

FYSEMR 23I: Earth Science Goes to the Movies: Math and Physics of Natural (?) Disasters



- **FYSEMR 23I**
- **Harvard College/Graduate School of Arts and Sciences:** 160219
- **Term:** 2023 Fall / Full Term
- **Course Instructor(s):** Miaki Ishii
- **Location:** Geological Museum 204 (FAS)
- **Meeting Time:** Wednesday 03:00 PM - 05:45 PM
- **Exam Group:** FAS16_C
- **Course Description:**

Natural disasters such as earthquakes, tsunamis, tornadoes, hurricanes, and volcanic eruptions can have devastating effects on society, but are often over-exaggerated for the silver screen. How can we tell what is believable and what is not? Participants in this seminar will watch one Earth-science related movie each week, will learn background about the science behind the natural disasters portrayed on film, and then will apply math and physics concepts and equations to develop "back-of-the-envelope" calculations that assess realism. Students will be exposed to a wide variety of Earth-science topics and should walk away not only with the ability to point out flaws on-screen, but also the ability to explain natural phenomena in the world around them.

- **Notes:** Students are expected to attend Tuesday evening movie viewing sessions (time TBD). This seminar is highly participatory and collaborative, and students should be ready to engage not only with the material, but also with one another.

Students are required to attend classes and expected to attend movie viewing on Tuesdays from 19:00 in the 3D visualization lab starting September 19th.

Course Requirements

Students must:

- Be comfortable with high-school level math and science

- Attend class
- Actively participate in class discussion
- Complete weekly assignments and work closely with fellow students
- Attend group viewing of each film on Tuesday evening

Course Structure

- Each week's movie will be screened for the class via zoom on Tuesdays from 19:00.
- Class meets once a week.

Weekly Assignments

These assignments consist of readings relevant for the natural phenomena depicted in the movie for the week, identification of some scenes from the movie, and some calculations associated with topics covered in class.

Final Project

The final project is to create a proposal for a blockbuster GeoSciFi movie plot based upon concepts learned in class. This will be completed in a group of 2 to 5 students. Each proposal will include at least one violation of the laws of physics, a proposed movie poster, and one quantitative assessment of the reality of a component in the plot. Each group will present the plot to the class, and will write up an outline of the plot as a final written report.

Teaching Staff

Instructor: [Miaki Ishii](http://seismology.harvard.edu/ishii.html) (<http://seismology.harvard.edu/ishii.html>)

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Teaching Fellow: Thomas Lee

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Office Hours: Tues 15:00-16:00 (appointments by request, just email me!)

Office: Geological Museum 202A

Tentative Course Outline

Week*	Movie	Topic
Week 1	Introduction	Preparation for the Montserrat RPG
Week 2	Montserrat Role Playing Game	
Week 3	<i>Dante's Peak</i> (1997)	Volcano Monitoring
Week 4	<i>Twister</i> (1996)	Tornadoes
Week 5	<i>San Andreas</i> (2015)	Earthquakes
Week 6	<i>The Core</i> (2003)	Geomagnetic Storms
Week 7	<i>The Day After Tomorrow</i> (2004)	Climate Change
Week 8	Vorti City Role Playing Game	
Week 9	<i>Armageddon</i> (1998)	Asteroid Impacts
Week 10	<i>Volcano</i> (1997)	Volcanic Eruption
Week 11	<i>Deep Impact</i> (1998)	Tsunamis
Week 12	<i>2012</i> (2009)	Too much to choose from here...

Montserrat Role Playing Game

For the second week's class, the students will play the Montserrat Role Playing Game. This game takes place on the island of Montserrat where a volcanic eruption may or may not occur. Students are expected to be active participants in their assigned roles (government, community, or scientists), and students who are late for the class will not be allowed to participate. Therefore, students with schedules that will not allow on-time start of the class are

discouraged from enrolling in the course.

Generative Artificial Intelligence (GAI) Policy

This course encourages students to explore the use of GAI tools such as ChatGPT for most assignments and assessments -- any cases in which it is disallowed will be explicitly noted at the top of each assignment when given.

Any use of these tools must be appropriately acknowledged and cited with a GAI use statement. This statement shall be included in brackets at the end of each assignment or part of assignment in which these tools are used. The statement shall clearly note the degree to which GAI was used. Examples of such statements include but are not limited to:

- "[GAI was used to better understand the problem]"
- "[GAI was used to find sources of information for research]"
- "[GAI was used to outline the text of this answer]"
- "[GAI was used to improve the clarity and grammar of this answer]"
- "[GAI was used to generate the text of this answer]"

If no statement is provided, it will be assumed that GAI was not used in any way.

When using GAI, it is the responsibility of the student to assess the validity and applicability of any output which is utilized. Students shall not be penalized for the degree to which GAI is used in cases where it is allowed; however, students shall bear the final responsibility for the quality and accuracy of any and all submitted work.

Violations of this policy will be considered academic misconduct. Finally, we draw your attention to the fact that different classes at Harvard could implement different AI policies, and it is the student's responsibility to conform to expectations for each course.