MAST/GEOG 667: Wind Power Meteorology
Fall 2013, 3 credit hours

Syllabus

Instructor: Cristina L. Archer
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Monday, Wednesday 3:30-4:45PM
Robinson Hall 203

Description: This course explores the fundamental concepts of meteorology that are needed to understand onshore, offshore, and airborne wind power. Topics include: forces affecting winds; terrain and land-use effects; air turbulence; numerical modeling; wind power and energy from turbines; and wind measurement technologies.

Textbooks (not required):

- Ahrens, C. D. (2008): *Meteorology today*. Brooks Cole, 9th edition, 549 pp.
- Jacobson, M. Z. (2005): *Fundamentals of atmospheric modeling*. Cambridge University Press, 2nd edition, 813 pp.
- Burton T., D. Sharpe, N. Jenkins, and E. Bossanyi (2001): *Wind energy handbook*. John Wiley and sons, 617 pp.

Office hours: Monday, Wednesday 9:00-10:00AM, or by appointment.

Grading:

Homework	15%
Midterm	30%
Final exam	40%
Project	15%

Grades:

A	A-	B+	B	B-	C+	C	C-	D
93%	90%	87%	83%	80%	77%	73%	70%	60%

Policies: Deadlines will be strictly enforced and no late turn-ins will be accepted, unless prior arrangements had been made with the Instructor.
Eating and drinking are not allowed in the classroom. You will be asked to remove any food or beverage you bring into the classroom.
Please turn off your cell phones and pagers so that you can focus on the class work.
Any student who has a need for accommodations based upon the impact of a disability should contact me as soon as possible. Contact the Office of Disabilities Support Services to coordinate appropriate accommodations.
All students must be honest and forthright in their academic studies. To falsify the results of one's research, to steal the words or ideas of another, to cheat on an assignment, or to allow or assist another to commit these acts corrupts the educational process. Students are expected to do their own work and neither give nor receive unauthorized assistance. Any violation of this standard will be reported to the Office of Student Conduct. Please read http://www.udel.edu/stuguide/11-12/code.html

End of class: the last day of this class will be Wednesday, December 4.

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Course schedule (tentative)

1. What is wind?
    1. Upper-level winds: Pressure Gradient Force and Coriolis (pressure surfaces, geostrophic flow, wind symbols)
    2. Near-surface winds: add Friction (flow around lows and highs at surface, weather and winds associated with L and H)
    3. Distributions of winds on Earth (synoptic flow near surface, winds crossing isobars, fronts, where are the windiest spots?)

2. How does wind change with time, height, and location?
    a. Global circulation, jet streams, and thermal wind (aloft)
    b. Seasonality
    c. Diurnal cycles
    d. Terrain effects (sea/land and mountain/valley breezes)
    e. Turbulence in the boundary layer (eddies, intermittency)
    f. Power law and log law (in the boundary layer)

3. How do we measure winds?
    a. Anemometers
    b. Remote sensing
    c. Field trip to Lewes tower (to be arranged)

4. Power and Energy in the wind
    a. Wind power density (including temperature and altitude corrections to air density)
    b. Betz limit
    c. Wind speed and power distributions (Weibull, Rayleigh, wind power classes)
    d. Actual wind power curves and capacity factors
    e. Annual energy generated by wind turbines

5. Forecasting wind and wind power
    a. The momentum equation
    b. Numerical modeling (including parameterizations of turbulence)
    c. Wake effects
    d. Array losses (turbine spacing)