Measuring Ground Motion with GPS: How GPS Works (Demonstration)

With printouts of typical GPS velocity vectors found near different tectonic boundaries and models of a GPS station, demonstrate how GPS works to measure ground motion.

GPS velocity vectors point in the direction that a GPS station moves as the ground it is anchored to moves. The length of a velocity vector corresponds to the rate of motion. GPS velocity vectors thus provide useful information for how Earth's crust deforms in different tectonic settings.

Demonstration length

5 – 10 minutes for setup and **10 – 15 minutes** to demonstrate

Major concepts

- Earth's surface is constantly in motion.
- GPS can be visualized as velocity vectors.
- A velocity vector points in the direction that a GPS station is moving and its length is proportional to the rate of motion.
- Velocity vectors from GPS data show how Earth's crust moves in different tectonic settings.

Supplies

- Gumdrops, toothpicks, and clay (to make GPS models)
- Printouts showing velocity vectors near different tectonic boundaries (Supplementary Materials)
- Printouts of maps with velocity vectors showing real world examples (Supplementary Materials)

Instructions for assembly

- Construct GPS models with the gumdrops, toothpicks, and clay.
- Cut the printouts of the velocity vectors and map examples along the tectonic boundaries.

Leading the demonstration

1. Describe the parts of the demonstration:
    - With the GPS model, the gumdrop is the antenna and raydome, the toothpicks are the legs, and the clay is the cement.
    - The tectonic boundary printouts are cut along the boundary. The velocity vectors on each side show how fast and in what direction it is moving.

2. Discuss the basics of getting velocity vectors from GPS:
    - GPS stations are firmly secured to the ground so that when the ground moves, the GPS station moves, too.
    - Velocity vectors show the direction and how fast a GPS station is moving.
3. Have participants explore how different velocity vectors relate to different tectonic settings. Note that you can either begin with the map examples and transition to the velocity vectors-only examples or vice versa.

Sample questions to consider

- How do we use GPS in our daily lives? What does it tell us?
- What are the different types of tectonic boundaries?
- How do you think the velocity vectors would look in each type of tectonic setting?
- How many different scenarios can you think of for how the velocity vectors would look for the same tectonic setting?