NGSS Aligned Data-Rich Learning Materials for the Next Generation Scientists

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About the Table

Tectonic Setting

- As a suite, the educational materials cover the major tectonic settings

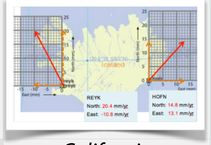
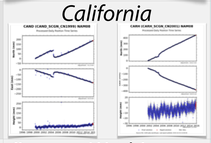
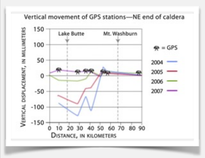
Lessons & Modules

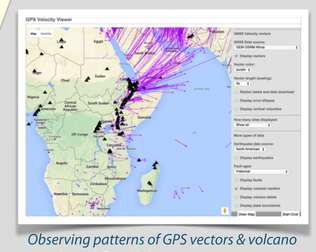
- Free to educators & public
- Middle & High -school students are engaged in the practice of science
- Data-rich: providing experiences with scientific practices and cross-cutting concepts
- Includes GPS data from the EarthScope Plate Boundary Observatory plus additional data UNAVCO and other sources.
- Place-based and geographically relevant

Alignment Matrix: Coverage & Gaps

- Coverage in this suite of resources draws on strengths of available data. As lessons and modules become more complex, additional NGSS alignment occurs.
- Gaps (absence of an X) highlight areas to focus with future resources. Connecting to high quality resources is a priority.

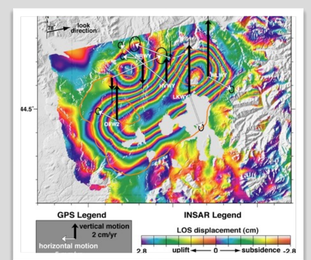
Next Generation Science Standards Three Dimensions of Alignment

Tectonics	Lesson / Module Title	Location	Science and Engineering Practices: 1. Asking questions (for science) and defining problems (for engineering)	2. Developing and using models	3. Planning and carrying out investigations	4. Analyzing and interpreting data	5. Using mathematics and computational thinking	6. Constructing explanations (for science) and designing solutions (for engineering)	7. Engaging in argument from evidence	8. Obtaining, evaluating, and communicating information	Crosscutting Concepts: 1. Patterns.	2. Cause and effect.	3. Scale, proportion, and quantity.	4. Systems and system models.	5. Energy and matter.	6. Structure and function.	7. Stability and change.	Disciplinary Core Ideas: ESS1.C: The History of Planet Earth	ESS2.A: Earth's Materials and Systems	ESS2.B: Plate Tectonics and Large-Scale System Interactions	ESS3.B: Natural Hazards	ETS1.B: Developing Possible Solutions	PS2.A: Forces and Motions	PS4.A: Wave Properties	Performance Expectations: MS-ESS2-2	MS-ESS3-2	HS-ESS1-5	HS-ESS2-1	HS-ESS2-3	HS-ESS2-4	HS-ESS3-1	HS-ETS1-3
Divergent Boundaries	**Measuring Plate Motion with GPS** • *How does GPS work to pinpoint a location on Earth?* • *What can GPS tell us about Iceland?* • *Extension: Exploring East Africa plus basin & range in Western United States* • *Apply your knowledge*	*Iceland, East Africa, Basin & Range* 	X		X	X	X				X	X			X			X	X	X	X	X			X	X		X				
Transform Boundaries	**Exploring Plate Motion and Deformation in California with GPS** • *Analyze GPS time series data* • *Investigate deformation - what happened* • *Extensions: Explore more GPS data*	*California* 	X		X	X	X				X	X			X			X	X	X	X	X			X	X		X				
Convergent Boundaries	**Detecting Cascadia's Changing Shape** (Module) • *Cascadia tectonic setting* • *Deformation & strain* • *Earthquakes* • *Tsunami*	*Oregon, Washington, N. California* 				X	X	X	X	X		X	X	X			X		X	X	X	X	X	X	X	X	X	X		X	X		
Hot Spots	**Taking the Pulse of Yellowstone's "Breathing" Volcano: Problem-Based Learning in America's First National Park** (Module) • *Monitoring volcanic activity* • *Jigsaw:* • *Eruptive history* • *Seismic activity* • *Hydrothermal activity* • *Using GPS to view how Yellowstone is inflating & deflating over time* • *Analysis, Decision Making, Presentation*	*Yellowstone, Snake River Basin* 	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X		X	X	X	X		X	X				X	X	X
Regional / World View	**Visualizing Relationships with Data** • *Jigsaws for Western United States & Alaska:* • *Visual distribution of volcanos* • *Visual distribution & magnitudes of earthquakes* • *Ground deformation using GPS data* • *Option: Diving into the GPS data: Exploring Tectonic Motions of the world using the UNAVCO GPS Velocity Viewer*	*Western U.S., Alaska* 				X		X	X	X		X		X			X		X	X	X		X			X	X					X	

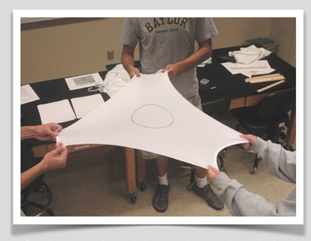


Observing patterns of GPS vectors & volcano locations in East Africa. (Source: UNAVCO GPS Velocity Viewer)

Using a hands-on flour volcano demonstration, students learn how the surface if the Earth can crack and deform from inflation & deflation. (Photo: Shelley Olds)



Students calculate uplift from 2004 and 2006 using an InSAR image overlaying Yellowstone calderas (Image: Chang, W.-L., et al., 2007)



Students explore deformation and strain by deforming a circle. (Photo: Vince Cronin)

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