Syllabus
CLIM 470 Numerical Weather Prediction
Fall 2019
MW 9:00am – 10:15 am
Research Hall 121

Instructor: Cristiana Stan
Room 267, Research Hall
703-993-5391
cstan@gmu.edu
Course Credits: 3
Course Website: Blackboard
Office Hours: Thursday – 1:00pm-2:30pm

Required Text:
Coiffier, Jean 2012: Fundamentals of Numerical Weather Prediction, Cambridge Press, ISBN 978-1-107-00103-9

Assignments:
Periodic homework is assigned and is due at the start of the class indicated. No late homework will be accepted except under prior arrangement. Homework will be graded and returned. There will be one exam during the semester and a Final. Exams are designed to test basic concepts and are closed books and closed notes. A class project will be assigned after the midterm exam. The project is due on the day of final. The project will be evaluated based on an oral presentation.
Late assignments: 10% is taken off for up to three days late; 30% is taken off for work submitted up to a week late. No assignment is accepted after one week, except for special extensions granted on the day the homework is assigned.

Grading:

Homework	8%	
Quizzes	2%	
Midterm Exam	20%	Tuesday, October 15, 9:00 am -10:15 am
Class Project	50%	Monday, December 16, 7:30 am -9:00 am
Final	20%	Monday, December 16, 9:00 am -10:15 am

Course description
Basic concepts of numerical weather model prediction, including the numerical models used and the rationale for large suites of meteorological forecasts. Sources of errors in the forecast: errors in the initial conditions and in the numerical weather prediction models. Interpretation of the output of numerical models.

Course Outline

1. Introduction
- The early days of numerical weather prediction
- The beginning of modern numerical weather prediction
- Numerical weather prediction today
- Developments in computing

2. What is a numerical weather prediction model?
- Weather prediction equations
- Physical parameterizations
- Data assimilation

3. Grid point models
- The finite difference methods
- The common used grids and their properties

4. Spectral models
- Spectral methods
- Spectral method on a double periodic domain

5. Time integration schemes
- Non-iterative schemes
- Iterative schemes
- Time filtering method on the sphere

6. Vertical discretization
- Hydrostatic/Non-hydrostatic models
- Sigma vertical coordinates
- Hybrid vertical coordinates

8. Errors in the models
- Aliasing errors
- The effects of time differencing on energy conservation
- Quality control of observations

9. Operational Forecasting
- The forecasting process
- Ensemble forecasting
- Forecast verification

10. Post-processing of model output
- Introduction to GrADS

11. Examples of NWP models
- The North American Mesoscale (NAM) forecast system
- The Global Forecast System (GFS)

FORTRAN MODULE

1. Introduction to FORTRAN
- Download and install
- Compiling, linking and executing

2. Basic elements of FORTRAN
- Structure of a FORTRAN Program
- Constants and Variables

3. FORTRAN Program Design
- Loops: DO, WHILE

The block IF, ELSE, and ELSE IF construct; SELECT CASE

4. FORTRAN basic I/O concepts

Read, Write

File formats

5. Introduction to arrays and pointers

University Requirements:

GMU is an Honor Code university; please see the Office for Academic Integrity for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else' s work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind) please ask for guidance and clarification.

If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Office for Disability Services (SUB I, Rm. 4205; 993-2474;http://ods.gmu.edu) to determine the accommodations you need; and 2) at the beginning of semester talk with me to discuss your accommodation needs.

Students must use their MasonLIVE email account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information.