General

The course will cover general methods we use to understand data and the application of appropriate models that can tell us more about the solid-earth system. Starting with data, we will cover probability theory, data distributions, hypothesis testing, data filtering. From here, we will explore how we use the observed data to better constrain models of earth structure and behavior. We will start with simple linear inverse methods, examine ill-posed problems and regularization methods, followed by iterative, non-linear, and stochastic inverse methods. Upon completion of this course, we expect participants to be able to understand basic geophysical inverse methods, and be able to properly examine, evaluate and prepare existing and novel data for better earth model development and understanding.

Office Hours: We will be open to your communications primarily online, and will focus on establishing one-on-one and small group meetings when necessary. Canvas messages/Email are preferred for quick, short-answer questions, particularly about logistics. However, if you've run into a conceptual block, or would like to discuss a topic in more detail, this is best done by appointment.

Required Text: None.
We will be providing a number of e-books and other digitally available material necessary for success in this course.

Required Electronics: Students must have a computer with reliable high-bandwidth internet, a functional webcam, speakers, and microphone (mic'ed-headphones are fine). A quiet and minimally disruptive environment for online activities and study are important.

Online Resources and Communication: Canvas is the primary organizational resource for information about the class. Lectures are planned to be live or pre-recorded with discussion to follow. We will be using The BlueJeans Meeting schedule within Canvas for classes unless you hear otherwise during the semester. All lecture material will be recorded and available on Canvas. Being at class and on-time is essential for performing best in this course.
Communication is planned through Canvas using either the internal email-like application, Canvas announcements, or discussion. If you need to email us outside of Canvas, please identify `[EAS 6314]` at the beginning of the subject line.

Health: For any face-to-face contact, all are expected to have a good mask covering their mouth and nose at all times when inside. All interactions should be with at least 6 feet of separation. Materials and discussions are planned to be made available for remote instruction when necessary. Your safety, that of your families, and ours are of the utmost importance, followed by a quality education. More information on GT guidance with regards to face-coverings and other COVID-related information is available at: *http://health.gatech.edu/coronavirus/students*

Students with Disabilities: If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or `http://disabilityservices.gatech.edu`, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail us as soon as possible in order to set up a time to discuss your learning needs.

Evaluation

Quizzes (40%): Approximately every 2 weeks we will have a brief quiz ($\sim$20 min) on the prior material (mostly following prior quiz). These may be administered through Canvas, and can only be taken at that time. The lowest quiz grade is dropped.

Homework (40%): Approximately every 2 weeks we will assign homework that will be normally due one week later. These will primarily/entirely consist of computer-based exercises. Homework will be submitted electronically through canvas and must be clearly organized and presented, and points may be deducted for poorly-organized and difficult to interpret information. The lowest homework grade is dropped.

Term Project (20%): Term projects will consist of a written report and in-class presentation of a specific data-driven inverse problem that may be related to your research. More details will come during the semester.

Attendance: You are expected to attend the class either in-person or remotely. If health-measures require, we may move to fully-online instruction for some fraction of the course. We will not be taking direct attendance. In any serious situation that precludes your participation in class (death in the family, serious illness, etc.) you should contact the Dean of Students as they are there to help you in these cases (`http://www.deanofstudents.gatech.edu/`).

Course Grade: Your grades will be based on your performance during quizzes, homework assignments, and a term project, with their relative weight listed above.

- Letter Grade: A $\geq$ 90% > B $\geq$ 80% > C $\geq$ 70% > D $\geq$ 60% > F

- Satisfactory/Unsatisfactory: S $\geq$ 70% > U

Academic Honesty

General: It is expected that all students are aware of their individual responsibilities under the Georgia Tech Academic Honor Code, which will be strictly adhered to in this class. The complete text of the Honor Code may be found at: `http://honor.gatech.edu`.

Student-Faculty Expectations

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgment, and responsibility between faculty and students. Please see `http://catalog.gatech.edu/rules/22/` for some basic expectation that we should have of each other. Ultimately, we should respect each others

time, hard work, and quest for knowledge. We all should strive to build an environment for cordial and effective interaction.

Pathway to success:

Students would do best in this course if they keep up with reading, actively participate in lecture, turn in assignments on time, and rapidly seek help if they begin to fall behind, or are having difficulty with a topic. When prepping for quizzes, it is wisest to focus on content that was discussed in lecture rather than material only covered in the reading material.

Lectures

Week	Topic	Comments
Understanding Data:		
1	Introduction, Data/Model relationship	
2 (Q; Jan 19)	Probability Theory and Randomness	*No class (Jan 17) on MLK*
3	Data distributions (single-variable)	
4 (Q)	Data distributions (multi-variable)	
5	Parameter Estimation	
6 (Q)	Hypothesis Testing	
7	Data filtering (incl. Fourier series)	
Inverse Methods:		
8 (Q)	Inverse problems and Lin. Algebra review	
9	Linear Least Squares Inversion	
10 (Q)	Ill-posed Inversions	
–	–	*Spring Break*
11	Regularization	
12 (Q)	Iterative methods	
13	Non-linear problems	
14 (Q)	Stochastic Inversions and Presentations (Apr 20)	
15 (Apr 25)	Presentations (continued)	*Last class day*
Topics and timing are subject to change during the semester.		
(Q)uizzes mostly every-other Monday		

Campus Resources for Students

In your time at Georgia Tech, you may find yourself in need of support. Below you will find some resources to support you both as a student and as a person.

Academic support

- Center for Academic Success http://success.gatech.edu:

    - 1-to-1 tutoring http://success.gatech.edu/1-1-tutoring
    - Peer-Led Undergraduate Study (PLUS) http://success.gatech.edu/tutoring/plus
    - Academic coaching http://success.gatech.edu/coaching

- Drop-in tutoring for many 1000 level courses: *Residence Life's Learning Assistance Program: https://housing.gatech.edu/learning-assistance-program*

- Group study sessions and tutoring programs: *http://omed.gatech.edu/programs/academic-support*

- Individualized help with writing and multimedia projects: *Communication Center (http://www.communicationcenter.gatech.edu)*

- Academic advisors for your major: *http://advising.gatech.edu/*

Personal Support at Georgia Tech Resources

- The Office of the Dean of Students: http://studentlife.gatech.edu/content/services; 404-894-6367; Smithgall Student Services Building 2nd floor: *You also may request assistance at https://gatech-advocate.symplicity.com/care_report/*

- Counseling Center: http://counseling.gatech.edu; 404-894-2575; Smithgall Student Services Building 2nd floor

    - Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, referral services, and crisis intervention. Their website also includes links to state and national resources.
    - Students in crisis may walk in during business hours (8am-5pm, Monday through Friday) or contact the counselor on call after hours at 404-894-2204.

- Students' Temporary Assistance and Resources (STAR): http://studentlife.gatech.edu/content/need-help: *Can assist with interview clothing, food, and housing needs.*

- Stamps Health Services: https://health.gatech.edu; 404-894-1420: *Primary care, pharmacy, women's health, psychiatry, immunization, allergy, health, nutrition*

- OMED: Educational Services: http://www.omed.gatech.edu

- Women's Resource Center: http://www.womenscenter.gatech.edu; 404-385-0230

- LGBTQIA Resource Center: http://lgbtqia.gatech.edu/; 404-385-2679

- Veteran's Resource Center: http://veterans.gatech.edu/; 404-385-2067

- Georgia Tech Police: 404-894-2500