

## Chapter 15

# Aquifers and Wetlands

**SUMMARY:** This chapter begins with an overview of the hydrological cycle and considers the flow of water in wetlands and underground. Special attention is paid to flow through vegetated wetlands.

### 15.1 The Hydrological Cycle

Rivers and streams are but a link in the global cycle of water, called the *hydrological cycle*. Approximately half of the solar energy striking the earth's surface is estimated to be consumed by the latent heat necessary to convert liquid water into water vapor, either through evaporation (mostly over the oceans) or through transpiration (mostly of plant leaves). The combination of these two processes, together called *evapotranspiration*, consumes an enormous amount of energy, about 4000 times the present rate of human energy consumption, and corresponds to the annual removal of a one-meter thick layer of water around the entire globe.

The moisture so introduced in the lower atmosphere travels with the prevailing winds and is subjected to the vagaries of their thermodynamics. Sooner or later, an air mass undergoes a temperature drop (due to net cooling or to an adiabatic pressure decrease) that lowers the saturation level sufficiently to force an excess of moisture to condense. *Precipitation* (rain, snow, sleet, etc.) forms and returns the water to the earth's surface. Some of what falls on the continents percolates through the ground and creates subsurface flow in aquifers, while the rest remains on the surface and gathers in a system of streams and rivers. Both flow systems, collectively called *runoff*, return water to the vegetation, lakes and, of course, the oceans, where it is subjected to evapotranspiration, thereby closing the loop. This water loop, consisting of evapotranspiration, precipitation and runoff, constitute the hydrological cycle (Figure 15.1).

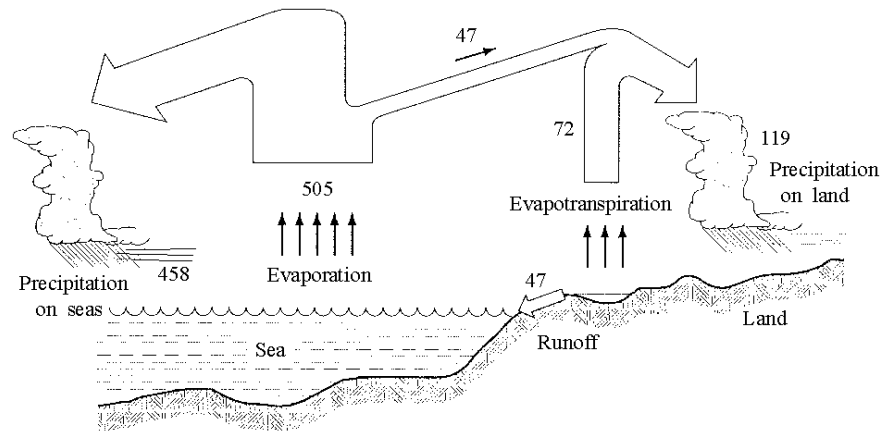


Figure 15.1: The hydrological cycle. Units are  $10^3 \text{ km}^3/\text{year}$ . (From Masters, 1997, based on earlier estimates)

## Chapter 16

# NEXT CHAPTER

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