AOSC 652: Analysis Methods in Atmospheric & Oceanic Science: Fall 2018

Jeff Henrikson (jhenriks@umd.edu)

MWF, 12:45 pm to 1:50pm, CSS Bldg, Room 3426

Class website: Elms

Text (primary):

Python Programming and Visualization for Scientists (2016) Alex DeCaria
FORTRAN 77 Programming (2nd edition, 1990) by T.M.R. Ellis
Numerical Recipes in FORTRAN: The Art of Scientific Computing (1992) by William Press et al.
Numerical Analysis by Richard L. Burden and J. Douglas Faires

Course Descriptions/Objectives. The objective of the course is to provide students experience in the development of code to solve a variety of numerical problems they are likely to encounter during their dissertation research and subsequent careers in atmospheric and oceanic science. This course is composed of hands on lessons in the development of code to solve a variety of numerical problems and to visualize data in manners common to these fields. Numerical method theory will be taught through the analysis of actual atmospheric and oceanic data records. For instance, the lesson plan on Multiple Linear Regression will be based on analysis of the global mean temperature record, from 1900 to present, tabulated by the Climate Research Unit of the University of East Anglia. The lesson plan focused on Fourier Analysis will be based on the proxy for temperature preserved in the Vostok ice core.

Typically, the Monday and Wednesday class sessions will be devoted to a combination of a lecture and interactive coding examples related to the weekly topic. An assignment will be handed out at the end of the second meeting of each week (on Wed). The third meeting of each week will be largely devoted to in class work on the assigned problem (typically due at the start of the first lecture of the following week) with the instructor present for consultation and encouragement. Assigned problems will be drawn from real world examples of the various topics in atmospheric and oceanic science.

The class is taught in a Computer Instructional Laboratory setting. Students will be exposed to Python and FORTRAN in a Linux environment. We will work with data from NASA satellites written in modern file formats such as HDF5 and NetCDF and students will be exposed to advanced graphical capabilities of Python.

Requirements: Successful completion of freshman physics (PHYS 141) and Calculus III (MATH 241) or their equivalents is required. The course is geared to students with a physical sciences background (i.e., understand differentiation & integration). No prior programming experience is required.

Grades: Grades will be determined based on online quizes (10%), the weekly assigned projects (70%), and a final project (20%) that will be chosen either by each student or from a list of suggested final projects. The last week of class will be devoted to the final project. The final project will emphasize application of the tools of the class to a problem of current interest in the geophysical sciences. Late assignments grades will lose 20% per day late.

Know your rights!

For more information regarding your rights as a student and the University policies that cover missed classes, please visit the following website:
http://www.ugst.umd.edu/courserelatedpolicies.html

Academic Accommodations:

If you have a documented disability, you should contact Disability Support Services 0126 Shoemaker Hall. Each semester students with documented disabilities should apply to DSS for accommodation request forms which you can provide to your professors as proof of your eligibility for accommodations. The rules for eligibility and the types of accommodations a student may request can be reviewed on the DSS web site at:
http://www.counseling.umd.edu/DSS/receiving_serv.html

Religious Observances:

The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance. Notice should be provided as soon as possible but no later that the end of the schedule adjustment period. Prior notification is especially important in connection with final exams, since failure to reschedule a final exam before the conclusion of the final examination period may result in loss of credits during the semester.

Weekly Schedule

Week	Topic
01	Intro to Linux & Text Editing
02	Intro to Python, Simple Computation & Graphics
03	Intro to Graphics & Analysis of Satellite Measurements of Atmos. Comp.
04	Least Squares Analysis, Statistical Regression, and Spline Fitting
05	Satellite Data Visualization
06	Numerical Integration
07	Root Finding & Newton Raphson Minimization
08	Fourier Analysis; HDF & NetCDF File Formats;
09	Multiple Linear Regression; File Management
10	Intro to FORTRAN, Simple Computation
11	Getting to know FORTRAN: Data Sorting, Input/Output, and Simple Statistics
12	Intro to Parallel Computation
13	Short week due to Thanksgiving: review of past assignments
14	Work on computational project
15	Continue work on computational project (Mon, Wed) and present projects (Fri)
16	Finish Presenting Projects (Mon)