

Using Real-World Data to Understand Earth's Moving Surface

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Welcome!



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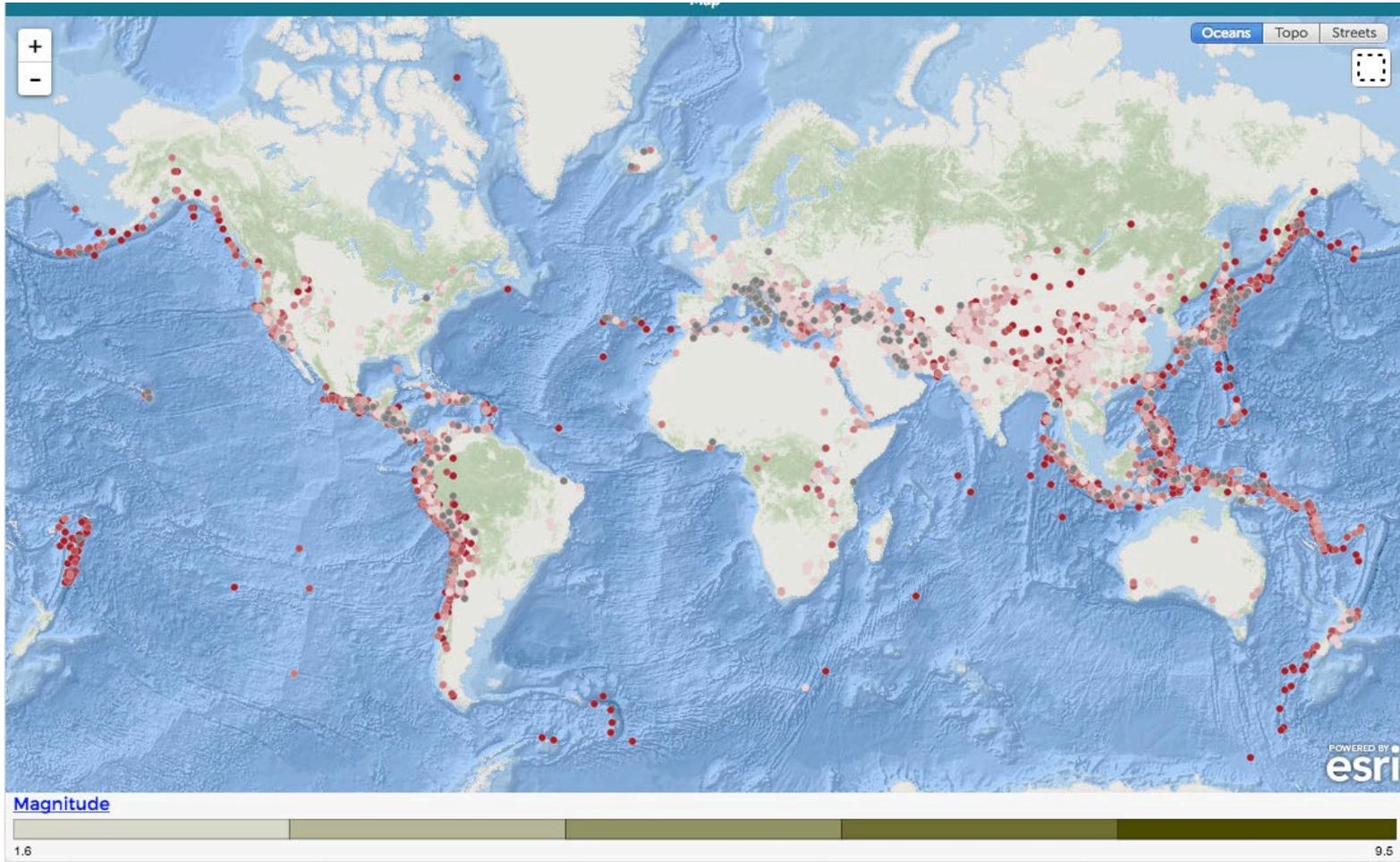


Phenomena

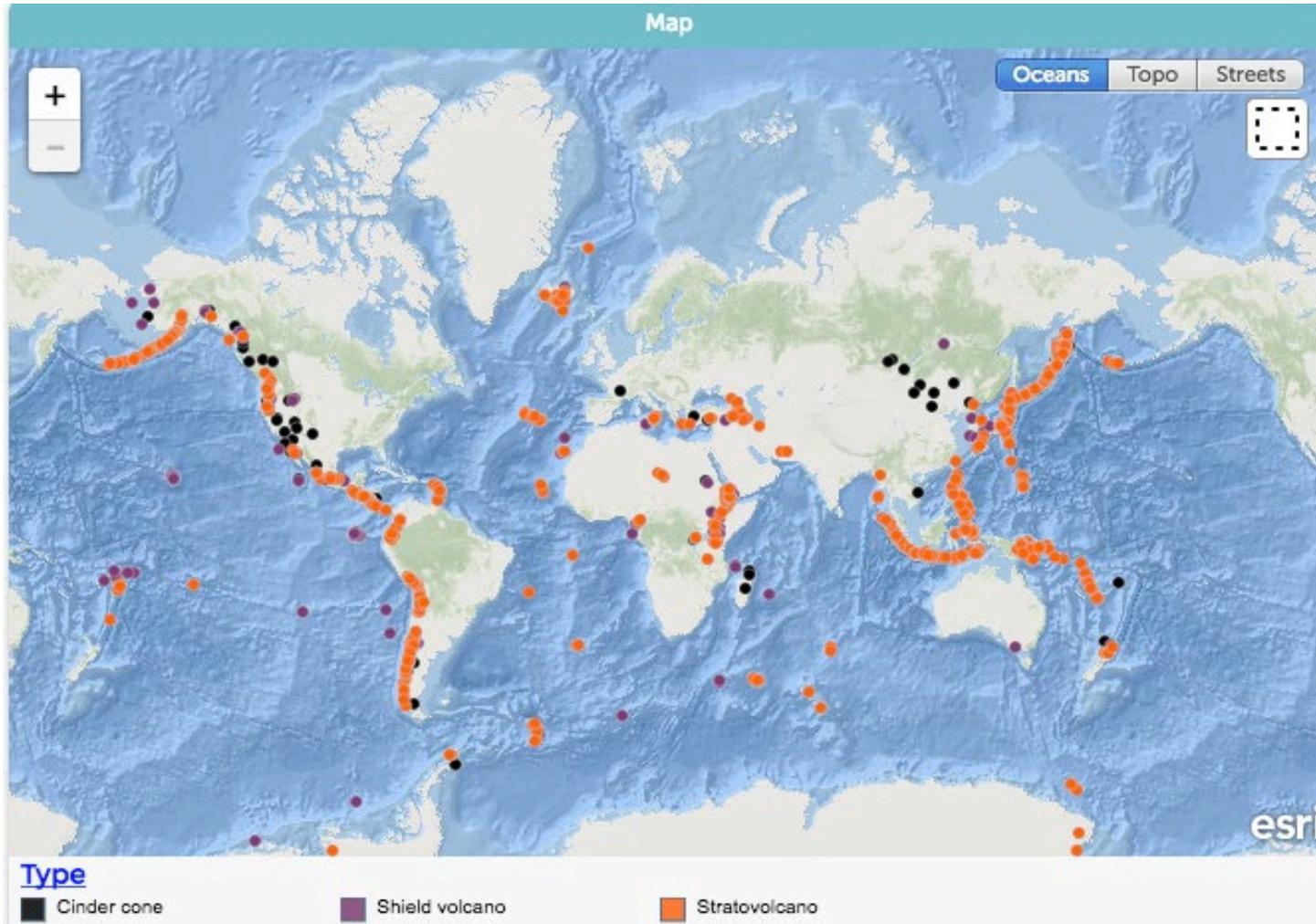
- **Unit Phenomena:** The Earth's surface changes over time.
- **Learning Sequence Phenomena:** Earthquakes and volcanic eruptions (and their related hazards) do not happen everywhere on Earth.



Major Earthquakes (1998-2018)



Locations of Active Volcanoes



Learning Sequence Conceptual Flow

Activity 6

Students analyze and interpret data as they map the locations of significant earthquakes and major volcanoes around the world. They look for patterns in the distribution of earthquakes and volcanoes.

Activity 7

Students analyze and interpret GPS data to determine the Earth's surface is moving slowly.

Activity 8

Students read an article about the Earth's structure to obtain information about how Earth's surface is broken into plates that move.

After these activities in the sequence, students investigate geological processes that happen at plate boundaries and their associated natural hazards.



NGSS PEs in this Activity

Working towards MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Disciplinary Core Idea

ESS2.A: Earth's Materials and Systems

The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.

Science And Engineering Practice

Constructing Explanations and Designing Solutions

Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future.

Cross Cutting Concept

Scale Proportion and Quantity

Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.



NGSS PEs in this Activity

Working towards MS-ESS3-2: Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Disciplinary Core Idea

ESS3.B: Natural Hazards

Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.

Science And Engineering Practice

Analyzing and Interpreting Data

Analyze and interpret data to determine similarities and differences in findings.

Cross Cutting Concepts

Patterns

Graphs, charts, and images can be used to identify patterns in data.

Influence of Science, Engineering, and Technology on Society and the Natural World

The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.



How do you know if something has moved?



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Discuss the following question with a partner:

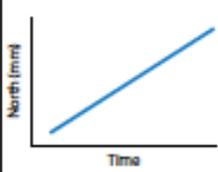
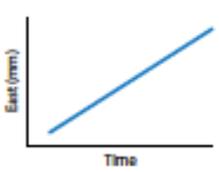
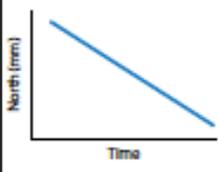
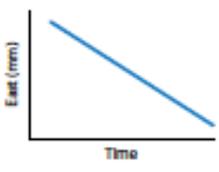
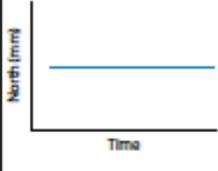
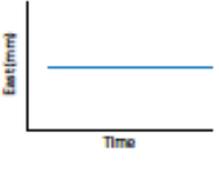
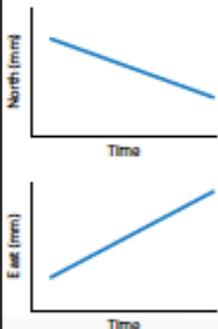
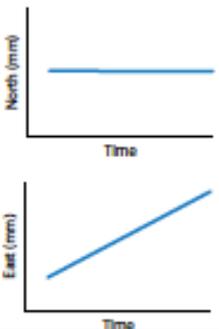
What do you know about GPS?



VISUAL AID 7.1

INTERPRETING GPS TIME-SERIES DATA PLOTS

To interpret GPS data, you must carefully analyze the labels on the axes to determine the type of motion.

If GPS data look like this...	... the station is moving toward the ...	If GPS data look like this...	... the station is moving toward the ...
	north		east
	south		west
	Not moving north or south		Not moving east or west
When combining N-S and E-W plots that look like this...	the overall direction the station is moving is towards the...	When combining N-S and E-W plots that look like this...	the overall direction the station is moving is towards the...
	southeast		east

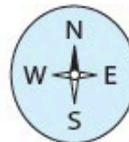
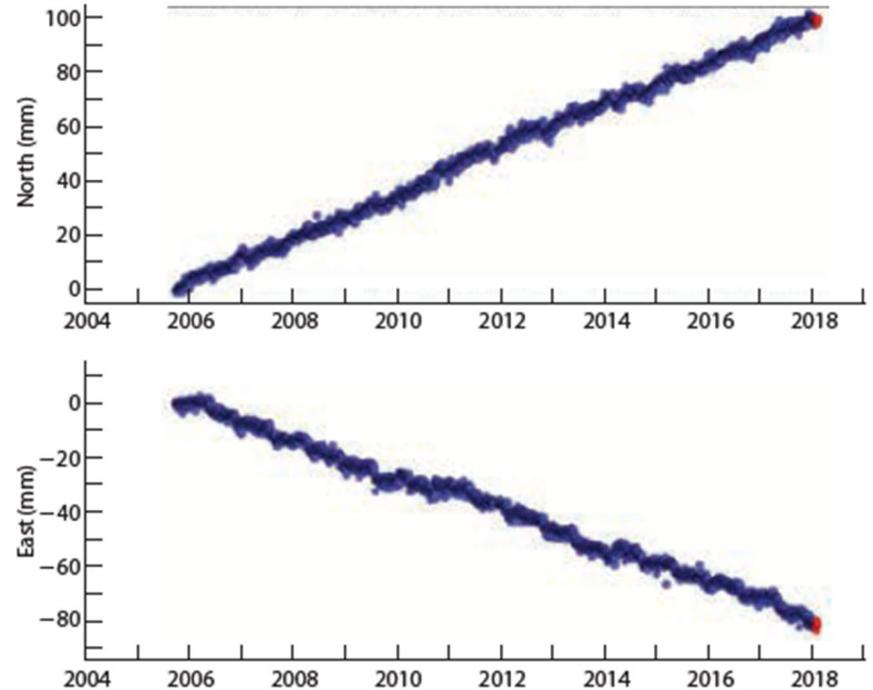
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Hayfork, CA

Hayfork, CA

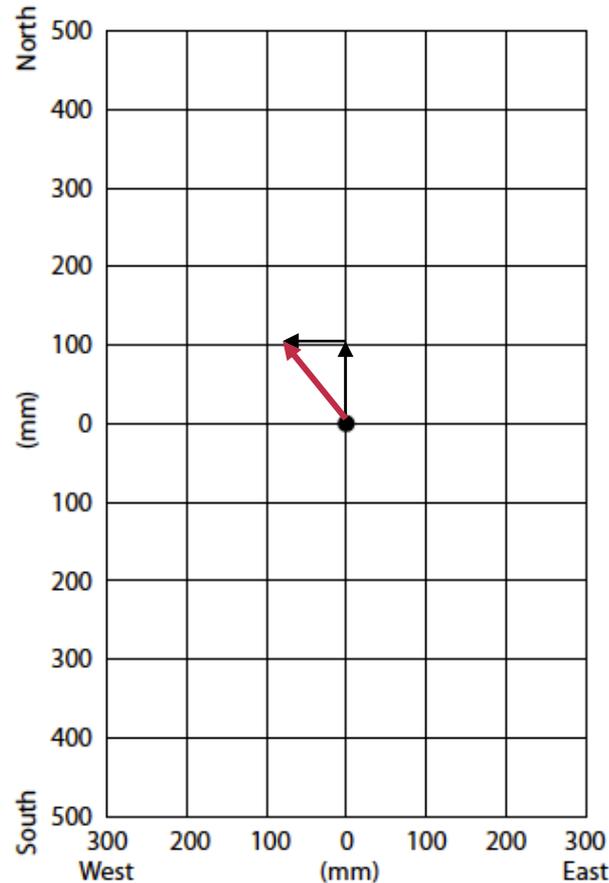


GPS time-series plot for station P332



Student Sheet 7.1

Location Station P332 Hayfork, CA



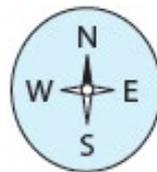
With your partner, describe the movement of this GPS station over this time period.

Group Work

- Make a group of 4. One pair works on analyzing and interpreting the data for the GPS stations in Alaska, while the other pair works on the data for the GPS stations in Iceland. Use a fresh copy of Student Sheet 7.1 for your analysis.
- After both pairs are done, share your work on Student Sheet 7.1. Discuss the similarities and differences between the data from the locations you focused on.



Southern California



Analysis Items

- Discuss Analysis items 2 and 3 with your group.
- Share your ideas with the larger group.



Reflection

- In what ways did you see the three dimensions of the NGSS in this activity?
- What challenges do you think students will have in approaching this task?
- What supports will help students be successful?
- What are the potential benefits of using real-world data in the middle school classroom? The challenges?



Additional Resources

- www.sepuplhs.org (slides and resources for this presentation will be available on this site after CSTA; a version of this presentation and materials are available from NSTA earlier this year)
- <https://earthquake.usgs.gov/earthquakes/map/>
- <https://codap.concord.org/>



Research Study

- **Purpose of our study**

We are developing high-quality assessments to monitor students' progress towards understanding the Next Generation Science Standards (NGSS).

Who can participate?

To participate, you must be currently teaching the NGSS in your middle school science classroom at a public or private school. Additionally, your principal or district must agree that we can conduct research in your classroom.

Interested in participating?

Please contact us!

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 - Email: srkolar@berkeley.edu

