

CLASSROOM ACTIVITY

GRACE

Scientists use the scientific process to investigate questions they have about the natural world. In this feature, scientists use data from two orbiting satellites to determine where the Earth's water is accumulating and where it is drying up. This feature is a good illustration of the tools and technology scientists use to gather data.

CLASS DISCUSSION

Establish Prior Knowledge

Introduce the topic by discussing with students how water levels in their own area shift. Use the following questions to guide the discussion:

- When does water accumulate in this area?
(Answers may include: during rain or snow fall, snow melt in spring)
- Is there depletion of water in this area? When does it occur?
(Answers may include: During periods when there is no rain, overuse of water that is not replenished.)
- How does our local government track these shifting water levels? What tools or technology do they use?
(Answers may include: They measure water levels in reservoirs, lakes, and streams; they use water meters to measure people's water usage.)
- Suppose a government wanted to track Earth's shifting water resources worldwide. How do you think they could do this? *(Answers will vary.)*

Explain that, in an effort to monitor the effect of climate change on Earth's water resources, NASA has developed a way to measure Earth's shifting water month by month. Tell students that in the video they are about to see; scientists use satellite technology to track the planet's freshwater, saltwater, and ice.

Exploration

Before watching the video have students read the synopsis. As they watch the video, have students take notes about the how the two satellites work together to gather data. Have students view the Feature. Use the following to guide a class discussion.

- Is the gravity field on the Earth uniform? *(no) What does it depend on?*
(It depends on the mass of the surface. The mass can vary depending on the type of surface, e.g., rock, ice, water.)
- How does the GRACE tracking system work?
(Answers will include: two satellites orbit the Earth, one following the other. When the first satellite flies over a high mass area, the gravity pulls it, causing it to speed up. The second satellite is still moving at a slower speed, so the distance between them becomes greater. The second satellite then speeds up when it reaches the high mass area. The two satellites gauge the distance between them by beaming microwave signals back and forth. These readings produce a gravitational field map for the strip of Earth beneath and its concentration of mass. Scientists can determine from the mass whether the strip of land is a glacier or a mountain, for example. As the data continues to be collected scientists can measure how the mass of a certain area changes. As a glacier melts, for example, the mass will diminish.)

CLASSROOM ACTIVITY

GRACE (cont'd)

- Before GRACE how would scientists have collected the data?
(Answers will include: Scientists would have had to set up an incredible array of equipment along with hundreds of students and volunteers working several hours a day, a few times a week throughout the year. Even so, the data collected would not have been enough.)
- What does the data GRACE has collected show?
(Possible answers: The data show areas that are wetter than usual, dryer than usual or areas that have stayed the same. GRACE's data documents long-term trends caused by climate change.)

Wrap-Up

Use the following question to wrap up your discussion.

- How can scientists use the Grace data?
(Answers may include: Grace data tracks the distribution of water and helps scientists understand how climate and water availability is changing over time.)