

Atmospheric Sciences 5270: Wind Power Meteorology

<http://www.inscc.utah.edu/~krueger/5270>

Credit hours: 1.5

Classroom: WBB 711

Class hours: Tu Th 10:45 to 12:05

Instructor: Steve Krueger, Professor

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Office hours TBD or by appointment.

Course description: Siting of wind turbines, regional wind resource assessment, and short-term prediction of the wind resource. Aspects of boundary layer meteorology important for wind energy: wind profiles and shear, turbulence and gusts, and extreme winds. Wind climate analysis, wind resource estimation and siting, and their relation to local topography and surface features. Meteorological models used for estimation and prediction of the wind: their types, inputs, limitations, and requirements.

Prerequisites: MATH 1220 and PHYS 2220. Recommended courses: ATMOS 3200, ATMOS 5040, ATMOS 5050, ATMOS 5220.

Course objectives: At the end of the course, the student will have a basic understanding of aspects of boundary layer meteorology important for wind energy and of atmospheric models used for estimation and prediction of the wind, and a comprehensive understanding of and practical experience in wind resource assessment

Teaching and learning methods: In-class lectures, discussion, and computer programming supplemented by outside-of-class reading assignments and computer programming. The students will use MATLAB programming skills to analyze meteorological data and to present results in graphical form.

Required Reading:

Petersen, E. L., et al., 1998: Wind power meteorology. Part I: Climate and turbulence. *Wind Energy*, **1**, 2–22.

Petersen, E. L., et al., 1998: Wind power meteorology. Part II: Siting and models. *Wind Energy*, **1**, 55–72.

AWS Truepower, 2010: *Wind Resource Assessment Handbook*. The New York State Energy Research and Development Authority.

Recommended Textbook: Stull, R. B., 1988: *An Introduction to Boundary Layer Meteorology*, Kluwer Publishers, 666 pp. Nice discussion of the methods, observational and computational tools used in boundary layer meteorology.

Evaluation methods and criteria: The course grade will be determined from problem sets (70%) and a final exam (30%). The grading scale will be A: ≥ 90 , B: 80-89, C: 70-79, D: 60-69, F: < 60 .

Schedule of lecture topics:

- Wind turbines; geographical distribution of wind power resources
- Diurnal cycle of boundary layer vertical structure over land
- Boundary-layer equations
- Inertial oscillation
- Surface layer wind profiles
- Analysis of tower wind data: Estimating the wind power at hub height
- Climate adjustment process (adjusting the record at a wind monitoring site to the historical norm)
- Simulating atmosphere flow for wind energy applications
- Uncertainty in wind resource assessment

Holidays: (none)

Last day of class: Tuesday, February 26

Final exam: Tuesday, February 26, 10:45 to 12:05

Drop and Withdrawal dates:

- Last day to add or drop (delete) classes: Friday, January 11 (Students can drop classes by phone or web through this date, and the classes will not appear on their transcripts.)
- Last day to withdraw from classes: Friday, February 1. (Students can withdraw from classes by phone or web, but will “W” will appear on their transcript for these courses.)

Disability Services: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

Faculty and student responsibilities: All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.