Master Syllabus
Department of Geography

GEOG 450/550: Mesoscale Meteorology

Course Description

Survey of mesoscale-related phenomena of the atmosphere, including thunderstorms, tornadoes, and lake-effect snow. Includes information about forecasting the occurrence and evolution of such phenomena with tools like Skew-T diagrams and Doppler radar. (3 credit hours).

Prerequisite: GEOG 330.

Course Objectives

The objective of the course is to introduce students to concepts and forecasting techniques associated with mesoscale meteorological phenomena. Specific aims of the course are to enable students to:

1. define the mesoscale and compare and contrast it with other meteorological scales

2. explain underlying synoptic, mesoscale, and microscale processes that cause mesoscale phenomena including, but not limited to, lake-effect snow, coastal fronts, thunderstorms, and tornadoes

3. describe the climatology of hazards (e.g., hail, flash flooding, tornadoes) associated with mesoscale weather phenomena

4. synthesize meteorological data such as maps, satellite and radar images, observations, and soundings into accurate forecasts of the development, life, and death of mesoscale phenomena in the atmosphere.

Course Rationale

Students will develop a conceptual framework to recognize and explain the development and evolution of mesoscale phenomena in the atmosphere. Students will also learn about the hazards associated with mesoscale phenomena. Finally, students will learn to use tools such as maps and soundings to forecast the occurrence of mesoscale phenomena. Consequently, students will be able to forecast and warn the general public about future hazardous weather situations. Geography 450 serves as a requirement for the Option IV: Meteorology and Climatology, Professional Track; Geography 550 partially fulfills the elective requirement. In addition, this course is one of the required courses for those seeking qualification for the title “meteorologist” by the

American Meteorological Society (AMS) and for employment by the National Weather Service under the Federal Civil Service guidelines (GS-1340).

Course Content and Format

Students will be presented material in a lecture-style format that will include multimedia presentations and case study discussions. The following shows an example of a potential outline of topics for this course, with time allotment for each topic at the discretion of the instructor:

1. Course Introduction

2. Use of Skew-T and Hodograph diagrams

3. Mesoscale Winter Weather
    a. Lake Effect Snow
    b. Cold-air Damming/Coastal Fronts
    c. Upslope Snowstorms

4. Introduction to Severe Convective Storms
    a. Thunderstorm types
    b. Squall lines and supercells
    c. MCCs

5. Convective Hazards Associated with Severe Convective Storms
    a. Damaging straight-line winds
    b. Hailstorms
    c. Flash Flooding (Hydrology Review)
    d. Tornadoes
    e. Lightning and Thunder

6. Additional topics in mesoscale meteorology

Textbook Suggestions

Markowski, P., and Y. P. Richardson, 2010: *Mesoscale Meteorology in Mid-Latitudes.* Wiley-Blackwell. 424 pp.

Doswell, C. A., 2001: *Severe convective storms*. Meteorological Monographs, Vol. 28, No. 50, American Meteorological Society, Boston. 570 pp.

Ray, P. S., ed., 1986: *Mesoscale meteorology and forecasting.* Boston, AMS. 793 pp.

Methods for Evaluating Student Performance:

Forms of evaluation might include examinations, quizzes, homework problem sets, presentations, and analysis of real-world examples. Graduate students enrolled in the course as Geography 550 would be expected to accomplish an additional work load (e.g., term paper, additional problems on homework and exams, etc.).

Evaluation of the Course

Student evaluation of the course using university (and departmental) course evaluation forms.