

### Syllabus for ATMS 373 – Applied Numerical Modeling – Spring 2022

Date	Topic	Reading/Homework*
M 10 Jan 2022	Introduction/ Overview	D&VK Chap. 1, LP#1
W 12 Jan	Primitive Equations	D&VK Chap. 2, LP#2
W 19 Jan	“	Activity #1 Due
M 24 Jan	“	
W 26 Jan	Discretization of the Primitive Equations	D&VK Chaps. 3-4, LP#3, Activity #2 Due
M 31 Jan	“	
W 2 Feb	“	Activity #3 Due
M 7 Feb	Simple Models	D&VK Chaps. 6-7, LP#4
W 9 Feb	“	
M 14 Feb	“	Activity #4 Due
W 16 Feb	Complex Models	D&VK Chaps. 8, 13, LP#5
M 21 Feb	“	
W 23 Feb	“	Activity #5 Due
M 28 Feb	Lecture/Review	
W 2 Mar	<b>Exam I</b>	<b>D&amp;VK 1-4, 6-7, 8, 13, Activity #1-5, lecture notes through 28 Feb</b>
M 14 Mar	Boundary Conditions	D&VK Chap. 9, LP#6
W 16 Mar	“	
M 21 Mar	Model Physics	D&VK Chap. 10, LP#7
W 23 Mar	“	<i>Final Project Plan Approval</i> Activity #6 Due
M 28 Mar	“	
W 30 Apr	Data Assimilation	D&VK Chap. 12, LP#8
M 4 Apr	“	Activity #7 Due
W 6 Apr	“	
M 11 Apr	“	
W 13 Apr	Post-processing of Models	D&VK Chaps. 17-18, LP#9 Activity #8 Due
M 18 Apr	“	
W 20 Apr	“	
M 25 Apr	<b>Final Project Presentations</b>	<b>Final Project due</b>
Finals Week	<b>Exam II</b>	<b>D&amp;VK 9-10, 12, 17-18, Activity #6-8, lecture notes from 14 Mar – 25 Apr</b>

\*assignment completed before class meets on this date

## Description

“LONG TERM (THURSDAY NIGHT THROUGH MONDAY) . . .  
LOW CONFIDENCE CONTINUES THROUGH 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%
<b>Total</b>	<b>100%</b>

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 **23 March 2022**. 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 23 March. The final project is due on **25 April 2022**.

## **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 4:00 pm on the date they are due and will have an automatic 10% deduction from their final score. Assignments handed in after 4:00 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.

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## **Instructor**

Doug Miller  
232-5158

[http://www.atms.unca.edu/dmiller/  
dmiller@unca.edu](http://www.atms.unca.edu/dmiller/dmiller@unca.edu)

## **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

**(continued)**

### **Office of Academic Accessibility**

UNC-Asheville values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources.

Students who experience a barrier to full access to this class should let the professor know, and/or make an appointment to meet with the Office of Academic Accessibility as soon as possible. To make an appointment, call 828.232.5050; email [academicaccess@unca.edu](mailto:academicaccess@unca.edu); use this link <https://uncaoaintake.youcanbook.me/>; or drop by the Academic Accessibility Office, room 005 in the One Stop suite (lower level of Ramsey Library). Learn more about the process of registering, and the services available through the Office of Academic Accessibility here: <https://oaa.unca.edu/>

While students may disclose disability at any point in the semester, students who receive Letters of Accommodation are strongly encouraged to request, obtain and present these to their professors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester.

### **Sexual Harassment and Misconduct**

All members of the University community are expected to engage in conduct that contributes to the culture of integrity and honor upon which the University of North Carolina at Asheville is grounded. Acts of sexual misconduct, sexual harassment, dating violence, domestic violence and stalking jeopardize the health and welfare of our campus community and the larger community as a whole and will not be tolerated. The University has established procedures for preventing and investigating allegations of sexual misconduct, sexual harassment, dating violence, domestic violence and stalking that are compliant with Title IX federal regulations. To learn more about these procedures or to report an incident of sexual misconduct, go to [titleix.unca.edu](http://titleix.unca.edu). Students may also report incidents to an instructor, faculty or staff member, who are required by law to notify the Title IX Office.

### **Academic Alerts**

Faculty at UNCA are encouraged to use the university's Academic Alert system to communicate with students about their progress in courses. Academic Alerts can reflect that a student's performance is satisfactory at the time the alert is submitted, or they can indicate concerns (e.g., academic difficulty, attendance problems, or other concerns). Professors use the alert system because they are invested in student success and want to encourage open conversations about how students can improve their learning, and students who respond to alerts quickly are consistently more likely to earn credit for the course. Please note, professors of 100-level courses are required to submit at least one alert about each student on or before the seventh week of classes.

When a faculty member submits an alert that expresses a concern, the student receives an email from Academic Advising notifying them of the alert and subsequent registration

hold on their account. To clear the hold, the student must complete a short Google Response Form included in the alert e-mail; the results will be shared with their instructor and advising staff. Instructors may also request to meet with the student to discuss the alert.

Questions about the Academic Alert system can be directed to Anne Marie Roberts ([amrober1@unca.edu](mailto:amrober1@unca.edu)) in OneStop Advising and Learning Support.

### **University Writing Center**

The University Writing Center (UWC) supports writers in one-on-one sessions lasting 10 to 45 minutes. Consultants can help writers organize ideas, document sources, and revise prose. If you visit the UWC, bring a copy of your assignment, any writing or notes you may have, and the sources you are working with. Make an appointment by visiting [writingcenter.unca.edu](http://writingcenter.unca.edu) and clicking on "Schedule an Appointment," or drop in during open hours Monday-Friday.

### **Academic Integrity**

As a community of scholars dedicated to learning and the pursuit of knowledge, UNC Asheville relies on the honesty and academic integrity of all the members of its community. Any act of plagiarism, cheating, or use of unauthorized materials or assistance is academic dishonesty. A person who knowingly assists another in academic dishonesty is likewise guilty of dishonesty. A student committing a first offense of dishonesty will receive a failing grade or a grade of zero for the assignment or test. A student committing a second offense of dishonesty will receive a failing grade in the course and be reported to the Senior Director of Student Success.

In all situations where a student has been disciplined for academic dishonesty, the instructor must submit a brief statement of the case to the Senior Director of Student Success with a copy to the student. The Senior Director maintains records of academic dishonesty incidents and notifies the instructor when a student is found to have multiple offenses. Depending upon the severity and/or repetition of the offense, the Senior Director and/or instructor may recommend that the Provost impose an additional penalty, such as cancellation of graduation with honors, cancellation of scholarships, or dismissal from the university. If the Provost decides that additional penalties are warranted, the student will be notified in writing.

If a student feels that he or she has been unjustly accused of academic dishonesty, the student has ten (10) class days from the date of the instructor's written notification to the student to respond in writing. This response is to be sent to both the instructor and the Senior Director of Student Success. The instructor should then meet with the student to discuss the charges within five (5) class days. If needed, the student may then contact the Senior Director for assistance in identifying options for possible resolution. If needed, the Faculty Conciliator will be contacted to mediate and/or convene the Academic Appeals Board.