

Volcano Monitoring (GEOSC-234)

Spring 2025 Syllabus

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Class/ Lab Schedule: Thu 1.00-4.00 PM **Class/Lab Location:** Labs will be conducted in rooms 1033 and 3019 in the Taylor Science Center based on the contents that week, location details will be confirmed before each lab.

Welcome to Volcano Monitoring!

The dynamic nature of volcanoes and the associated hazards make it crucial for geoscientists to decipher and monitor volcanic activity. In this course, we will explore various types of volcanism, types of volcanic hazards, and associated strategies and challenges in monitoring them. Using case studies we will explore various geophysical, remote sensing, and geochemical monitoring methods used to study volcanoes around the world.

Educational Goals and Learning Outcomes

Hamilton College challenges its students to foster the fulfillment of the eight educational goals throughout their time at the College. Below is a description of how the expected learning outcomes of this course promote several of these goals:

- **Intellectual Curiosity and Flexibility** - Students will examine facts, phenomena, and issues about volcanoes in depth to gain a better understanding of their hazards, current monitoring capabilities, and outlook and efforts to increase these capabilities.
- **Aesthetic Discernment** - Students will learn to evaluate and describe patterns in ground deformation, seismic, and gas monitoring data.
- **Analytic Discernment** - Students will learn basic concepts in the scientific field of volcanology. They will also learn how to analyze and interpret data from a variety of volcano monitoring methods to make inferences about the state of the volcano.
- **Disciplinary Practice** - Students will engage in the focused practice of disciplinary techniques and methods in geophysics, remote sensing, and geochemistry commonly used to monitor volcanoes.
- **Creativity** - Students will utilize data-driven approaches to develop original ideas and interpretations about volcano alert levels and communicating risk.
- **Communication and Expression** - Students will learn to communicate and express their interpretations about the state of a volcano in both written and oral forms through formal presentations and informal classroom discussions. They will discuss ways to communicate information about risk to help people make informed decisions to mitigate the effects of a potential volcanic hazard.
- **Ethical, Informed, and Engaged Citizenship** - Students will be asked to consider and evaluate how exposure to natural hazards and their impacts is distributed across different regions. They will engage in discussions to develop strategies for evaluation and dissemination of research on volcanic risk.

Quantitative & Symbolic Reasoning (QSR)-Intensive designation:

This course meets the College's expectations for the QSR-Intensive designation. Therefore, this class will:

- Include material in at least one of the following three categories:
 - **Statistical Analysis** - The use of statistical analysis to describe data and make inferences.
 - **Mathematical Representation** - The use of mathematical models such as those based on graphs, equations, and geometric objects to represent patterns, relationships, and forms.
 - **Logic and Symbolic Reasoning** - The use of formal logic or symbolic reasoning such as in the following examples: the proper construction of a computer program or a formal proof; the analysis of language in linguistics; or the study of music theory.
- Include four or more graded assignments (tests, quizzes, problem sets, labs, oral presentations, exhibits) in at least one of the three categories described above. QSR projects will be substantial and will be distributed across the semester.
- Provide explicit instruction in problem-solving or data analysis techniques and strategies specific to the level and content of the course.

Textbook and Readings

There is no required textbook for this course. We will refer to some of the chapters from Volcanic Hazards, Risks, and Disasters (2015) by John F. Shroder & Paolo Papale which is available through the Hamilton College library. Additional readings will be uploaded on Blackboard.

Course Schedule

Dates	Topic	Assignments
Part 1: Introduction		
Week 0 & 1 (Jan 22 to Jan 24)	Global distribution of active volcanoes	
Week 2 (Jan 27 to Jan 31)	Types of volcanic hazards and risk. Overview of monitoring methods.	
Part 2: Monitoring Methods		
Week 3 (Feb 3 to Feb 7)	Ground deformation observations - What do they tell us about the state of the volcano?	Quiz 1# Volcanic hazards and risk (Due Wed Feb 5 at 4 PM)
Week 4 (Feb 10 to Feb 14)	Case study #1 - Monitoring using ground deformation observations (levelling & GPS)	
Week 5 (Feb 17 to Feb 21)	Case study #2 - Monitoring using ground deformation observations (InSAR)	
Week 6 (Feb 24 to Feb 28)	Seismological observations - What do they tell us about the state of the volcano?	Quiz 2# Ground deformation monitoring (Due Wed Feb 26 at 4 PM)
Week 7 (Mar 3 to Mar 7)	Case study #3 - Monitoring using seismological observations (Volcanic earthquakes)	
Week 8 (Mar 10 to Mar 14)	Case study #4 - Monitoring using seismological observations (Seismic tomography)	Quiz 3# Seismic monitoring (Due Wed Mar 12 at 4 PM)
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Course Schedule – continued from previous page

Dates	Topic	Assignments
Week 9 (Mar 17 to Mar 21)	Spring recess	
Week 10 (Mar 24 to Mar 28)	Spring recess	
Week 11 (Mar 31 to Apr 4)	Presentations	Mid-term Assignment (Due in class on Thurs Apr 3)
Week 12 (Apr 7 to Apr 11)	Volcanic gas measurements - What do they tell us about the state of the volcano? Case study #5 - Monitoring using volcanic gas measurements (SO ₂ flux, CO ₂ flux, Multi-GAS)	
Part 3: Informed decision-making and risk communication		
Week 13 (Apr 14 to Apr 18)	Deterministic vs probabilistic approaches. Physical vs statistical models. Probabilistic Volcanic Event Trees.	
Week 14 (Apr 21 to Apr 25)	Case study #6 -Integrated monitoring efforts - Integrating various data from various agencies. Exploring the role of machine learning and other automation tools.	Quiz 4# Gas monitoring, Probabilistic volcanic event trees (Due Wed Apr 23 at 4 PM).
Week 15 (Apr 28 to May 2)	Risk Communication and role of society.	
Week 16 (May 5 to May 9)	Developing & communicating volcano alert levels.	
Week 17 and 18 (May 12 to May 19)	Finals	Final exam (Due Thu May 15 at 10 PM)

Office hours

Scheduled office hours Mon 1.30-2.30 PM, Wed 3-4 PM, or by appointment. Scheduled office hours will be held in my office in the Taylor Science Center, Room 1022. Other appointments may be held via Zoom or in-person. Office hours are an opportunity for you to get to know me and for me to get to know you. While you are welcome to drop by directly during office hours, to ensure that all of you get an opportunity to talk, I highly encourage you to reserve a 20-minute slot via Calendly a day in advance (https://calendly.com/skanakiy-hamilton/office_hours_20min_reservation). If you can briefly mention what you would like to talk about, that would also help me come more prepared. Note that the time slots on Calendly are not meant to limit your time to 20 min but rather ensure that everyone who wants to come to office hours has an opportunity to talk. We can always find additional time outside of office hours to discuss more. Come with questions about the volcano monitoring class, getting involved in research, career-related questions, or anything else you feel like chatting about. My goal is to help you succeed at Hamilton and beyond and I am here to help you in any way I can.

Grading

The final grades will be determined at the semester's end based on the aggregate grades for each of the below assessment criteria. The quizzes will be in multiple-choice and/or short-answer format. Course grades will be assigned on the below scale.

Assessment Criteria	
Assessments	Percent of final grade
Weekly class/lab exercises	30%
Mid-term Assignment	15%
Homework Readings & Class Participation	5%
Quizzes	35%
Final exam	15%

Grading Scale	
Grade values	Grade
97-100%	A+
93-96.9%	A
90-92.9%	A-
87-89.9%	B+
83-86.9%	B
80-82.9%	B-
77-79.9%	C+
73-76.9%	C
70-72.9%	C-
67-69.9%	D+
63-66.9%	D
60-62.9%	D-
< 60%	F

Student Resources

Support services such as the Writing Center, Quantitative and Symbolic Reasoning Center, Oral Communications Center, and Language Center are available to all students for all courses through Hamilton College.

- **Writing Center:** <https://my.hamilton.edu/academics/centers/writing>
- **Oral Communication Center (OCC):** <https://my.hamilton.edu/academics/centers/oralcommunication>
- **Quantitative & Symbolic Reasoning Center (QSR):** <https://my.hamilton.edu/academics/centers/qsr>
- **Language Center:** <https://www.hamilton.edu/academics/centers/languagecenter>

College & Classroom Policies

Attendance

Most of this course involves hands-on data analysis, discussion of materials, and group work. It is therefore expected that students attend all classes and labs. If you must miss a class or lab, please inform the instructor by email as soon as possible and arrange to obtain notes and information from a classmate. You will still be held responsible for the content, materials, and discussion that you missed. If any extenuating circumstances will prevent you from attending class for an extended period (e.g. severe illness) please contact the Instructor as soon as possible to work out a plan. If any circumstances prevent me from coming to a class, I will inform you through email in advance or through a colleague on the day.

Honor Code

All students are required to read and abide by the Hamilton College Honor Code (<http://www.hamilton.edu/student-handbook/studentconduct/honor-code>). Academic integrity is expected at all times. If you are not clear on how the Honor Code applies to activities and assignments specific to this course, please be sure to ask for clarification.

Classroom Conduct

I want this class to be welcoming for all students and an environment where everyone can freely ask questions, discuss their ideas even if they are conflicting, and help each other learn. We are on this journey together and an environment of mutual respect will create a positive learning experience for everyone involved. All students are expected to familiarize themselves and abide by the Hamilton College Code of Student Conduct.

Accommodations

I want to ensure that this class is accessible to all students. Hamilton is committed to making reasonable accommodations for students with properly documented disabilities. If you are eligible to receive an accommodation(s) and would like to make a formal request for this course, please discuss it with the Instructor within the first two weeks of the semester. You will need to provide the Assistant Dean for Accessibility Resources with appropriate documentation of your disability at the start of the semester. More information is available at <http://www.hamilton.edu/student-handbook/other/disability-support-services>. I request that any student with a documented disability needing academic adjustments or accommodations make an appointment to speak with me within the first two weeks of the semester. All discussions will remain private/confidential.

Late Work

If there is ever a need to submit work late, please inform the instructor 48 hrs before the work is due and obtain approval. Work submitted late without informing and receiving approval from the instructor will count against the final grade. If there are extenuating circumstances (e.g., death in the family, severe illness) that prevent you from coming to class for any in-class graded work, talk to the instructor about the possibility of a make-up assignment.

Use of Technology

Feel free to use laptops/ tablets to take notes in class if you prefer. All cell phones must be silenced and put away during class, lab, and field trips. If you suspect an emergency and need to take a phone call, feel free to step out of the classroom to take the call. Many class activities will require the use of a laptop. I will let you know in advance to bring a laptop along when needed. Use of technology other than for normal course-related work is not permitted during class, lab, or fieldwork.

Safety

Safety should be everyone's primary concern. I will let you know if any lab/ class activity requires special safety measures. If in doubt, err on the side of caution and ask the instructor. Always remember that you are responsible for not only your safety but for the well-being of those around you.

Support for Mental Health

There are times when each of us feels overwhelmed, anxious, or depressed. There are many resources available on campus to support you:

- Counseling Center (www.hamilton.edu/offices/counselingcenter, 315-859-4340) located at 100 College Hill Road offers individual and group therapy, peer counselors, psychiatric treatment, and a 24-hour hotline. Press option 2 to speak with a counselor 24/7/365
- Associate Dean of Students for Student Support Services Sarah Solomon (ssolomon@hamilton.edu)
- Associate Dean of Students for Academics Adam Van Wynsberghe (avanwyns@hamilton.edu)
- Your faculty advisor
- Your RA and Area Director in your residence hall

If at any time you feel suicidal or in danger of harming yourself or others, reach out for support! The Hamilton community cares and is available to help. Campus Safety is available 24/7 for urgent concerns (315-859-4000), as is the Counseling Center (315-859-4340 opt 2).

Disclaimer

The syllabus and schedule are meant to be comprehensive. However, if adjustments are needed as we progress through the course, I will inform you of any changes made and provide an up-to-date syllabus on Blackboard. Furthermore, in the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within the timeframe. I will provide an updated syllabus should such a need arise which will supersede this version.