Course Syllabus

Time: Monday, Wednesday, Friday, 5th period (11.45 - 12.35)
Location: 214 Williamson Hall / online
Instructor: Prof. Juliane Dannberg
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Office Hours: Friday, 12.35 p.m. - 2 p.m. noon, or by appointment

Welcome to GLY4450/GLY5455, Introduction to Geophysics!

In this course, we will look at the structure and the motion of material in the Earth's interior. This includes answering questions such as:

- What is plate tectonics and what causes plates to move?
- What processes lead to volcanism and where is melt present in the Earth's interior?
- What are the major structures inside the Earth and what processes lead to the formation of these structures?

We will use tools from mathematics and physics, and in particular computer modeling, to address these questions. In addition, we will discuss the constraints on these problems provided by paleomagnetism, mineral physics, seismology, volcanology, geochemistry, petrology, and other disciplines.

Prerequisites: 1 year of calculus and 1 year of college physics or consent of instructor.

Textbooks:
Turcotte & Schubert, *Geodynamics*, Second Edition, Cambridge University Press.
Schubert, Turcotte & Olson, *Mantle Convection in the Earth and Planets*, Cambridge University Press.

Materials: Most of the exercises will require a computer to complete them. We will discuss and install the required software together in class, but it is important that you bring your computer so that you can get help with the installation, and can participate in all of the exercises.

Projects and grading

Your grade in this class will be determined by how you do in the 4 writing assignments, and in your final presentation, specifically:

- Writing assignment 1 (worth 20%)
- Writing assignment 2 (worth 20%)
- Writing assignment 3 (worth 20%)
- Writing assignment 4 (final project, worth 30%)
- Final presentation (worth 10%)

What each of these assignments involves and when it is due will be discussed for each assignment individually. I will upload detailed descriptions of each assignment throughout the semester. The assignments will all involve thinking and writing, not just doing – you will find that you will be better off if you start working on them early. You will need to present one of these assignments to the class at the end of the semester. There will be no midterm or final exams.

To aid you with the writing portion of the course, we will run peer review sessions before reports are due (see below), and I will leave detailed comments during grading of earlier reports that will help you in writing the later ones.

Information on current UF grading policies for assigning grade points can be found here: catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/ (http://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/) .

If you have a good reason for submitting an assignment late, and talk to me about this before the assignment is due, I usually allow one assignment over the whole semester to be submitted late by up to three days, without any penalty. Otherwise, I will still accept late submissions of assignments up to one week after the original due date, and you will receive 85% of the credit.

Grading scale

Name:	Range:	
A	100 %	to 94.0%
A-	< 94.0 %	to 90.0%
B+	< 90.0 %	to 87.0%
B	< 87.0 %	to 84.0%
B-	< 84.0 %	to 80.0%
C+	< 80.0 %	to 77.0%
C	< 77.0 %	to 74.0%
C-	< 74.0 %	to 70.0%
D+	< 70.0 %	to 67.0%
D	< 67.0 %	to 64.0%
D-	< 64.0 %	to 61.0%
F	< 61.0 %	to 0.0%

Course objectives

As there are so few observations available about the structure and dynamics of the Earth's interior, models are an essential tool to understand what is happening inside the Earth. Modeling is about describing the world around us in a mathematical way, and my primary goal for this course is to teach you the way we come up with geophysical models, to extract information from them, and to write and communicate about them. This includes questions such as: What can a specific model tell us about the physical processes in the Earth? How do different model parameters influence these processes? How can we use observations to make sure a model is consistent with what we know about the Earth?

Our goal here is not to derive a mathematical formula that is “correct”. Rather, we will try to come up with one that in mathematical terms describes what we think happens in the Earth, but that is still, probably, only an approximation of reality. Estimating and evaluating how good an approximation it is to reality is an important second step, as is assessing which of multiple possible models matches real data best. It is this process that I want to teach you.

Additional objectives I have for this course are:

- To make you familiar with a range of tools that can be used to solve partial differential equations: Most models you will encounter in life are stated in terms of formulas that do not allow simple solutions with paper and pencil. Rather, they will require the use of computers, and knowing the right tools and how to operate them is an important skill.
- To be able to communicate results through presentations and comprehensive reports: Working in teams and exchanging information is a part of daily life. Doing so concisely and efficiently is something you can learn and practice, and we will do so in this class.

Research, citations, plagiarism, peer review

Your writing assignments will require you to find data and resources in the library, on the internet, or elsewhere. Using what others have done before is part of research, but you must clearly label what is your work and what you got from elsewhere. In other words, you must make it obvious to the reader if you are directly quoting what others have written and you must provide references to original sources of both quotes and ideas you are using. If you don’t, this is called plagiarism, and it is not acceptable – neither in this class, nor anywhere else in life. People lose their jobs by plagiarizing others, and you will get zero points on your assignments if you do. In other words: don’t. If you use what others have said or written, give credit where credit is due. Since writing is such an important part of this class, we will also peer review each other’s work. This implies that others will get to see what you are writing for your assignments. This may seem intimidating at first, but it is really the best way to write a project to let others around you give feedback, tell you what worked and what didn't, which parts were unclear, etc., before you give your report to me. Reading what others write also gives you an idea of the level at which this class operates, and whether you need to step up or can relax a bit. If you would like to use an idea of one of your classmates in your report, discuss this with the person who had it and if you do incorporate it provide adequate credit in the form of a reference. You can never copy or use a classmate's work without their consent and without proper attribution.

References:
Some of these policies are taken and/or modified from the class **MATH 442 at Texas A&M (https://www.math.colostate.edu/~bangerth/teaching/2015-fall-442/first-day-handout.pdf)** that I co-taught with Prof. Wolfgang Bangerth.

Schedule

Week 1	Introduction, the big picture, using Linux and the geodynamic modeling software ASPECT
Week 2	Heat flow: Observations and theory, mid-ocean ridges, seafloor spreading, cooling of plates, connections to the magnetic field
Week 3	Heat flow: terms in the heat flow equations and their effects, the mantle geotherm
Week 4	Global mantle convection and Stokes flow, lithosphere and asthenosphere
Week 5	Global convection & seismic observations: seismic tomography, how to use seismic models in geodynamics
Week 6	Mantle plumes and hot spots, observations from the gravity field, the geoid and dynamic topography
Week 7	Elasticity & Flexure: Ocean islands, volcano chains and bending of the lithosphere/crust
Week 8	Rheology & Phase transitions: creep mechanisms, the viscosity structure of the Earth, phase transitions
Week 9	Subduction: Forces acting on the subducted plate and how to model them
Week 10	Melting and melt migration: Where is met generated in the Earth and how does it move?
Week 11	Chemical geodynamics: What is the composition of the Earths, what chemical reservoirs exist in the deep Earth, and what material do they represent?
Week 12	Stress and Strain; Faults and Earthquakes
Week 13	Bonus topic by student input/request
Week 14+15	Final presentations

Attendance and make-up exams

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: **catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/ (http://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/)**

Policy on Zoom Presence

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

You will need to present one of the 4 assignments to the class at the end of the semester. For this presentation, you will have to participate with your audio and video switched on.

Accommodations for students with disabilities

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting **https://disability.ufl.edu/students/get-started/ (https://disability.ufl.edu/students/get-started/)**. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Online course evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at **gatorevals.aa.ufl.edu/students/ (http://gatorevals.aa.ufl.edu/students/)**. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via **ufl.bluera.com/ufl/ (http://ufl.bluera.com/ufl/)**. Summaries of course evaluation results are available to students at **gatorevals.aa.ufl.edu/public-results/**