

ESCI 6000 / INES 8090 – NUMERICAL WEATHER PREDICTION – FALL SEMESTER 2008

COURSE WEB SITE:

<http://personal.uncc.edu/betherto/esci6000.htm>

COURSE TIME:

Monday and Wednesday: 3:30 – 4:45 P.M., Room 203

COURSE INSTRUCTOR:

Dr. Brian Etherton – Room 237. Office Hours: Mon./Wed. 1-2 P.M., Tues./Thurs., 10-11 A.M.

COURSE DESCRIPTION:

Numerical Weather Prediction (NWP) is a tool to both predict and to understand the atmosphere. The fundamental principles of NWP are to develop all the equations that govern the atmosphere, apply those equations to a discretized representation of the atmosphere, and then parameterize the impacts of processes that occur on scales smaller than the discretized atmosphere. This course will first go through the equations that govern the atmosphere, cover the mechanics of solving those equations, and then discuss the parameterization of sub-grid scale processes. With this toolbox in place, students will use the WRF model as a means of hypothesis testing.

REQUIRED TEXT:

“Mesoscale Meteorology Modeling”, 2nd Edition, by Roger Pielke

EXAM SCHEDULE AND GRADING:

Exam #1	Wednesday – September 17 – 3:30 P.M.	10%		
Exam #2	Wednesday – October 15 – 3:30 P.M.	10%		
Exam #3	Wednesday – November 5 – 3:30 P.M.	10%		
FINAL EXAM	Wednesday – December 17 – 2:00 P.M.	25%		
HOMEWORK	(4 during the semester)	20%		
Final Presentation	Monday – December 8	10%		
Final Paper		15%		
100-90 A	89-80 B	79-70 C	69-60 D	59-0 F

UNIVERSITY POLICY:

Students are expected to comply with university policy as it relates to academic integrity and student expectations. The Code of Student Responsibility can be found at the following website: <http://www.legal.uncc.edu/policies/ps-104.html>

Students with documented disabilities are eligible to receive assistance from the Office of Disability Services in Fretwell 230 (ext. 4355). For detailed information please see the current UNC Charlotte catalog.

TOPICS FOR THE COURSE:

BASICS OF NUMERICAL WEATHER PREDICTION (first quarter of course)

THE BASIC EQUATIONS AND THEIR SIMPLIFICATION – Conservation of mass, heat, motion, and water. P. 2 and 3.

AVERAGING THE CONSERVATION RELATIONS – Putting the equations of motion onto a grid. P. 4.

COORDINATE TRANSFORMATIONS – Using variables other than height as the vertical coordinate, such as pressure, Exner, Sigma-Z. P. 6.

METHODS OF SOLUTION – Finite difference schemes, forward, centered, and backward in space and in time. Time splitting. Aliasing. P. 10

SUB GRID SCALE PROCESSES (second quarter of course)

SUBGRID SCALE FLUXES – Fluxes within the ground, from the ground to the surface layer, and from the surface layer to the boundary Layer. P. 7.

RADIATION FLUX DIVERGENCE – Longwave and Shortwave Radiation. P. 8.

MOIST THERMODYNAMIC PROCESSES – Phase changes of water in stable and unstable atmospheres. P. 9.

MODEL PRE- AND POST-PROCESSING (third quarter of course)

BOUNDARY AND INITIAL CONDITIONS – Initialization schemes, data assimilation (3DVar, LAPS, Ensemble Kalman Filter), spatial boundary conditions. P. 11.

MODEL EVALUATION – Evaluation criteria, comparisons to other models and to observations, model budgets. P. 12.

MESOSCALE MODELS – Mesoscale systems. P. 13.

WEATHER RESEARCH AND FORECASTING (WRF) MODEL AND HYPOTHESIS TESTING USING WRF (final quarter of course)

WRF AND WPS WORKFLOW – Downloading of files from NCEP, executables, scripting.

WRF AND WPS NAMELISTS – Parameters within namelist.input and namelist.wps.

POST PROCESSING – WRF2GRADS and GrADS.

COURSE POLICIES:

Attendance, Participation and Due Dates: Regular class attendance and active participation is expected. You are responsible for all information presented in class; if you are absent, you will need to contact a classmate to obtain the material.

Assignment Deadlines and Exam Dates: **I expect you to turn in assignments and take exams as scheduled** - except due to extraordinary circumstances or participation in a college sanctioned event. **I will not accept late assignments.** If you know you will not be in class on the due date, turn the assignment in early. **Exams will occur as scheduled and there are no make-up exams.** If you miss an exam for what you believe to be a valid reason, you must provide written documentation in order for me to consider allowing a make-up exam. There will be **no extra credit.**

Expectations: Responsibilities of both students and instructor for this course are reasonable and in keeping with UNC-Charlotte guidelines for academic ethics. As a student, you are expected to arrive for class on-time. **I am under no obligation to reiterate material for those arriving late.** To do so would interrupt the flow of class for all the other students.

ACADEMIC INTEGRITY:

The UNC Charlotte Code of Student Academic Integrity governs the responsibility of students to maintain integrity in academic work, defines violations of the standards, describes procedures for handling alleged violations of the standards, and lists applicable penalties. The following conduct is prohibited in that Code as violating those standards:

A. Cheating. Intentionally using or attempting to use unauthorized materials, information, notes, study aids or other devices in any academic exercise. This definition includes unauthorized communication of information during an academic exercise.

B. Fabrication and Falsification. Intentional and unauthorized alteration or invention of any information or citation in an academic exercise. Falsification is a matter of altering information, while fabrication is a matter of inventing or counterfeiting information for use in any academic exercise.

C. Multiple Submission. The submission of substantial portions of the same academic work (including oral reports) for credit more than once without authorization.

D. Plagiarism. Intentionally or knowingly presenting the work of another as one's own (i.e., without proper acknowledgement of the source). The sole exception to the requirement of acknowledging sources is when the ideas, information, etc. are common knowledge.

E. Abuse of Academic Materials. Intentionally or knowingly destroying, stealing or making inaccessible library or other academic resource material.

F. Complicity in Academic Dishonesty. Intentionally or knowingly helping or attempting to help another to commit an act of academic dishonesty.

A full explanation of these definitions, and a description of procedures used in cases where student violations are alleged, is found in the complete text of The UNC Charlotte Code of Student Academic Integrity. This Code may be modified from time to time. Users are advised to contact the Office of the Dean of Students to assure they consult the most recent edition.