Syllabus for ATMS 373 – Applied Numerical Modeling – Spring 2015

Date	Topic	Reading/Homework*
M 12 Jan 2015	Introduction/ Overview	D&VK Chap. 1, LP#1
W 14 Jan	Primitive Equations	D&VK Chap. 2, LP#2
W 21 Jan	"	Activity #1 Due
M 26 Jan	"	Activity #2 Due
W 28 Jan	Discretization of the Primitive Equations	D&VK Chaps. 3-4, LP#3
M 2 Feb	"	
W 4 Feb	"	Activity #3 Due
M 9 Feb	Simple Models	D&VK Chaps. 6-7, LP#4
W 11 Feb	"	
M 16 Feb	"	Activity #4 Due
W 18 Feb	Complex Models	D&VK Chaps. 8, 13, LP#5
M 23 Feb	"	
W 25 Feb	"	Activity #5 Due
M 2 Mar	Lecture/Review	
W 4 Mar	Exam I	D&VK 1-4, 6-7, 8, 13, Activity #1-5, lecture notes through 2 Mar
M 16 Mar	Boundary Conditions	D&VK Chap. 9, LP#6,
W 18 Mar	"	
M 23 Mar	Model Physics	D&VK Chap. 10, LP#7 Activity #6 Due
W 25 Mar	"	*Final Project Plan Approval*
M 30 Mar	"	
W 1 Apr	Data Assimilation	D&VK Chap. 12, LP#8
M 6 Apr	"	Activity #7 Due
W 8 Apr	"	
M 13 Apr	"	
W 15 Apr	Post-processing of Models	D&VK Chaps. 17-18, LP#9 Activity #8 Due
M 20 Apr	"	
W 22 Apr	"	
M 27 Apr	"	Activity #9 Due
W 29 Apr	Final Project Presentations	Final Project due
Finals Week	Exam II	D&VK 9-10, 12, 17-18, Activity #6-9, lecture notes from 16 Mar – 27 Apr

*assignment completed before class meets on this date

Description

"LONG TERM (THURSDAY NIGHT THROUGH MONDAY)...
LOW CONFIDENCE CONTINUES THOUGH THE EXTENDED PERIOD WITH MEDIUM
RANGE MODELS STILL ALL OVER THE PLACE REGARDING UPPER LOW MOVING
OUT OF THE PLAINS AND TOWARD THE N GULF STATES LATE IN THE WEEK.
THE LATEST GFS IS STILL SHOWING THE UPPER LOW REMAINING CLOSED OFF
AND NEARLY STATIONARY OVER THE N GULF THROUGH THE WEEKEND. HAVE
STUCK TO PREVIOUS PACKAGE WITH THE EXCEPTION OF ADDING A SOLID
CHANCE POP TO SAT."

As weather forecasters, we rely heavily on numerical weather models to aid in making our short- and long-term forecasts (see above quote). Unfortunately, we believe their predictions all too readily because we don't understand when they work and when they don't. This course is intended to give the student a basic introduction to numerical weather prediction and should assist the student in evaluating model-derived forecasts with a critical eye.

Outline

Introduction
- Overview of course
- D&VK Chap. 1

Primitive Equations
- D&VK Chap. 2

Discretization of the Primitive Equations
- D&VK Chaps. 3-4

Simple Models (based on filtered equations)
- D&VK Chaps. 6-7

Complex Models (based on the primitive equations)
- D&VK Chaps. 8, 13

Boundary Conditions
- D&VK Chap. 9

Model Physics
- D&VK Chap. 10

Data Assimilation
- D&VK Chap. 12

Post-processing of Models
- Predictability and Ensemble Forecasting
- D&VK Chaps. 17-18

Spectral Methods {time permitting}
- D&VK Chap. 11

Student Learning Outcomes

- understand how mathematical devices are applied to the governing laws that determine the evolution of atmospheric structures
- improve problem-solving skills by applying knowledge to model-based hands-on activities and experience the limitations of numerical methods
- develop the ability to make a significant contribution to a team-based research effort

Grading

Activities	20%
Monday Model Brief	10%
Exam I	20%
Exam II	20%
Final Project	30%
Total	**100%**

92% < total score ≤ 100%	A
90% < total score ≤ 92%	A-
88% < total score ≤ 90%	B+
82% < total score ≤ 88%	B
80% < total score ≤ 82%	B-
78% < total score ≤ 80%	C+
72% < total score ≤ 78%	C
70% < total score ≤ 72%	C-
68% < total score ≤ 70%	D+
60% < total score ≤ 68%	D
total score ≤ 60%	F

Activities

Activities (both in-class and at-home) will be assigned throughout the semester and are intended to aid in improving your understanding of the course material contained in the lecture and reading assignments. Activities will be defined as *individual* or *group* assignments. When an assignment is designated for a *group*, each individual within the group will receive an identical grade.

Monday Model Brief

Each student will be responsible for giving discussions on the weather of the day and how atmospheric models are being used by operational centers and weather offices (WPC, SPC, NWS) to make their weather forecasts. Each discussion should include a brief background description of the current weather for CONUS and focus primarily on how the operational forecasters are using the models [e.g. Is there a clear-cut "model-of-choice"? If so, do we know why the forecasters made it the MOC? Is there a discussion about model continuity in their discussion? If so, how do the forecasters use the notion of model continuity in their forecast?] Do the forecasters list any inadequacies of the models? If so, what are they?

Exams I and II

The mid-term exams (I and II) will be primarily testing new material introduced since the previous exam or since the start of the semester. Exam II will be taken during Final Exams week and will test the material given during the second half of the semester.

Final Project

Each student will be part of a research team responsible for completing an in-depth activity related to boundary conditions, numerics, data assimilation, model physics, modeling, or model post-processing. The final project idea must meet the approval of the instructor by 25 March 2015. A presentation and write-up will be required as part of the final project. Details of the presentation and write-up will be given after 25 March. The final project is due on 29 April 2015.

Assignment/Quiz/Exam Policy

Assignments are to be handed in before the start of lecture on the date they are due. Assignments handed in after the start of lecture are considered late until 4:30 pm on the date they are due and will be have an automatic 10% deduction from their final score. Assignments handed in after 4:30 pm on the date they are due will receive no credit.

Quizzes and Exams are written tests and will be taken on the date they are scheduled, unless circumstances (e.g. medical or loss in the family) warrant. Make-up quizzes and exams for special circumstances will consist of an individual oral graded question and answer session at a mutually agreed upon time outside of the usual class meeting time.

Instructor

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Textbook

"A First Course in Atmospheric Numerical Modeling" by Alex J. DeCaria and Glenn E. Van Knowe (D&VK)

References

"Atmospheric Modeling, Data Assimilation and Predictability" by Eugenia Kalnay

"An Introduction to Numerical Weather Prediction Techniques" by T.N. Krishnamurti and L. Bounoua

Disabilities

Contact Prof. Miller early in the course if you have a disability that requires special accommodations.

Academic Integrity

Cheating or plagiarism results in a failed assignment, quiz, or exam on the first infraction. A second infraction results in course failure and a report to the UNCA

administration. See http://www.unca.edu/catalog/academicregs.html under “Student Responsibilities” for a refresher on the UNCA policy.