

I Fresh Water and Water Budgets

Topic 1 All the World's Water

How much water is there on and in the whole Earth? Scientists estimate the answer to be about one and one third billion cubic kilometers. The number is so large that it is difficult to picture. How much of Earth's water is salt water? How much is fresh water? This question is important because most uses of water require fresh water. With the growth of industry and the increase in population, the need for fresh water becomes more and more critical.

More than 97 percent of all Earth's water is in the ocean as salt water. Less than 3 percent is fresh water. Of this 3 percent, more than two thirds is frozen in the ice caps and glaciers of Greenland, Antarctica, and high mountain regions. Therefore, only about one half of one percent of all Earth's water is usable fresh water.

Where is this fresh water located? A tiny part of it flows on the surface in rivers and streams. About 100 times that amount is stored in lakes and swamps. However, most of the fresh water is in the ground. By one estimate, the amount of groundwater is 50 times as much as all the water in rivers and lakes! It is thousands of times as much as in all Earth's rivers at any given moment.

Topic 2 The Water Cycle

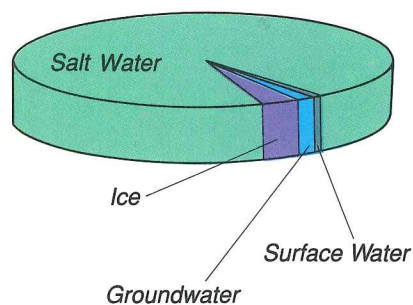
The **hydrosphere** is the water of Earth's surface. The hydrosphere includes groundwater, running water, lakes, and oceans. The movement of water from one part of the hydrosphere to another is described by the hydrologic cycle, or **water cycle**. The path of water in the water cycle is shown in Figure 9.2.

Sunlight provides the energy that evaporates water from the surface of Earth. Some of the water vapor comes from the continents, but most comes from the oceans. Winds carry the water vapor from the ocean over the continents. Part of the water vapor condenses into clouds, then falls as rain or snow.

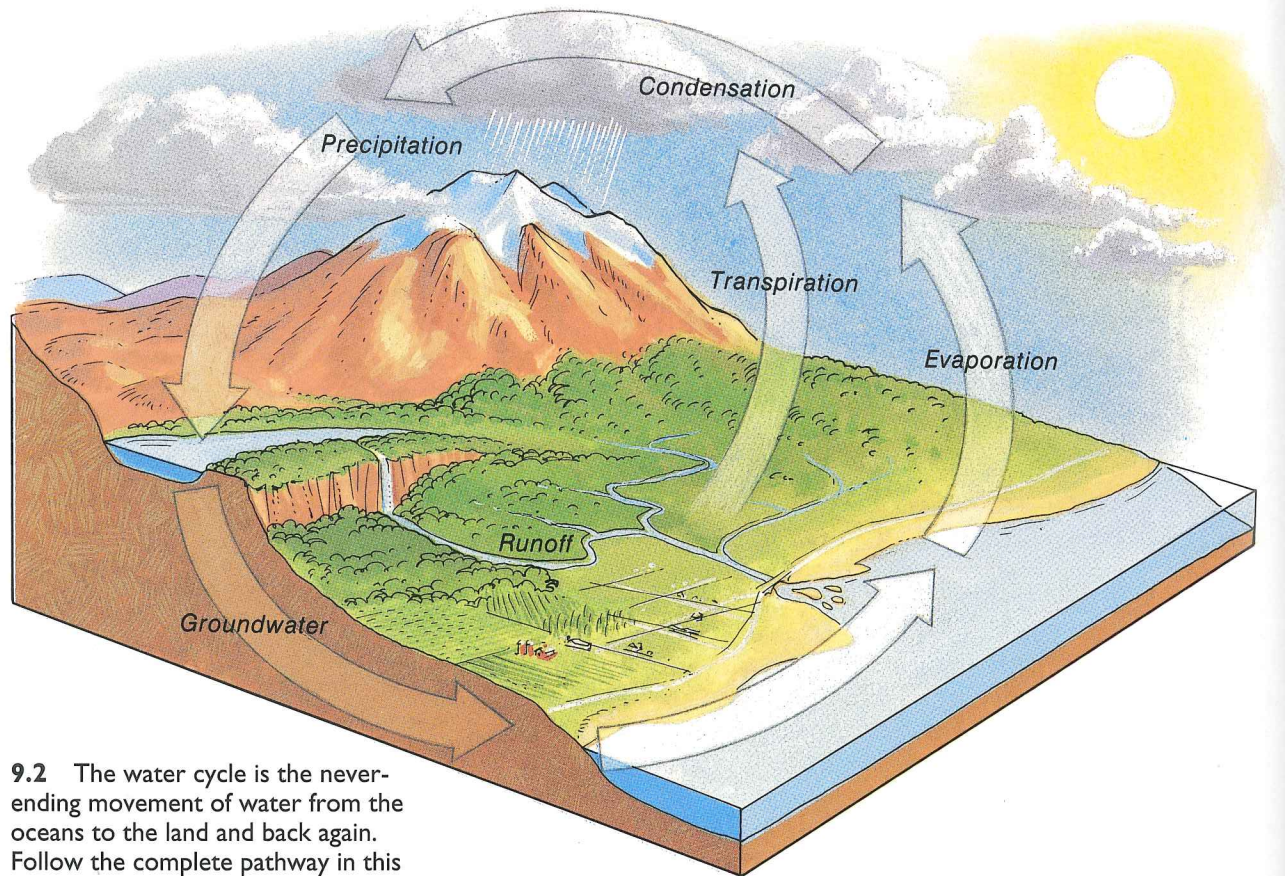
Some of the rain returns to the ocean from rivers and streams as runoff. Some seeps into the ground to become groundwater. Some returns to the air by *evaporation* from the ground or by *transpiration* from plant leaves. Hydrologists (scientists who study the hydrosphere) usually combine evaporation and transpiration in the term **evapotranspiration**.

OBJECTIVES

- A** Describe the distribution and quantity of fresh water on Earth.
- B** List the parts of the hydrosphere and describe the movement of water in the water cycle.
- C** Identify the conditions under which groundwater surplus, usage, deficit, and recharge occur.
- D** Compare the climates of different areas by comparing their water budgets.



9.1 Less than three percent of Earth's water is fresh water, and less than one third of the fresh water is available as surface or groundwater. The rest is frozen.



9.2 The water cycle is the never-ending movement of water from the oceans to the land and back again. Follow the complete pathway in this diagram.

When runoff from the continents returns to the ocean, one turn of the water cycle is completed. Other routes are possible. For example, water that evaporates from the ocean can return to the ocean as rain. The water cycle never ends. The salt water of the ocean supplies fresh water to the continents over and over again.

Topic 3 The Water Budget

A budget is a statement of expected income versus expected spending or expenses. In a balanced budget, income and spending are equal. A **water budget** describes the income and spending of water for a region. In a water budget, the income is rain or snow. The spending includes water lost by use, by runoff, and by evapotranspiration.

The evapotranspiration of an area is controlled by air temperature. When air temperature is high, plants growing in the ground need and use more moisture. At such times, evapotranspiration is high. When air temperature is low, plants do not need or use as much moisture; thus, evapotranspiration is low.

If it rains during a time when the plants need little moisture, the extra moisture soaks into the soil, where it is stored between the