	-3.1	-0.3	-0.7	0.0
34	-0.0	-0.1	0.0	0.3	0.5	0.8	1.1	1.4	1.9	2.5	2.8	2.0	-0.5	-4.4	-4.4	-1.0	-0.4	0.0	0.0
35	-0.0	-0.0	-0.0	0.2	0.5	0.7	1.0	1.4	1.9	2.5	3.1	2.8	1.2	-2.7	-5.0	-1.9	-0.4	-1.0	0.0
36	-0.0	-0.0	0.1	0.4	0.6	0.9	1.3	1.8	2.4	3.2	3.4	2.4	-0.3	-4.5	-3.3	-0.4	-0.6	0.0	0.0
37	-0.0	-0.0	0.0	0.3	0.6	0.8	1.2	1.7	2.2	3.1	3.7	3.3	1.7	-1.8	-4.2	-0.8	-0.5	-0.9	0.0
38	-0.0	-0.0	0.1	0.5	0.7	1.1	1.5	2.1	2.9	3.8	3.9	3.2	1.4	-2.7	-1.4	-0.1	-0.8	0.0	0.0
39	-0.0	-0.0	0.0	0.4	0.7	1.0	1.4	1.9	2.7	3.7	4.4	4.0	3.4	1.6	-1.7	-0.0	-0.2	-1.1	0.0
40	-0.0	0.0	0.2	0.6	0.9	1.2	1.8	2.4	3.5	4.6	4.9	4.2	3.8	1.8	0.7	0.0	-0.6	0.0	0.0
41	-0.0	-0.0	0.1	0.4	0.8	1.1	1.6	2.2	3.1	4.5	5.4	5.2	4.3	4.8	2.7	1.0	-0.2	-1.0	0.0
42	-0.0	0.0	0.3	0.7	1.0	1.4	2.0	2.8	4.1	5.6	6.3	5.3	4.9	7.0	2.6	0.2	-0.4	0.0	0.0
43	-0.0	0.0	0.2	0.5	0.9	1.2	1.8	2.5	3.7	5.3	6.8	6.7	5.0	7.5	6.3	1.1	-0.1	-0.8	0.0
44	0.0	0.1	0.4	0.7	1.1	1.6	2.2	3.2	4.7	6.6	7.8	6.6	6.2	8.6	3.1	0.0	-0.6	0.0	-

45	0.0	0.0	0.2	0.6	0.9	1.3	1.9	2.7	4.1	6.0	7.9	8.1	8.6	8.0	6.1	0.3	-0.5	-0.7	0.0
46	0.0	0.1	0.4	0.8	1.1	1.6	2.3	3.4	5.1	7.4	8.8	7.6	7.1	6.8	2.7	-0.8	-0.9	0.0	0.0
47	0.0	0.0	0.2	0.6	1.0	1.4	2.0	2.8	4.2	6.3	8.6	8.5	7.3	6.2	4.6	0.2	-1.1	-1.2	0.0
48	0.0	0.1	0.4	0.8	1.2	1.6	2.3	3.4	5.2	7.5	8.8	7.7	6.2	4.8	2.3	-1.3	-1.2	0.0	0.0
49	0.0	0.0	0.2	0.6	1.0	1.4	1.9	2.8	4.1	6.2	8.1	8.3	6.5	4.9	3.3	0.4	-1.6	-1.1	0.0
50	0.0	0.1	0.3	0.8	1.1	1.6	2.3	3.2	4.9	7.0	8.1	7.0	5.3	3.6	1.9	-0.9	-1.5	0.0	0.0
51	0.0	0.0	0.2	0.5	1.0	1.3	1.9	2.6	3.8	5.6	7.4	7.2	5.9	4.1	2.5	0.7	-1.6	-1.2	0.0
52	0.0	0.1	0.3	0.8	1.1	1.6	2.1	3.0	4.4	6.1	7.0	6.3	4.7	3.0	1.5	-0.4	-1.6	0.0	0.0
53	0.0	0.0	0.2	0.5	1.0	1.3	1.8	2.4	3.4	4.9	6.2	6.5	5.2	3.6	2.0	0.7	-1.2	-1.4	0.0
54	0.0	0.1	0.3	0.7	1.1	1.5	2.0	2.7	3.8	5.2	6.1	5.6	4.2	2.6	1.2	-0.0	-1.6	0.0	0.0
55	0.0	0.0	0.2	0.5	0.9	1.3	1.7	2.2	3.0	4.2	5.4	5.4	4.6	3.3	1.7	0.5	-0.6	-1.4	0.0
56	0.0	0.1	0.3	0.7	1.1	1.5	1.9	2.5	3.3	4.4	5.1	4.8	3.7	2.3	0.9	0.1	-1.1	0.0	0.0
57	0.0	0.0	0.2	0.5	0.9	1.3	1.6	2.1	2.7	3.6	4.4	4.7	4.1	2.8	1.5	0.3	-0.3	-1.3	0.0
58	0.0	0.1	0.3	0.7	1.1	1.4	1.8	2.2	2.9	3.7	4.2	4.1	3.2	2.0	0.8	0.0	-0.5	0.0	0.0
59	0.0	0.1	0.2	0.5	0.9	1.2	1.6	1.9	2.4	3.0	3.7	3.8	3.3	2.5	1.3	0.3	-0.1	-0.8	0.0
60	0.0	0.1	0.3	0.7	1.1	1.4	1.7	2.0	2.5	3.1	3.5	3.3	2.7	1.7	0.7	-0.1	-0.2	0.0	0.0
61	0.0	0.1	0.2	0.5	0.9	1.2	1.5	1.8	2.1	2.6	3.0	3.2	2.9	2.1	1.1	0.2	-0.1	-0.4	0.0
62	0.0	0.1	0.3	0.7	1.1	1.3	1.6	1.8	2.2	2.6	2.9	2.8	2.2	1.5	0.6	-0.0	-0.1	0.0	0.0
63	0.0	0.1	0.2	0.5	0.9	1.2	1.4	1.6	1.9	2.2	2.6	2.6	2.3	1.7	1.0	0.2	-0.2	-0.1	0.0
64	0.0	0.1	0.4	0.7	1.1	1.3	1.5	1.7	1.9	2.2	2.4	2.3	1.9	1.3	0.4	-0.1	-0.1	0.0	0.0
65	0.0	0.1	0.2	0.5	0.9	1.1	1.4	1.5	1.7	1.9	2.1	2.1	2.0	1.5	0.8	0.1	-0.2	-0.1	0.0
66	0.0	0.1	0.4	0.7	1.0	1.2	1.4	1.5	1.6	1.9	2.0	1.9	1.6	1.0	0.4	-0.1	-0.1	0.0	0.0
67	0.0	0.1	0.2	0.5	0.8	1.1	1.3	1.4	1.5	1.6	1.8	1.9	1.6	1.2	0.7	0.1	-0.2	0.0	0.0
68	0.0	0.1	0.4	0.7	0.9	1.1	1.3	1.3	1.4	1.6	1.7	1.6	1.3	0.9	0.4	-0.1	-0.1	0.0	0.0
69	0.0	0.1	0.2	0.5	0.8	1.0	1.2	1.2	1.3	1.3	1.5	1.5	1.4	1.1	0.6	0.2	-0.2	-0.0	0.0
70	0.0	0.1	0.3	0.6	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.4	1.2	0.8	0.4	-0.0	-0.1	0.0	0.0
71	0.0	0.1	0.2	0.5	0.7	0.9	1.0	1.1	1.1	1.1	1.2	1.3	1.2	0.9	0.6	0.2	-0.0	0.0	0.0
72	0.0	0.1	0.3	0.6	0.8	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.0	0.8	0.4	0.0	-0.1	0.0	0.0
73	0.0	0.1	0.2	0.5	0.7	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.0	0.9	0.6	0.2	-0.1	0.1	0.0

74	0.0	0.1	0.3	0.6	0.8	0.9	0.9	0.8	0.8	0.8	0.9	0.9	0.9	0.7	0.4	0.1	-0.0	0.0	0.0
75	0.0	0.1	0.2	0.4	0.7	0.8	0.8	0.8	0.7	0.7	0.8	0.9	0.9	0.7	0.5	0.2	-0.0	-0.0	0.0
76	0.0	0.2	0.3	0.5	0.7	0.8	0.8	0.7	0.6	0.6	0.7	0.8	0.7	0.6	0.3	0.0	-0.1	0.0	0.0
77	0.0	0.1	0.3	0.4	0.6	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.7	0.6	0.4	0.1	-0.1	-0.0	0.0
78	0.1	0.2	0.3	0.5	0.7	0.8	0.7	0.6	0.5	0.5	0.6	0.6	0.6	0.5	0.2	0.0	-0.1	0.0	0.0
79	0.0	0.1	0.3	0.4	0.6	0.7	0.7	0.6	0.5	0.4	0.4	0.5	0.6	0.5	0.3	0.1	-0.0	-0.0	0.0
80	0.1	0.2	0.4	0.5	0.7	0.7	0.6	0.5	0.4	0.4	0.4	0.5	0.5	0.4	0.2	0.0	-0.1	0.0	0.0
81	0.0	0.1	0.3	0.4	0.6	0.7	0.6	0.5	0.4	0.3	0.3	0.4	0.4	0.4	0.3	0.1	-0.1	-0.1	0.0

PLOTTING PROGRAM AND OUTPUT: SEPTEMBER 1944 HURRICANE

In the following are the plotting programs of HTH DATA library subroutine of the plotting program and three-dimensional plots of the surge surface height (z - direction) versus time (hour, y - direction) and coastline distance (mile, x - direction). The X, Y, Z directions follow those in Fig. 1 (p. 150).

The 81 values along the X-axis of the plotting program HTH (81.19) have been reduced to 41 values. The distance between two points is 15 miles. There are 19 points in the Y-axis of the plot. The height of the surge (in feet) in the Z direction is defined from a zero datum at 15 feet above the origin for the sake of a better view of the surge surface.

All the data were generated from the main program by values of HTH (81.19), defined and stored in File 1, for the surge heights of the September 14, 1944, hurricane. No. 1. There are three other simulated storm surge height outputs for the 1944 hurricane. The only difference among the four sets of outputs are values of storm size and pressure drop.

PLOTTING PROGRAM

```
PW
$SET AUTOBIND
FILE  8(KIND=REMOTE)
FILE  6(KIND=PRINTER)
FILE  1=HTHDATA,UNIT=DISKPACK,RECORD=19,AREA=570*60,BLOCKING=30
      DIMENSION HH(19,81),HTH(19,81),XA(19),YA(19),H(19,41)
      REAL TITLE(3)/'SURGE SURFACE PLOT'/
      READ(1,5)  ((HTH(IJ,JI),IJ=1,19),JI=1,81)
      DO 3 J=1,81
      DO 3 I=1,19
       HH(20-I,82-J)=HTH(I,J)+15
    3 CONTINUE
       DO 4 K=1,81,2
       DO 4 L=1,19
       H(L,K*0.5+0.5)=HH(L,K)
    4 CONTINUE
    5 FORMAT(19F6.1)
       XA(1)=1
       YA(1)=1
       DO 1 I=1,18
       XA(I+1)=XA(I)+1
    1 CONTINUE
       DO 2 J=1,40
       YA(J+1)=YA(J)+2
    2 CONTINUE
       F=1.E5
       IDEV=9
       FACT=0.7
       VERT= 70.
       ROTANG=60.
      CALL PLTSRT('STORM PLOT',IDEV)
      CALL FACTOR(FACT)
      CALL SURPRJ(XA,19,YA,41,H,VERT,ROTANG,F,TITLE,18)
      CALL PLOT(0,0,IDEV)
      CALL EXIT
      END
#
```

NAME: SURPRJ, SPJALG

FUNCTION: Surface projection. To project a function of two independent variables onto a plane and display this projection with hidden lines removed.

CALLING SEQUENCE:

ALGOL -

```
SPJALG(XA,XCT,YA,YCT,H,VERT,ROT,F,TL,NTL);
```

FORTRAN -

```
CALL SURPRJ(XA,XCT,YA,YCT,H,VERT,ROT,F,TL,NTL)
```

ARGUMENTS:

XA the one-dimensional array containing X (abscissa) coordinate values.

XCT the number of X values in XA, maximum of 60.

YA the one-dimensional array containing Y (ordinate) coordinate values.

YCT the number of Y values in YA, maximum of 60.

H the two-dimensional array containing the Z data values which define the surface. H must be dimensioned (XCT,YCT) and all data values must be greater than or equal to zero.

VERT the vertical angle (degrees) of inclination of the observation from the X-Y plane of definition, $0<VERT<90$. (see Comments)

ROT the angle of rotation (degrees) of the observation about the Z axis. (see Comments)
For isometric projections, $0 \le ROT \le 89$.
For true projections, $15 \le ROT \le 74$.

F the focal length. (see Comments)
For isometric projections, $F=10^5$.
For true projections (the observation point located in the reference plane), F=0.

TL the array which contains the title of the projection.

NTL the number of characters (blanks included) in the title, maximum of 120.

COMMENTS:

1. Routine PLTSRT (ARR, device) must be called before SURPRJ or SPJALG to identify the graphics output

device. A call to PLOT (0,0,device) after the call to SURPRJ will insure transmission of the entire plot to the display device. The arguments for PLTSRT and PLOT are defined as follows:

ARR is a dimensioned array containing a character string.
device=9 implies plotting on the Tektronix.
device=-9 implies plotting on the CalComp plotter.

2. The graphic output is automatically scaled to approximately 8.5 inches square including a 0.5 inch space below the title. When using the Tektronix display a call to FACTOR must be made to scale the projection to a size which will fit on the screen which is 7.5 inches wide and 5.6 inches high. The pen returns to (0,0) at exit.

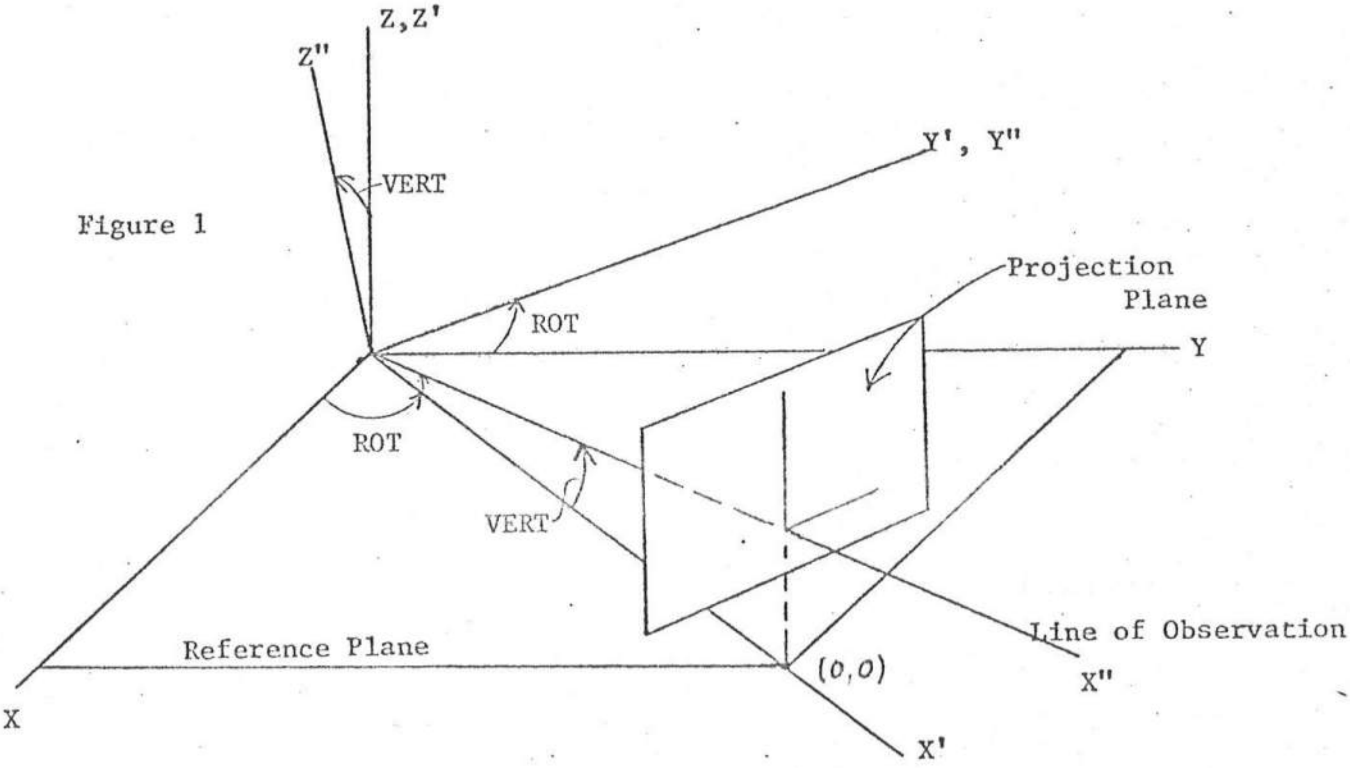
3. The number of X values XCT may be different than the number of Y values YCT; the reference plane (see Comment 5) need not be square. Also the spacing between X coordinates and/or Y coordinates may be variable.

4. An error comment is printed on file 6 for a surface too irregular for SURPRJ.

5. Arguments VERT, ROT, F

The X-Y coordinates specify the plane of definition or reference plane. The value ROT specifies the angle of rotation of the line of observation about the Z axis. The value of VERT is the angle of inclination of the observation above the reference plane. The surface is then projected onto a plane perpendicular to the line of observation. The focal length F defines

Figure 1



the point of observation of the projection, that is, the distance of the viewing point from the plane of projection. Isometric projections ($F=10^5$) show all dimensions in their actual size. True projections ($F=0$) are shown in perspective so parts of the surface nearer the viewer appear larger than parts that are farther away. Figure 1 shows the coordinate system and transformations in general. Figures 2-4 illustrate specific viewing orientations.

Figure 2

Cube positioned on reference plane. (Top shaded as a visual aid.)

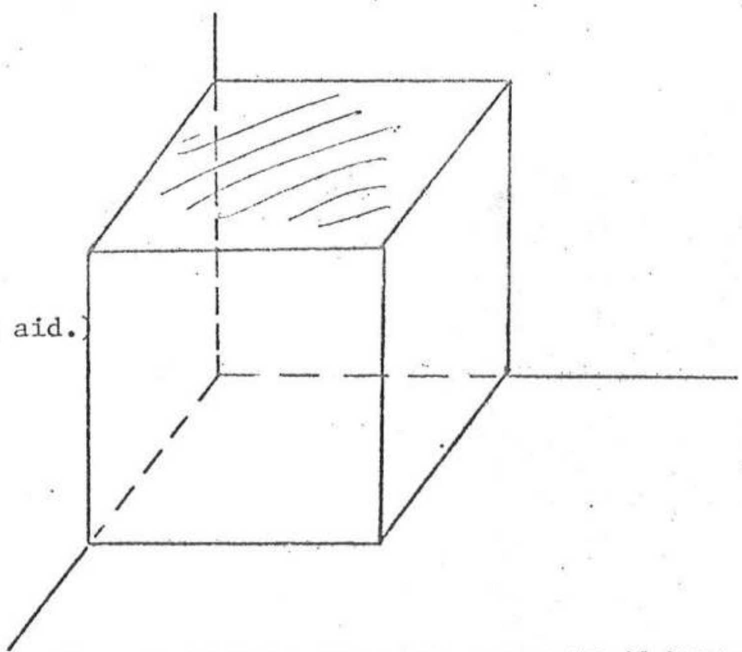
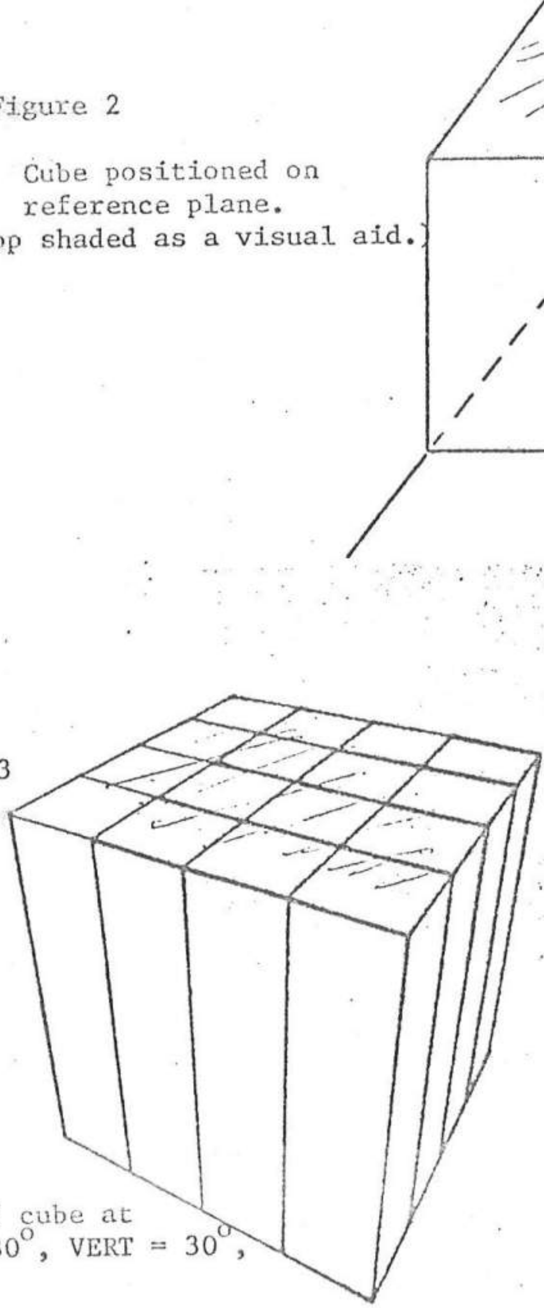


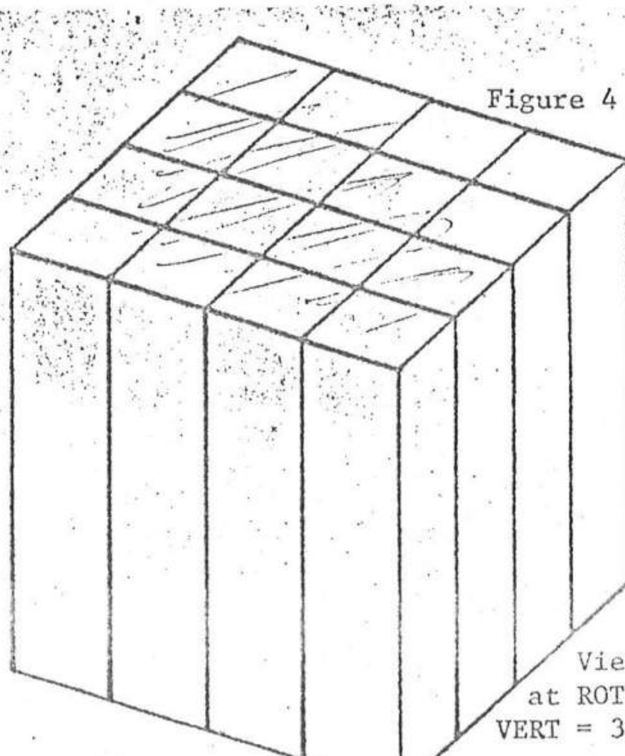
Figure 3



View of cube at ROT = 30°, VERT = 30°, F = 0

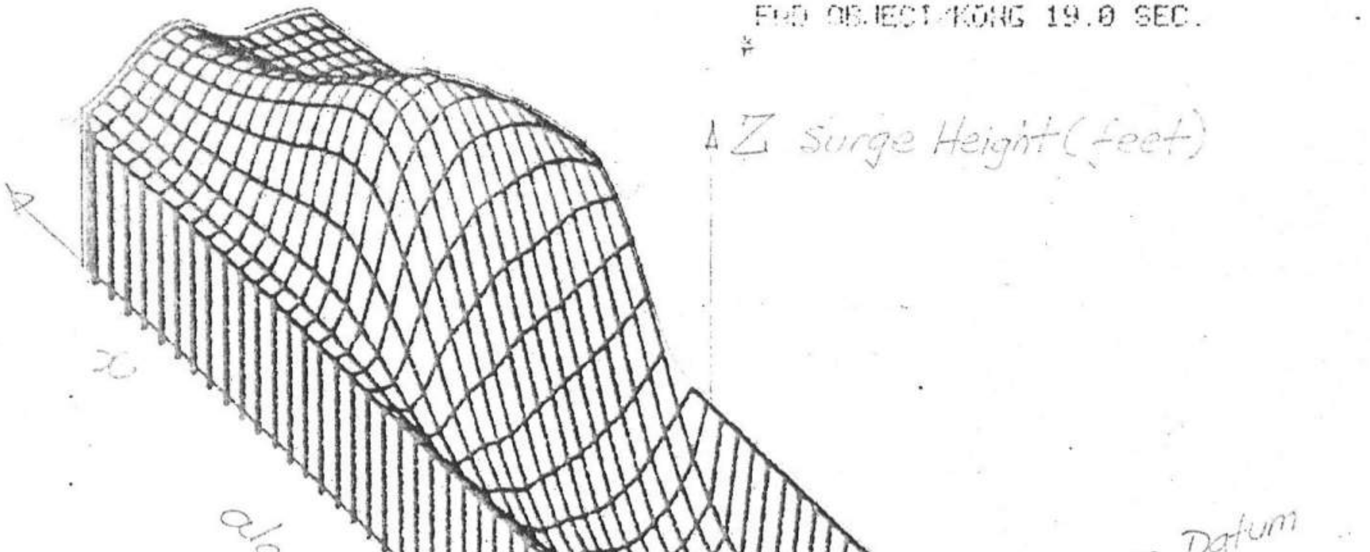
TRUE VIEW

Figure 4



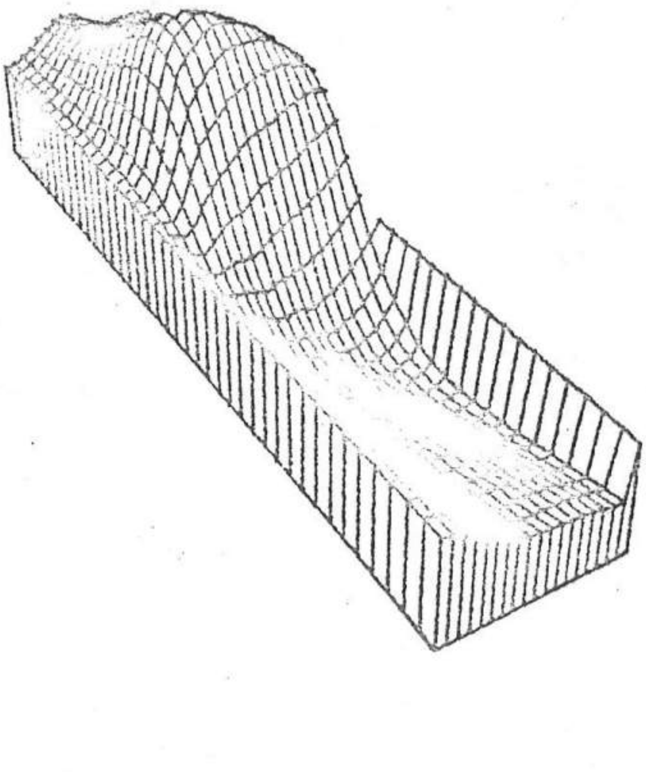
View of cube at ROT = 30°, VERT = 30°, $F = 10^5$

ISOMETRIC VIEW



SURGE SURFACE PLOT
1944 HURRICANE
F=1.E5
Factor=0.7
Vert. = 30
Rot. = 60

END OBJECT/KONG 18.5 SEC.
#



SURGE SURFACE PLOT

USER'S GUIDE

This program was applied to a parallel piped section (or basin) of the continental shelf, bounded on one side by a coastline with "vertical wall" and the remaining three sides by the open sea. The surge was generated by a storm driving force. If the storm is traveling very slow, or is stationary, or is moving at a speed greater than 60 m.p.h., then the program will be terminated with a warning message. This program does not allow storm track direction change of more than 15 degrees/hour. The storm size must be between 10 miles to 60 miles and the initial and final pressure drop must be between 10 MBS to 140 MBS.

The program was run on the Burroughs 6700 system at the Computer Center of the University of Delaware, using standard Fortran IV, with some variations in library functions and subroutines. The program uses "Timi" instead of the word "Time" to avoid confusion with the intrinsic function "Time" in the Burrough system. The computer hardware used includes the Burroughs 6700 central processing system with a 136 column output line printer, a 80 column card reader and an 80 column card puncher. The 9 track tapes were used to store meteorological input data and to transfer data to the diskpack. Each computer run takes about 25 minutes.

I. INPUT DATA SAMPLE

A sample for the required input data is given below. The data are arranged in sequence of data cards. Definition of all sysmbols are given following the sample.

AIDENT (JOB INFORMATION)										
*	*	*	*	*	*	*	STORM RESEARCH	*	*	PLOT
13A6.A2										

CARD 1

FORMAT

STA (STATION NAME)											
*	*	*	C	A	P	E	*	*	M	A	Y
2X	A10										

CARD 2

FORMAT

ALTO										ALNO										NBPOS					LMLE				
Δ	Δ	Δ	Δ	3	8	·	6	4	Δ	Δ	Δ	Δ	Δ	7	4	·	9	Δ	Δ	N	O	R	T	H	Δ	Δ	-	2	(
F10.3										F 10.3										A5					I 5				

CARD 3

FORMAT

PHI					ALAT				
Δ	2	7	·	5	Δ	3	8	·	6
F 5.1					F 5.1				

CARD 4

FORMAT

ALT (I)										ALN (I)							
Δ	Δ	3	7	.	Δ	Δ	Δ	Δ	Δ	Δ	Δ	7	7	.			CARD 5
Δ	Δ	3	6	.	7	5	Δ	Δ	Δ	Δ	Δ	7	5	.	2	5	CARD 6
Δ	Δ	3	6	.	5	Δ	Δ	Δ	Δ	Δ	Δ	7	3	.	5		CARD 7
Δ	Δ	3	6	.	2	5	Δ	Δ	Δ	Δ	Δ	7	1	.	7	5	CARD 8
Δ	Δ	3	6	.	Δ	Δ	Δ	Δ	Δ	Δ	Δ	7	0	.			CARD 9
F 10.5										F 10.5							FORMAT

PO					
Δ	3	0	.		CARD 10
F 5.1					FORMAT

PE					
Δ	4	4	.		CARD 11
F 5.1					FORMAT

RO					
Δ	4	0	.		CARD 12
F 5.1					FORMAT

RE					
Δ	4	0	.		CARD 13
F 5.1					FORMAT

ISTM			
1	2	0	0
I 4			

CARD 14
FORMAT

IDAY	
Δ	6
I 2	

CARD 15
FORMAT

NMNTH				
M	A	R	C	H
A 5				

CARD 16
FORMAT

IYEAR			
1	9	6	2
I 4			

CARD 17
FORMAT

II. DEFINITION OF SYMBOLS

CARD 1

AIDENT = Contains job information such as the job title and job identification. Maximum 80 alpha-numeric characters.

CARD 2

STA = Nearest station to center of basin. Station name up to 10 alpha characters. First two columns must be blanks.

CARD 3

ALTO = Latitude of basin's coastal center; use first 10 columns (column 1-10); real number; Format F 10.3.

ALND = Longitude of basin's coastal center; use second 10 columns (Column 11-20); real number, format F 10.3.

NBPOS = Direction of basin center from STA (nearest station of basin center); from column 21-25; five alphabetic characters; format A5.

LMLE = Distance in miles from STA to basin center; from column 26-30; integer; format I 5.

CARD 4

PHI = Angle in degree from North of STA (Fig. 1) to idealized coastline of STA (clockwise); first 5 columns; format F 5.1.

ALAT = Latitude of basin center; next 5 columns (column 6 $\tilde{-}$ 10); format F 5.1.

CARD 5 to CARD 9

\- Storm track divided in five positions, each separate by 6 hours distance;

ALT (I) - positions in latitude;
ALN (I) - positions in longitude.

CARD 5

ALT (1) = Storm first position

ALN (1) = Storm first position

CARD 6

ALT (2) = storm second position

ALN (2) = storm second position

CARD 7

ALT (3) = storm third position

ALN (3) = storm third position

CARD 8

ALT (4) = storm fourth position

ALN (4) = storm fourth position

CARD 9

ALT (5) = storm fifth position

ALN (5) = sotrm fifth position

All ALT column 1-10; Format F 10.5
All ALN column 11-20; Format F 10.5

CARD 10

PO = initial pressure drop, 10 MBS < PO < 14° MBS, real number, Format F 5.1.

CARD 11

PE = final pressure drop, 10MBS < PE < 140MBS, real number, Format F 5.1.

CARD 12

RO = initial storm size, 10 mile < RO < 60 mile, real number, Format F 5.1.

CARD 13

RE = final storm size, 10 mile < RE < 60 mile, real number, Format F 5.1.

CARD 14 to CARD 17 - initial time, hour, day, year of 1st of storm five positions.

CARD 14

ISTM - initial hours of 1st position, integer, Format I4.

CARD 15

IDAY - initial day of 1st position, integer, Format I2.

CARD 16

NMNTH - Month of 1st position, maximum 5 characters, Format A5.

CARD 17

IYEAR - Year of 1st position, Format I4.

III. DATA FILE (TOPOGRAPHY)

File 2 = Data UNIT = DISKPACK, RECORD = 14, BLOCKING = 30

File 2 is to be defined in this program for storing the information of SKW and DD in diskpack. The first 151 data are values of SKW. Then follow values of DD (15% data).

SKW (151) = (miles) Distance (along the line perpendicular to idealized coastline) from idealized coastline to coastline; each of the 151 distance are separated at 4 miles along idealized coastline. STA is set in the middle of this 600 mile line (Fig. 1). The coastal distance to the right of the idealized coastline is taken as positive; to the left negative. Data are real numbers with Format F 6.1.

DD (10, 151) = Depth of the basin. There are 151 data values taken along points intercepted by the X axis and Y axis (Fig. 2). All points are separated at 4 miles apart in both X and Y direction. The coast in the X-direction is extended for 40 miles and in the Y-direction 600 miles. Data are all read numbers with Format F 6.1.

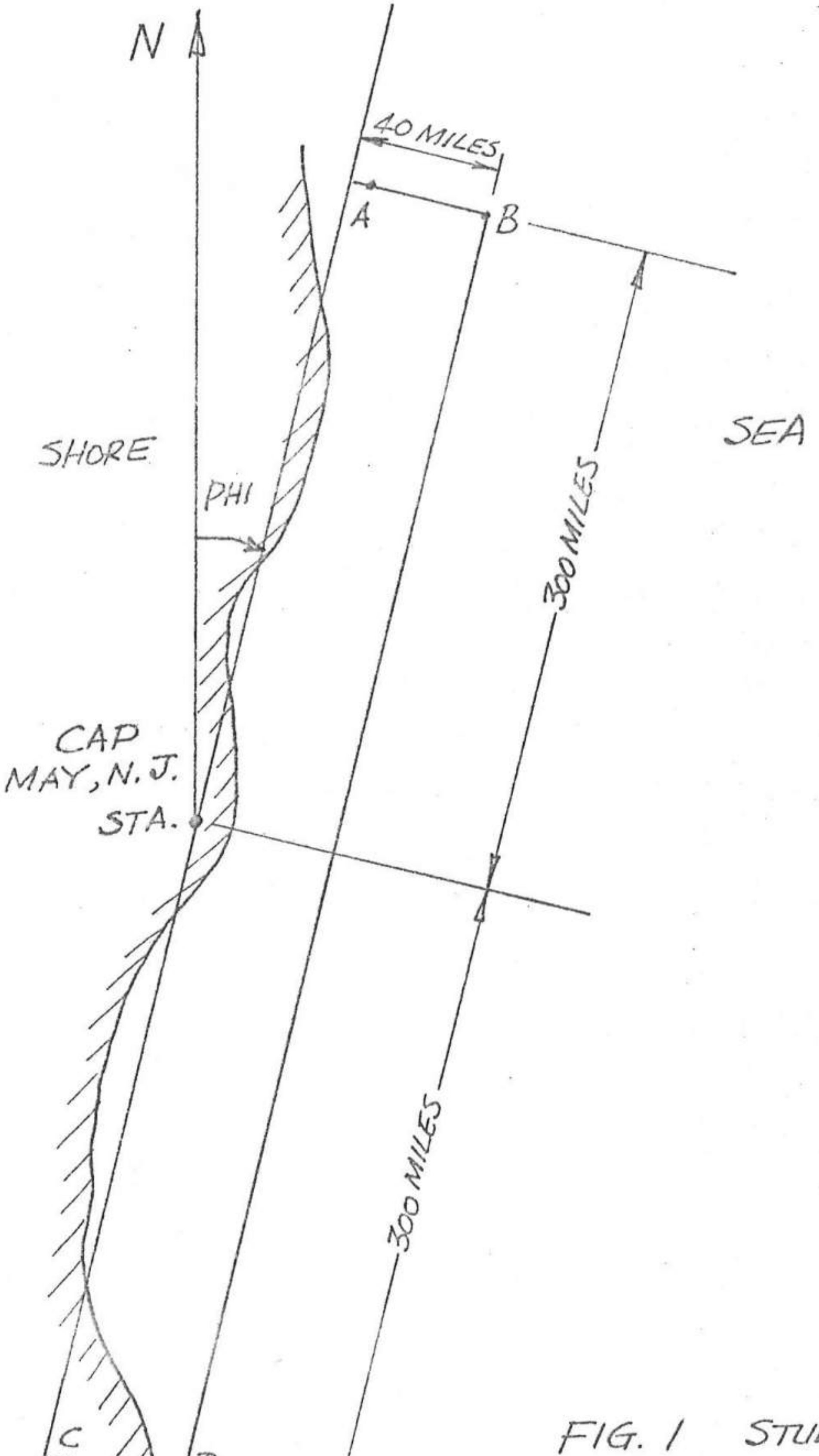


FIG. 1 STUDY SITE

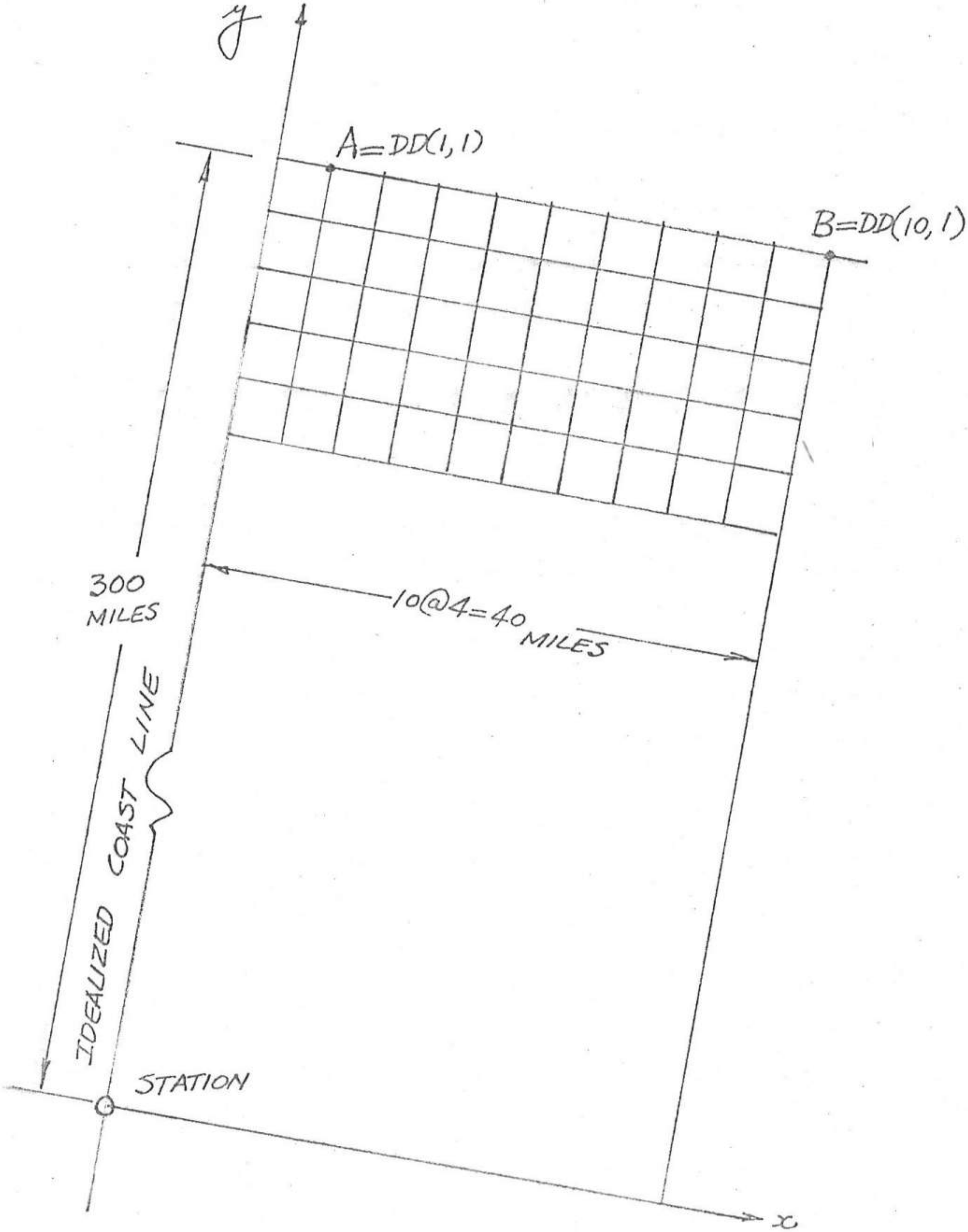


FIG.2 GRID SYSTEM

IV Output of the Program: The output of this program consists of six parts as follows.

(A) Input storm positons check: five storm positions are read in the computer. Check their time (hour, day, month, year), latitudes, longitudes, pressure drop and storm size. Print the distance (length) from STA to storm position, the azimuth of the storm, and the x and y coordinates of the storm position (centered at STA, see Fig. 2).

(B) Tabulated 48 hourly data of (smoothed) storm: These are data of time (hour, day, month, year), storm positions (by latitude, longitude, and by x-coordinate, y-coordinate), speed, and direction of storm motion, pressure drop (Delp), storm size and initial and terminate computation time of HTH (19.81) data.

(C) Coefficient and constant: Print constants and coefficients defined in and calculate by this program (see comment on subroutine force and force 1).

(D) Depth (feet) of field around basin center: Check the basin depth around central area 28 miles (y-axis) x 36 miles (x-axis). The basin center (75.12).

(E) Storm data at time of nearest approach to basin center: (1) Data of position (by x, y coordinate), maximum wind radius, speed, PADD (pressure in MB from RO = 149 to RO = infinity), and pressure drop. (2) Wind speed, pressure, inflow angle, and static, height s (in feet) as well as pressure gradient as a function of distance from storm center (radius).

(F) Surge height (feet) data: HTH (19.81) is the surge height, its x-coordinate, has 19 values correspondent to 19 hours from initial computation time (6:00 a.m., March 6, 1962) to terminate computation time (0:00 a.m., March 7, 1962). Its y-coordinate has dimension 81, cooresponding to 600 miles along idealized coastline (7.5 miles apart between two points). This tabulation in the output data is the surge height (in feet) along the coastline (idealized) durint the 19 hours period. It is indexed by the left most column from 1 to 81.

(G) Output file 1 = HTHDATA: The output of surge height HTH (19.81) has been written in diskpack (File 1). This can be used later for plotting and input to other program for analysis.

APPENDIX III

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