

## Unit 2

### Unit 2 objectives

In this unit, students will

- examine how the movement of water through the hydrologic cycle generates weather that impacts society;
- explore patterns of precipitation and surface flow at various scales;
- discover how topography, winds, weather fronts, and convection influence precipitation; and
- identify factors driving local precipitation.

### Finding web resources

See the Saguaro Project web page for a list and explanation of the Internet resources mentioned here.

<http://saguaro.geo.arizona.edu/ewr/>

# Instructions and resources

In this unit, students will investigate factors governing global and regional precipitation patterns and examine the ecological and socioeconomic implications of those patterns. Students then consider what happens to precipitation when it reaches the ground as they explore the influence of topography on surface water flow in the United States. Finally, in an investigation of surface water flow and runoff in important U.S. watersheds, students examine relationships between precipitation, discharge, and regional climate.

### Activity 2.1 – Too little, too much (Engage)

This activity generates student interest in factors controlling the movement of water through the hydrologic cycle by considering how major precipitation events influence their lives. Students read first-hand accounts and examine loss statistics from severe droughts and floods that have affected the United States. By illustrating the economic, ecological, and sociological effects of too little or too much precipitation, the readings and questions in this activity generate interest and prepare students to further explore precipitation patterns.

If students are interested in further exploration of recent or historical disasters resulting from too little or too much precipitation, web sites maintained by NASA's Global Hydrology and Climate Center, Dartmouth's Flood Observatory, the Federal Emergency Management Agency, the National Drought Mitigation Center, and the University of New Hampshire's Water Systems Analysis Group provide excellent information and links to additional resources.

### Activity 2.2 – Global precipitation patterns (Explore)

Using ArcView, students examine patterns of global precipitation using maps and tables to perform calculations and generate graphs. Students explore how geographic location (latitude and longitude) influences precipitation. To illustrate the relationship between precipitation and environmental features of the Earth, students compare global precipitation patterns to the distribution of two important earth biomes, deserts and rainforests.

Students may wish to further investigate global deserts and rainforests—how plants, animals, and humans have adapted to life in these biomes using the Rainforest web, University of California at Berkeley's Biomes, the National Park Service, and MBGnet web sites.

### Activity 2.3 – Moving air and water (Explain)

In this reading, students are provided with an in-depth explanation of how winds influence the occurrence of precipitation and how topography influences the movement of precipitation once it reaches the ground. Students learn about the forces that generate global winds and how these winds influence weather patterns. Students also learn how permeability,

porosity, slope, and aspect influence surface and ground water flow and the formation of watersheds.

### ***Activity 2.4 – U.S. precipitation patterns (Elaborate)***

Students use ArcView to consider how wind and topography influence precipitation in the United States. To determine the importance of wind in generating precipitation, students compare seasonal paths of jet streams across the United States to seasonal precipitation patterns. Using topography and precipitation profiles of the Pacific Northwest and the Great Plains, students visualize the relationship between topography and precipitation.

### ***Activity 2.5 – Surface water flow (Elaborate)***

Students use ArcView to further consider the relationship between topography and precipitation. They determine the influence of aspect on surface water flow in different regions of the United States. As part of this activity, students are asked to draw features on maps and relate previously discussed concepts to large-scale geographic features in the United States. Students compare the mean precipitation and annual discharge of important U.S. watersheds in different climates and estimate evapotranspiration and infiltration to determine the influence of these processes on runoff.

If students are interested in learning more about streamflow and watersheds in their area, they can obtain local information by visiting the Environmental Protection Agency's Surf Your Watershed and the United States Geological Survey real-time data sites. To complement this activity, you may also wish to measure discharge in a local stream or river. The methodology as well as specific lesson plans can be found on the University of Montana's Network Montana and Idaho Museum of Natural History's Digital Atlas web sites.

### ***Activity 2.6 – The local water picture (Evaluate)***

Students use Internet weather resources to determine how uplift triggered by topography, weather fronts, winds (jet stream), and non-frontal convection (thunderstorms) has contributed to recent precipitation events in the U.S. To answer some of the questions in this activity, students may wish to access data in the ArcView project files (specifically the jet stream and monthly precipitation movies), to review information about the seasonality of various weather phenomena.