

**Scientific Analysis and Modeling with Computer Programming**  
**Geography 404/504**  
**Three credits**  
**T/Th 9:30-10:45 am**  
**CNR 026**

With the proliferation of rapid scientific observations, statistical and simulation models, and remote sensing in recent years, there exists a need for individuals who can address scientific questions with computing methods more flexible, advanced, or detailed than available in graphical user interfaces. In this class, we will learn to utilize computer programming for scientific analysis. Topics include: review of basic programming and the programming environment; array manipulation and analysis; file and data input and output; handling missing data; interaction among different programming tools, including existing models and software; time series and spatiotemporal analysis; uncertainty and sensitivity analysis. Students will apply their learning to hands-on laboratory exercises designed to reinforce the lecture material. Students will also work on a project of their choosing.

#### I. Course Information

##### Instructor

Dr. Jeffrey Hicke  
McClure Hall 305D  
208-885-6240  
jhicke@uidaho.edu  
Office hours: Tuesdays, 10:45-noon; Wednesdays, 11-noon (both in CNR 26 computer lab); or by appointment.

##### Readings

Text (required): Gumley, Liam E. 2002. Practical IDL Programming. 1st Edition. Morgan Kaufmann.

Other useful texts:

Bowman, K. P. 2005. An Introduction to Programming with IDL: Interactive Data Language. Academic Press.  
Fanning, D. W. 2005. IDL Programming Techniques. Fanning Software Consulting.  
Kaplan, D. T. 2004. Introduction to Scientific Computation and Programming. Thomson. [uses Matlab]

Other sources of information:

IDL help manuals  
online information about IDL syntax (e.g., [www.dfanning.com](http://www.dfanning.com))

I will discuss sections from much of the Gumley book, but will liberally supplement with concepts and examples drawn from a number of sources, including my own examples. Please come to class having already read the assignments.

You will be responsible for the materials covered in class and the assigned readings.

You may be interested in purchasing a student version of IDL (Windows only?) for \$89 from ITT (RSI).

There is a Blackboard web site set up for this class that contains a calendar as well as a monitored forum for asking and answering questions of other students.

##### Goals of this course

The overarching goal of this course is to familiarize you with computer programming to aid you in analyzing or modeling scientific processes. I will use IDL in this course because I am familiar with it. However, I will try to avoid teaching concepts specific to IDL that will not be useful when using other programming environments or languages. I will strive to balance the teaching between what you need to learn about IDL with what you need to learn about computer programming to perform scientific analysis and modeling. You will leave this course with general knowledge about how to use programming as a powerful tool for scientific analysis and modeling, applicable when using any programming language.

By the end of the semester, you will:

- experience the capabilities of computer programming compared with other forms of analysis (e.g., Excel, GUIs)
- learn the general syntax of the IDL language
- be able to write efficient, clear, and commented subroutines and programs
- understand how to use computer programming to develop a model or perform some analysis
- complete a class project applying what you have learned to a topic of your choice

Prerequisites: An introductory computer programming class or permission of instructor.

Class communication: I will be emailing the class from time-to-time with important news and updates. Please check your uidaho.edu email account regularly.

##### Lab Information

- Unlocked hours: 8:30 am to 5 pm
- Access after hours by Vandal card
- There will be one userid and password for the class
- Use of disk space: on each lab computer, there is a folder named C:\geog504. Please create a folder with your last name under this, and confine your data/code to this folder...files in other locations will be deleted. All files will be deleted one week after the semester ends.
  - I would suggest you keep your code and data on a thumb drive, giving you flexibility about which computer to use
  - You may wish to back up your code to a folder under C:\geog504.
- You have access to a printer, but please limit your use

#### II. Grading

Grades will be assigned based on the following:

Homeworks	20%
Class Project	35%
Midterm	20%
<u>Final Exam</u>	<u>25%</u>
Total	100%

1. In-class assignments: Each Thursday, and some Tuesdays, I will provide an in-class, ungraded assignment for you to work on during the last part of class. Although not graded, these assignments will be invaluable for your learning and for completing the homework assignments, exams, and class project.

2. Homeworks: Homework will be assigned about every two weeks. The homework will apply the information covered in the lecture and in the in-class assignments. You can work on homeworks with other students, but what you turn in must be your own work and words.

To turn in your homework, please email me your code, plots, and write-up.

3. Class project.

You will do a class project that applies computer programming to a problem or analysis of your choice. See project description document sheet for more information.

4. Midterm and final. Both exams will be take-home. You are expected to do your own exam and not work with other students or speak to them about the exam. Dates:  
Midterm: hand out Feb. 21; due Feb. 28  
Final: hand out May 1; due May 8

Graduate students: In addition to the undergraduate work, graduate students will:

1. Answer additional questions in the homeworks and exams.
2. Produce a more in-depth class project and presentation.
3. Be graded separately from the undergraduate students.

### III. Tentative schedule (subject to change based on progress)

Week	Topics
1-6	Introduction to IDL: writing programs; data I/O; plotting
7-13	Programming applications: quality control/gap filling, time series analysis, spatiotemporal analysis, uncertainty/sensitivity analysis; mapping
14-15	Student presentations

Topics we will not cover: intricate details of IDL syntax; object-oriented programming; development of graphical user interfaces

### IV. Course policies

#### Missed exams/late assignments

I allow makeup exams in only the most extreme situations (e.g., dire sickness), and I require written verification in any situation (e.g., note from doctor). Late assignments will have 33% of the points deducted for each day late (i.e., homework turned in after class will have 33% of the points deducted; the next day, 66% of the points deducted; the following day, 100% of the points deducted). For the homeworks, once during the semester you can turn in a homework assignment up to 3 days late.

#### Academic dishonesty

Cheating or plagiarism will not be tolerated. Your work must be your own. Do not copy or plagiarize the work of others. If you are caught, you will receive no credit for that work, whether it is a homework assignment or an exam, and you will be referred to the Dean of Students for further disciplinary action. Depending on the seriousness of the plagiarism or cheating offense, you could be expelled from the university. I encourage you to discuss homeworks and assignments, but you must do your own work. The University of Idaho's policy on cheating is described in Article II of the UI Student Handbook or at <http://www.students.uidaho.edu/default.aspx?pid=56186>.

#### Additional information

Reasonable accommodations are available for students who have a documented disability. Please notify the instructor during the first week of class of any accommodation(s) needed for the course. Late notification may mean that requested accommodations might not be available. All accommodations must be approved through Disability Support Services located in the Idaho Commons Building, Room 333. Disability Support services can be contacted at 885-7200, email at [dss@uidaho.edu](mailto:dss@uidaho.edu), and via their website at [www.access.uidaho.edu](http://www.access.uidaho.edu) or [www.webs.uidaho.edu/aap](http://www.webs.uidaho.edu/aap).