

Using GPS to Track Movements of Earth's Lithospheric Plates

Student Activity

Investigate Part A: Data from the Global Positioning System

Data from Global Positioning System satellites will help you find out if the position of your community has changed over time. The map shows measurements at GPS recording stations in North America. Each station has a four character symbol. Arrows show the rate and direction of motion of the Earth's surface at that station. Longer arrows indicate faster motion than shorter arrows. The motions are shown relative to the GPS frame of reference, which you can think of as "attached" to the Earth's axis of rotation.

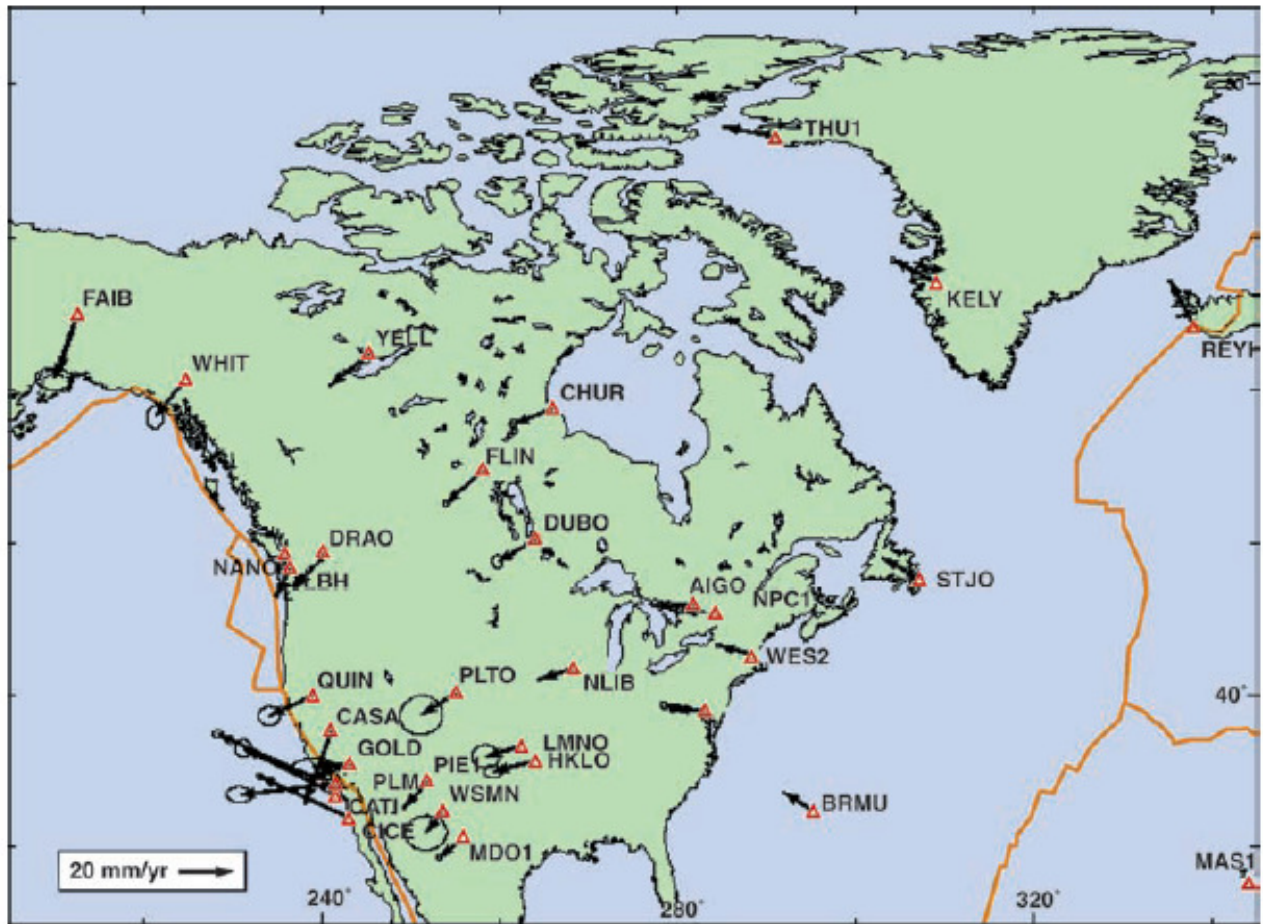


Figure taken from Earth Comm page

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1. Find the WES2 station (in the northeastern United States). Has the WES2 station moved over time? How do you know?
2. In what compass direction (N,E,S,W) is the WES2 station moving? Be specific.

3. The arrow in the lower left corner of the map is a scale. It shows a length of “20 mm/yr” arrow. Is the WES2 station moving more than or less than 20 mm/year. Explain.
4. Are all stations on the map moving at the same speed? Explain.
5. Are all stations on the map moving in the same direction? Explain.
6. What is the general or average direction of movement of North America?

Investigate Part B: Data from a Computer Model

Scientists can also use computer models that use geologic data to learn information about the changes in position of your community over time. To use this model, you will need to move to a computer and log on to the “Relative Plate Motion Calculator (RPM)” at http://sps.unavco.org/crustal_motion/dxdt/model/ Use the instructions (Figure 1) for the “Relative Plate Motion Calculator” to help you use the website.

Using the “Relative Plate Motion Calculator” you are going to find out the relative motion of various cities located on different lithospheric plates all around the world.

Copy the data table into your science notebook.

| City, County | Name of Plate | Latitude | Longitude | Rate of motion (mm/yr) | Direction of Motion | |
|----------------------------|--------------------------------|--------------|---------------|------------------------------|---------------------|----------------------|
| | | | | | Degrees | Compass Direction |
| Orlando, FL, USA | North American | 28° 32' 18" | -81° 22' 45" | | | |
| Honolulu, HI, USA | Pacific Plate | 21° 0' 59" | -156° 38' 26" | | | |
| La Paz, Bolivia. | South American Plate | -13° 58' 0" | -66° 12' 1" | | | |
| Berlin, Germany | Eurasian Plate | 54° 1' 59" | 10° 27' 0" | | | |
| Antarctica | Antarctic Plate | -90° | 120° | | | |
| Sydney, Australia | Indian- Australian Plate | -33° 52' 59" | 151° 13' 0" | | | |
| Riyadh, Saudi Arabia | Arabian Plate | 24° 44' 53" | 46° 44' 13" | | | |

Use the data you just collected from the RPM to complete the steps below:

1. On your world outline map (Figure 2) showing lithospheric plates, place dots on your map showing where each of the seven places are located. Use black to label each city with a unique four character abbreviation (like the map in part A).
2. On your world outline map, write the name of each plate listed on the data table.

3. Draw an orange arrow extending from each city to show the motion of the plate. The arrow should be approximately the correct number of degrees (from north and moving clockwise). The length of the arrow should be drawn according to the speed of the plate movement. For instance, if a plate moves 11 mm/yr, then the arrow should be 11 mm long. See Figure 3 for help plotting compass directions.

Answer the following questions in your notebook:

4. Which plate seems to be moving the fastest?
5. Which plate seems to be moving the slowest?
6. In your own words, describe the motion of the following plates:
 - a. North American –
 - b. Eurasian –
 - c. Australian-Indian –
 - d. Pacific Plate –