



Case studies

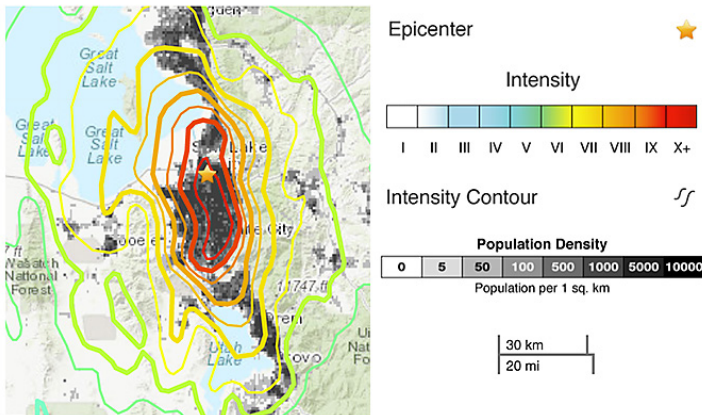
Students apply newly learned knowledge and skills to data or scientific problems in a real world context.



A simple example

SCENARIO: Students [analyze GPS time-series data](#) in the context of seismic hazards along Utah's Wasatch Front.

1. Students watch a [video](#) from the [Great Utah Shakeout](#) and read the summary of a [M7.0 scenario earthquake near Salt Lake City](#) for context before class.
2. In class, students analyze the GPS data and calculate strain rate across the Wasatch Fault.
3. Students then consider implications for seismic hazards, identify potential mitigation strategies, and present their analyses in a report to the Salt Lake City Council.



Why add case studies to your course?

- Students address a problem in a real world context, which requires them to consider multiple perspectives and think critically about potential solutions.
- Students practice being scientists by doing what real scientists do, using the vocabulary, methods, and skills they have learned in class.
- By working with authentic data, which can be inherently messy, students come to terms with uncertainty.
- Real examples are engaging, and, when learning occurs around a specific problem, material is likely to be better retained and more readily applied to another situation.
- When case studies extend over several class periods, the repeated practice solidifies long-term retention of skills and knowledge.
- Timely or local cases can be meaningful to students and applicable to their lives.

How much class time does it take?

- A case study can be a 15-20 minute interlude, a single or multi-day activity, or the framework for an entire course.

Tips for success

- Choose a case that effectively applies the content and skills that students are learning in your course. Case studies that involve a story and specific characters, or are part of a larger narrative, can bring a problem to life.
- Consider using a format that engages students in three components: 1) defining a problem, 2) developing a strategy for investigating or solving the problem, and 3) presenting findings and persuading others that the findings are reasonable.
- Be sure that data and other information about the case are readily available in usable form, and be prepared to address issues of data quality and uncertainty directly.
- Provide context for the case so that students can generate their own questions and explore the implications of their results.
- Incorporate short cases early in the semester so that

students can practice working in groups, brainstorming, and discussing before tackling extended cases.

- Plan student work to make it possible for you to interact effectively with each group. Approach students as collaborators in the process of posing questions, solving problems, and persuading others.
- **Make sure that your students are prepared.** During the case study, check in with students so that you can offer guidance and identify gaps in student preparation as they emerge. For short case studies, move around the classroom and eavesdrop on student conversations. For longer or more complex projects, use interim assignments or schedule check-in meetings.
- **Prepare yourself.** Know more about this topic than your students so that you can answer questions and help guide the students. Have a plan with clearly defined goals, but leave room for student exploration.



Examples and variations on case studies

- **Data from a published paper.** Provide students with field observations or other data from a published paper. Have them interpret the results and discuss the limitations of the data and methods.
- **Local topics.** Connect your course to events, problems, or hazards affecting your local community. This could become a [service learning project](#).
- **Recent and timely events.** The [USGS Earthquake summary posters](#) and [IRIS Teachable Moments](#) have datasets and context from recent major earthquakes.
- **Social responsibility as a geoscientist.** Use seismic data from the 2009 L'Aquila earthquake and coverage of the subsequent trial (see [Scientists on trial: At fault?](#)) to discuss the role geoscientists play in informing the public about tectonics-related hazards. The final report could be written as a [policy memo](#).
- **Scientific debates.** Students examine data from scientific studies on opposing sides of a current or [historical](#) scientific debate and argue on behalf of the authors. Consider engaging students through role playing.
- **As a frame for an entire course.** Choose a compelling real-world problem (e.g., earthquake hazards and seismic risk in northern Cascadia) as a semester-long focus for a structural geology and tectonics course. Teach the topics and skills of a typical SGT course in that context, rather than in a typical linear fashion, and have students do a culminating risk assessment from a structure/tectonics perspective at the end of the course.
- **Options for large classes.** With some modifications, case studies are effective in large classes. You can:
 - Break the class into groups and give each group a part of the case to work with. Take advantage of pre-existing groups, meetings with TAs, or lab sessions.
 - Use [one-minute papers](#) or other written responses to get all students participating in the discussion.
- **Use a jigsaw.** Divide the case study into “puzzle” pieces. Students teams study their individual pieces and then regroup to put the full case together.
- **Use a discussion.** Conclude the case study with a student-driven conversation around potential solutions.

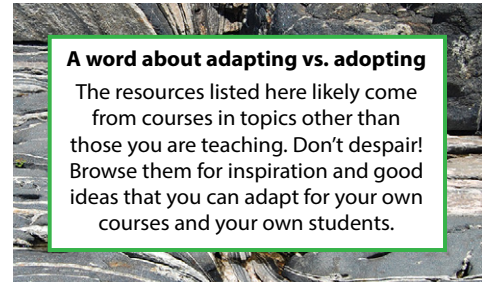
Resources on teaching with case studies

From the NAGT portal *Teach the Earth*

- InTeGrate's [Connect to the World We Live In](#): bringing real-world examples into the classroom.
- Case studies with tectonics themes (e.g., volcanic and earthquake hazards using GPS, LiDAR, and InSAR data) at [GETSI](#) and [InTeGrate](#).
- [Investigative Case-Based Learning](#) and [Teaching with the Case Method](#), with aspects applicable to many topics.
- [Science in the Courtroom](#), case study based on “A Civil Action”.
- [Teaching Structural Geology in the 21st Century](#) has some great case studies, including a nice example of [giant rock avalanches](#) from a published paper.

Elsewhere on the web

- [National Center for Case Study Teaching in Science](#) case study collection, including some geoscience examples.



Research papers on teaching with case studies

- Bonney K. M., 2015, [Case study teaching method improves student performance and perceptions of learning gains](#): Journal of Microbiology & Biology Education, v. 16 no. 1, p. 21–28.
- Dolphin, G., Benoit, W., Burylo, J., Hurst, E., Petryshen, W., and Wiebe, S., 2018, [Braiding history, inquiry, and model-based learning](#): A collection of open-source historical case studies for teaching both geology content and the nature of science: Journal of Geoscience Education, v. 66, no. 3, p. 205–220.
- Holley, E. A., 2017, [Engaging Engineering Students in Geoscience Through Case Studies and Active Learning](#): Journal of Geoscience Education, v. 65, no. 3, p. 240–249.

More On-Ramp pdfs & resources: serc.carleton.edu/onramps/index.html

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