

Have you ever used a GPS unit to find your exact location? Or go on a treasure hunt called geocaching? Have you seen a GPS unit mounted in a car to give directions? Different people use GPS in different ways. Mountain climbers often carry a small, hand-held unit. They use it to keep from getting lost. Families, like the people in the news story, sometimes use GPS to find hidden treasure. Some taxi drivers have GPS units to provide them with directions.

GPS units can be small enough to fit in your hand. They can also be larger and fixed to the ground or a building. The GPS unit in this photograph is at a school in Los Angeles.



[Image courtesy of Timothy P. Brown]

What is GPS?

GPS stands for **Global Positioning System**. Twenty-four GPS satellites orbit 20,000 kilometers above Earth's surface. They send special radio signals down to Earth. On the ground, there are GPS receivers. They pick up the radio signals from the satellites.



[Illustration of GPS satellite courtesy NASA]

How do these radio signals work? Think about how lighthouses communicate with boats. A lighthouse sends out signals in the form of flashes of light. A nearby boat captain sees the light signal. The signal tells the captain important information. The captain uses the signal to decide where to sail to avoid shallow water. The GPS system is similar. GPS satellites are like lighthouses. They send out signals with important information. The receivers on the ground are like boat captains. They receive the signal and use a computer to figure out their exact location. Then, different people use the information for different purposes.

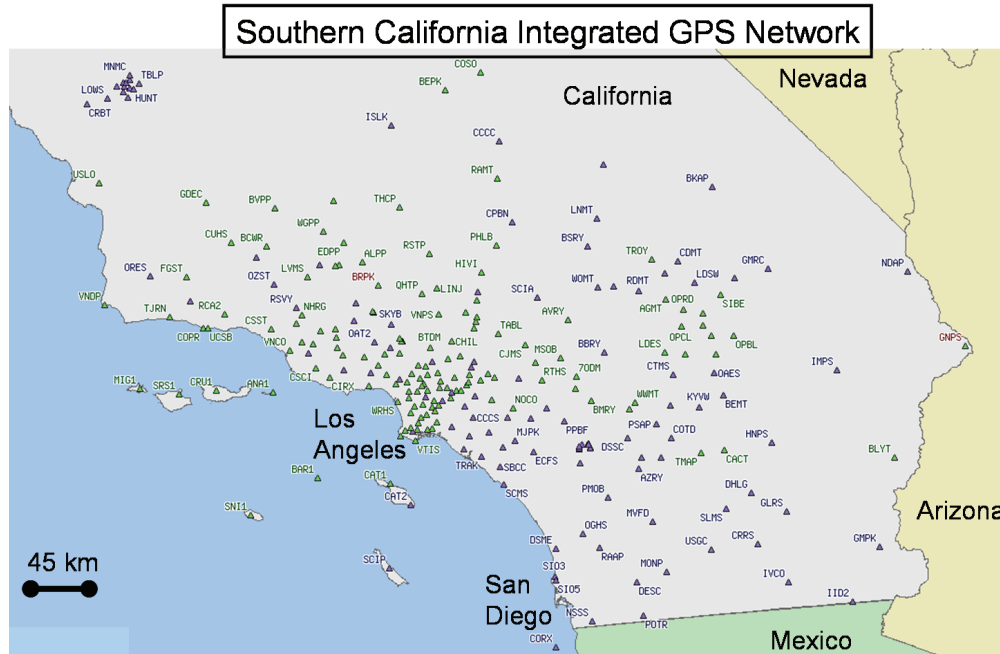
How do scientists use GPS?

Scientists have thousands of special GPS receivers. These receivers (called stations) are fixed to the ground at specific locations around the world. Scientists study how the exact locations of these stations change. They use the information to figure out how Earth's surface moves. The GPS system is very accurate. Often, scientists can tell if a station has moved as little as one-half of a centimeter!

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There are 250 GPS stations in southern California. This group of stations is known as SCIGN. SCIGN stands for the Southern California Integrated GPS Network. It is an important tool for scientists who study how the earth moves in your area.

City Hall in Los Angeles was built in 1924. It is now about 3 meters closer to San Francisco than it was in 1924. How can a building on solid ground move?



Map showing locations of GPS stations in the SCIGN. Each small triangle represents a GPS station. [Image courtesy SCIGN.org]

Name _____

Date _____

Part 1: Do this part as a class

How can you figure out how fast a station moves? You have to take some measurements and then do some calculations.

How long is the legend arrow? Measure it with a metric ruler.

The Legend arrow is _____ cm long.

This distance represents 5 cm of movement in one year, even though it is not exactly 5 cm long.

How long is the data arrow? Measure the PAMA arrow.

The PAMA arrow is _____ cm long.

This distance represents how fast this station is moving.

How fast does the PAMA station really move? To figure this out you need to do a calculation.

Length of the Data Arrow / Length the Legend Arrow = Data-to-Legend Ratio

_____ / _____ = _____

Now, multiply this Ratio by the speed that the Legend Arrow represents (5 cm/yr).

Ratio x Legend Arrow speed = Speed of the GPS station (in centimeters per year)

_____ × _____ = _____

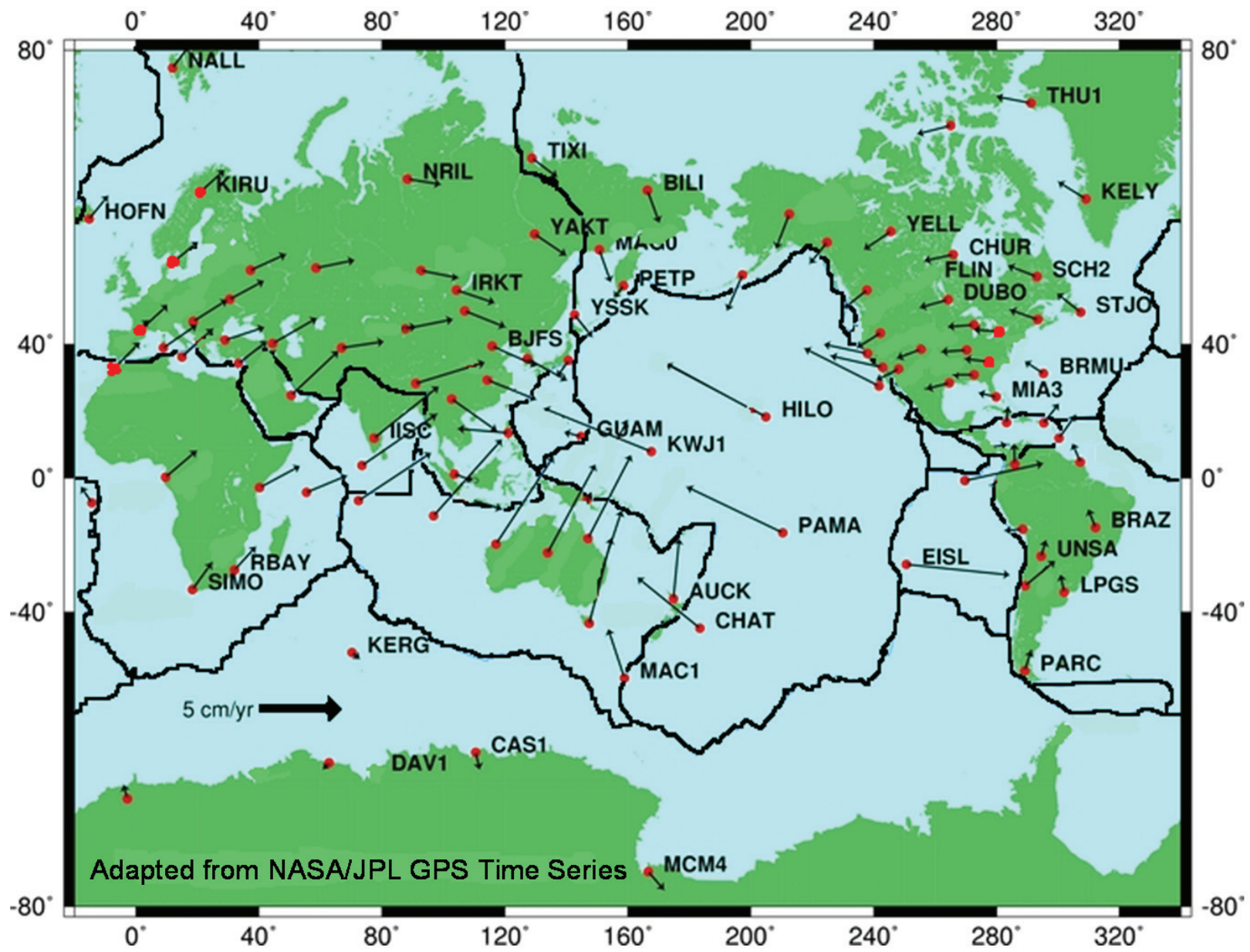
Part 2: Do this part in small groups or individually

How far does the HILO station move?

Locate the HILO station on the map. Measure the HILO Data Arrow. Use the data-to-legend ratio and the calculation above to figure out how far the station moves in one year.

Length of data arrow at HILO: _____

How far does the HILO station move in one year? _____



Name _____

Date _____

Think back to class simulation of the movement of the GPS stations.

1. In what direction did each group move?

HILO:

KWJ1:

PAMA:

EISL:

Australia:

2. Which groups seemed to move together in the same direction?

3. Which groups moved in different directions?

4. How did the Australia group interact with other groups?

5. Use the *GPS Data Map* to find two different GPS stations near your region. List the name of the station (if it is given) and describe how it moves. Include how much it moves each year and in which direction it moves.

6. Math Extension: At a rate of 10 cm/year, how long would it take Australia to move 4000 km? Show your calculation. (There are 100,000 cm in 1 km.)