



CE 3354 ENGINEERING HYDROLOGY

LECTURE 1: INTRODUCTION



OUTLINE

- Introduction
- Resources
- Surface and Groundwater Hydrology Concepts

INTRODUCTION

- Me: Theodore G. Cleveland, Ph.D., P.E., M. ASCE, F. EWRI
- You: I will call your name (alphabetical). You tell us what you want to be called.

SYLLABUS

- The syllabus is posted on the class web site:
- <http://cleveland1.ttu.edu/university-courses/ttu-courses/ce-3354/>
- The website (above) has excerpts from books that are referred to as well as extensive notes, and the exercise set and project statement.
- Be sure to visit the website before each lecture to check for updates, and download the readings.

WHAT IS HYDROLOGY?

- Study of the occurrence, circulation, storage, and distribution of surface and groundwater on the Earth.
- Engineering hydrology is the quantification of amounts of water at various locations (spatially) as a function of time (temporally) for surface water applications.

WHAT IS A WATERSHED?

- Topographic area that collects and discharges surface streamflow through one outlet or mouth (pour point)
- The area on the surface of the Earth that drains to a specific location
- In groundwater a similar concept is called a groundwater basin – only the boundaries can move depending on relative rates of recharge and discharge

HYDROLOGIC SYSTEM

- A hydrologic system is simply the collection of connected components that form the hydrologic cycle
- These components can be grouped into subsystems, treated separately, and the results combined according to interactions between the subsystems (CMM pg 5)

HYDROLOGIC CYCLE

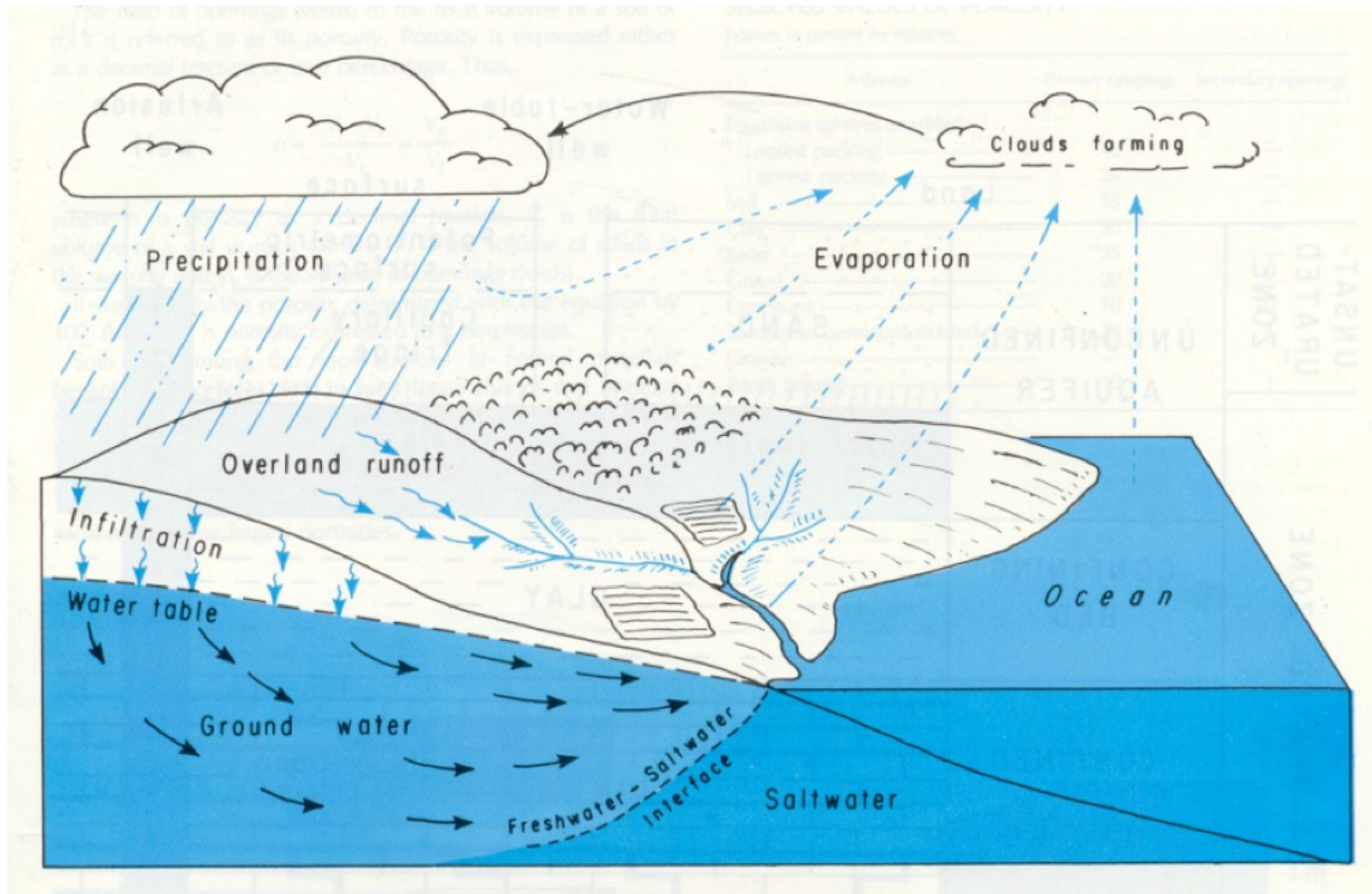


Figure 1.10 Diagram of hydrologic cycle.

(from Heath, R.C., 1983. Basic Ground-Water Hydrology, USGS Water Supply Paper 2220)

SURFACE WATER COMPONENT

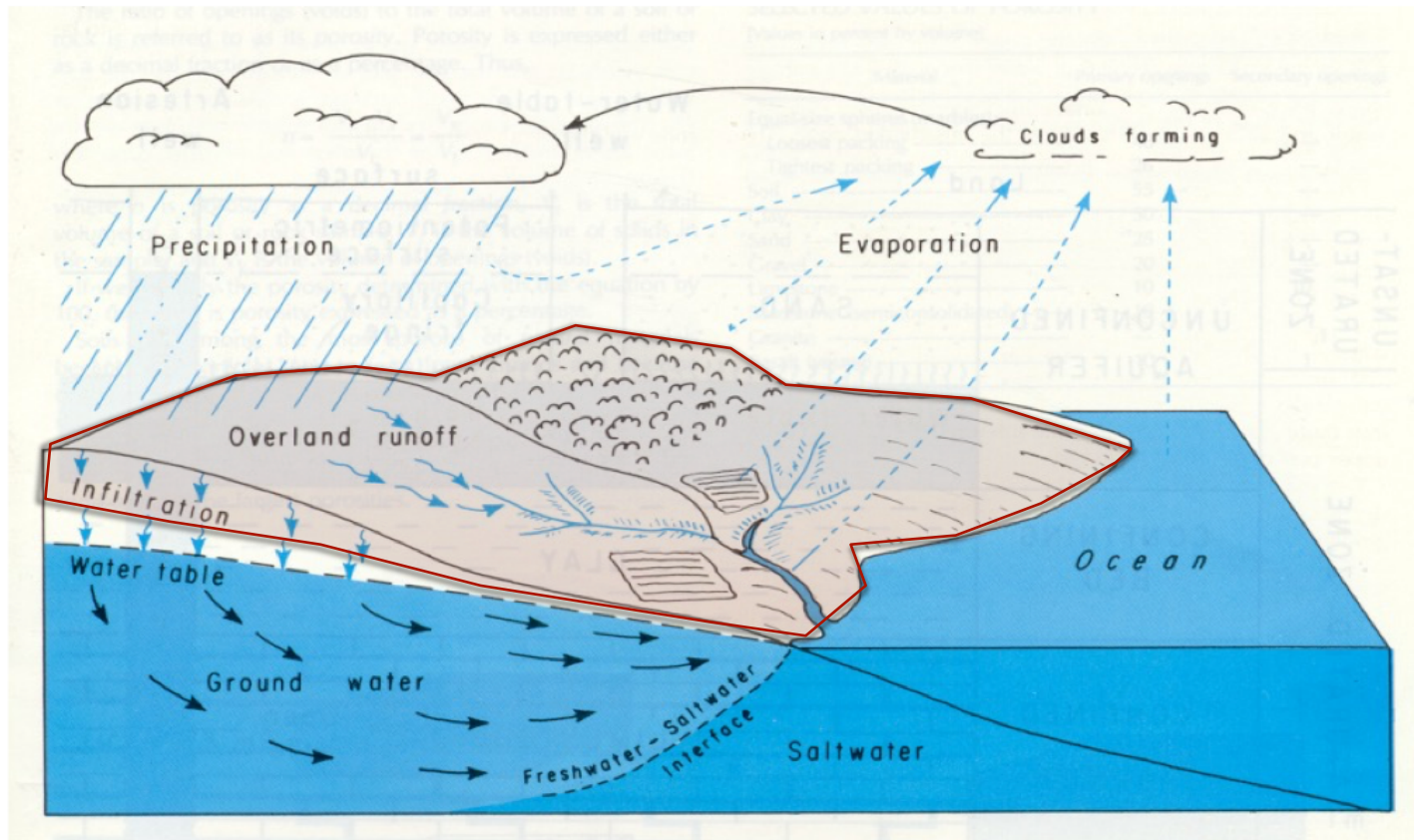


Figure 1.10 Diagram of hydrologic cycle.

(from Heath, R.C., 1983. Basic Ground-Water Hydrology, USGS Water Supply Paper 2220)

GROUNDWATER COMPONENT

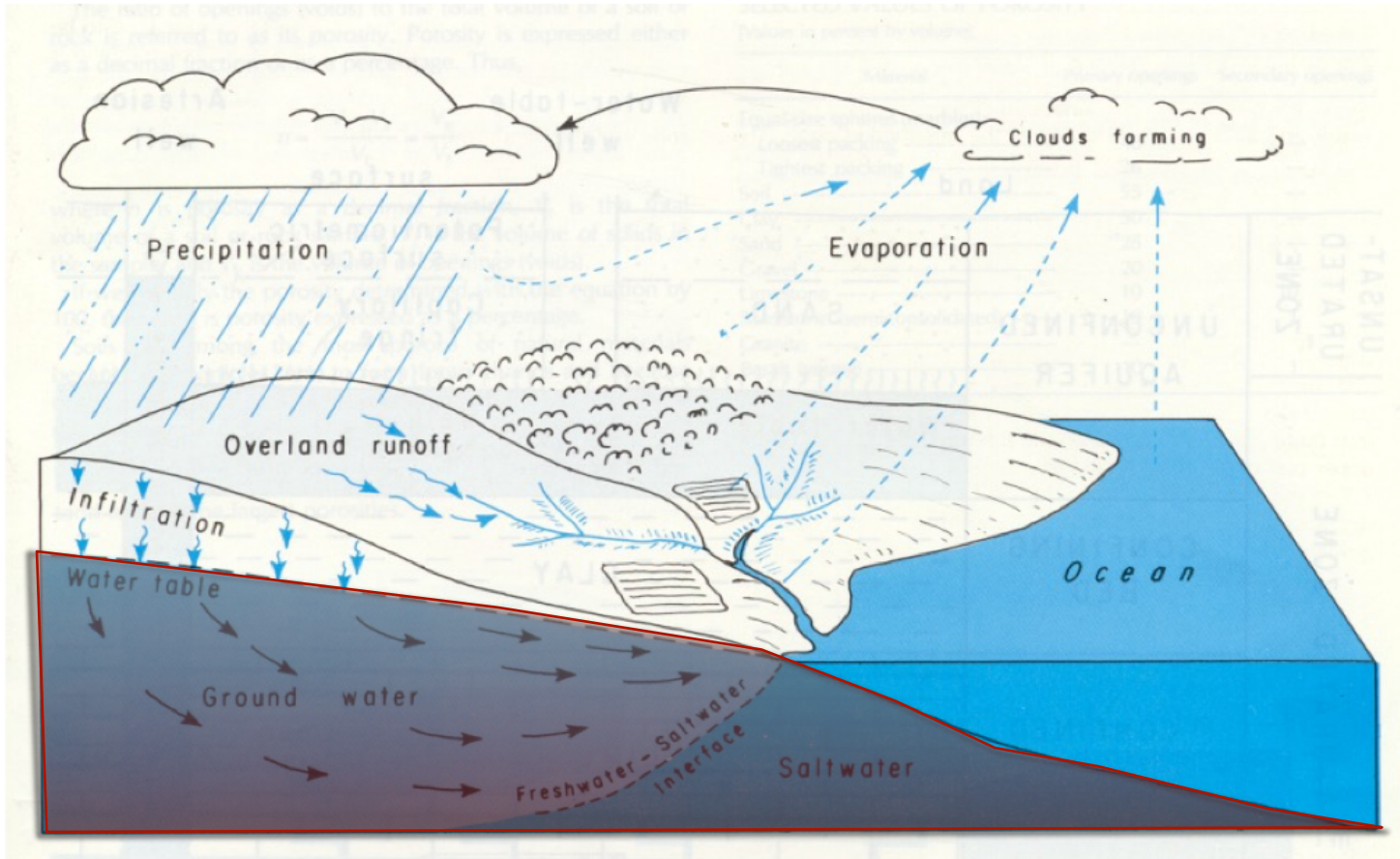
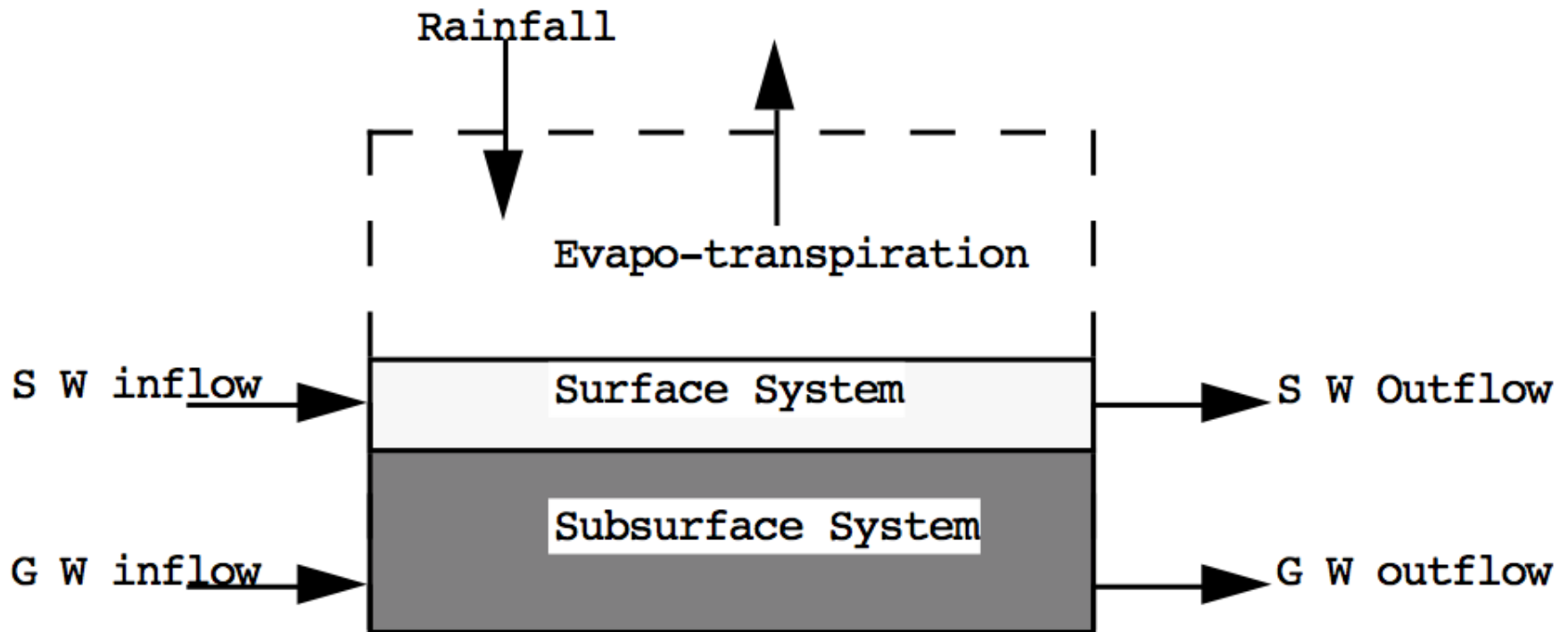


Figure 1.10 Diagram of hydrologic cycle.

(from Heath, R.C., 1983. Basic Ground-Water Hydrology, USGS Water Supply Paper 2220)

AS A SYSTEM DIAGRAM



ANOTHER VIEW OF HYDROLOGIC CYCLE

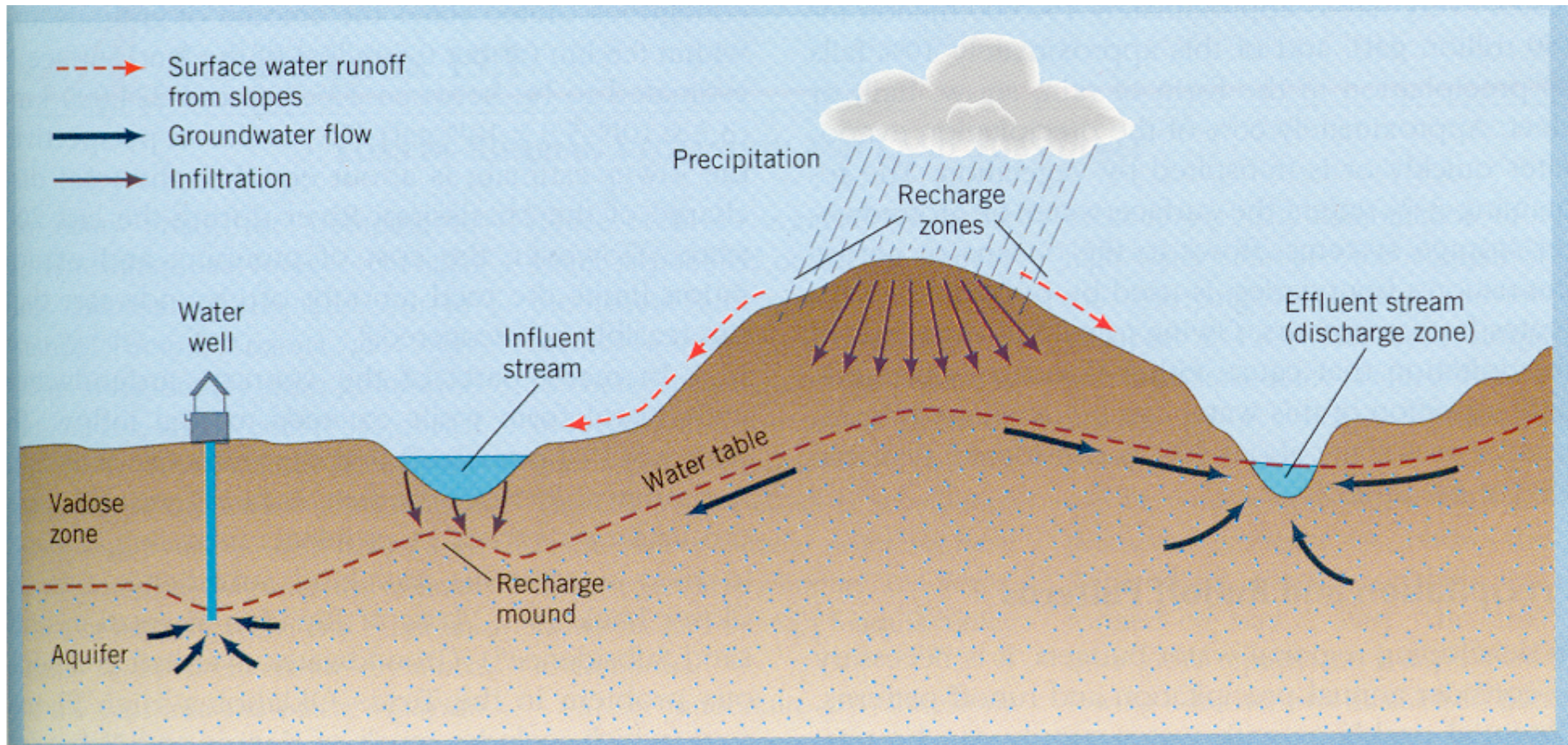


Figure 1.6 Schematic of hydrologic forcing processes, surface, and groundwater flow systems (evaporation not shown).

(from Botkin and Keller, 1998. Environmental Science, J. Wiley & Sons, New York)

WATER BUDGET

- The water budget, or hydrologic balance is simply the expression of the conservation of mass in hydrologic terms for a hydrologic system.
- Generally it is expressed as a rate (or volume) balance.
- The hydrologic equation is the fundamental tool in hydrology to describe amounts of water in storage in different compartments at different scales. The equation expressed in “words” is

Rate of inflow - Rate of outflow = Rate of change of storage + Rate of internal mass generation.

WATER BUDGET

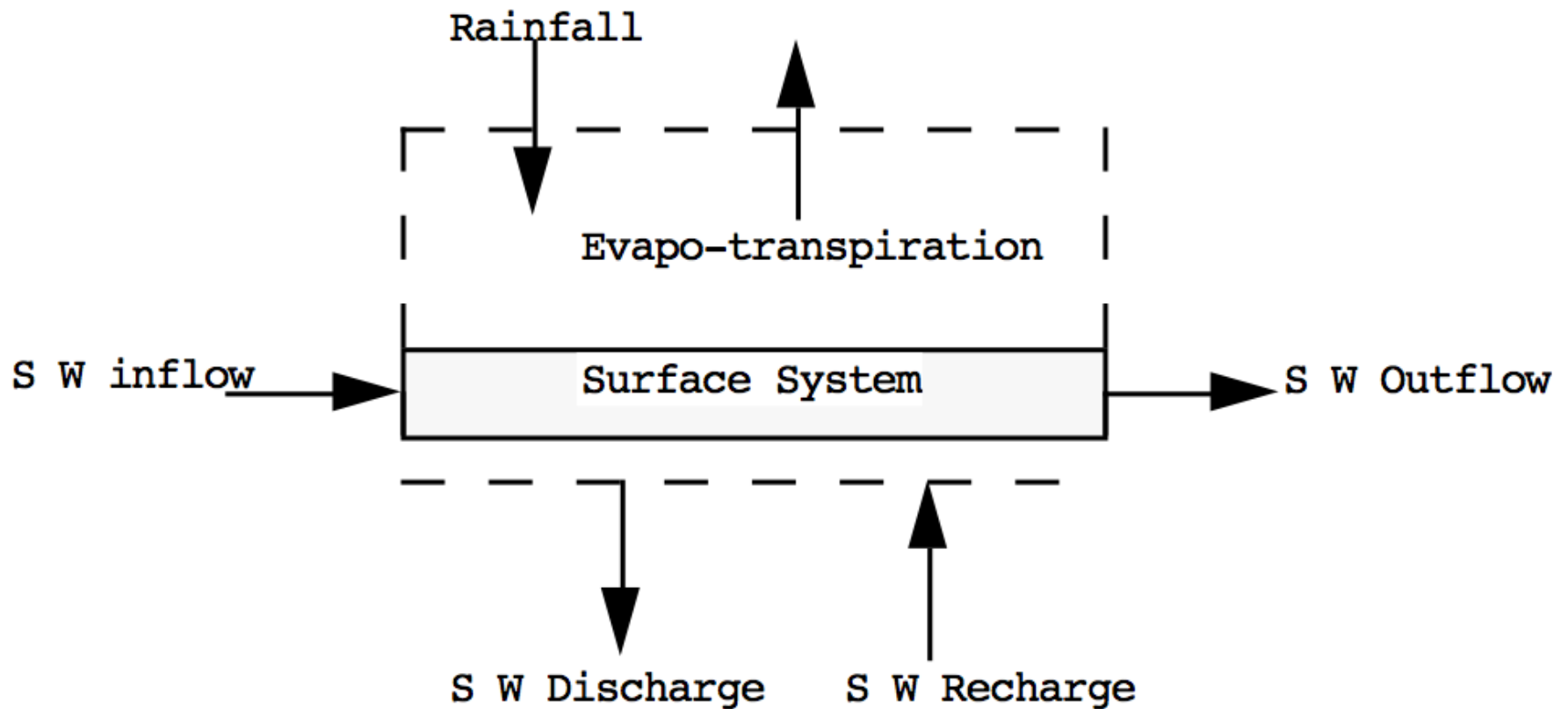
Symbolically, (as a rate equation) it can be represented as:

$$\frac{dI}{dt} - \frac{dO}{dt} = \frac{dS}{dt} + \frac{dG}{dt}$$

Where I is the inflow volume, O is the outflow volume, S is the storage volume, and G is the generated volume.

Compare to Equation 2.2.4 in CMM; Except for notation, and absence of internal generation they equations are identical.

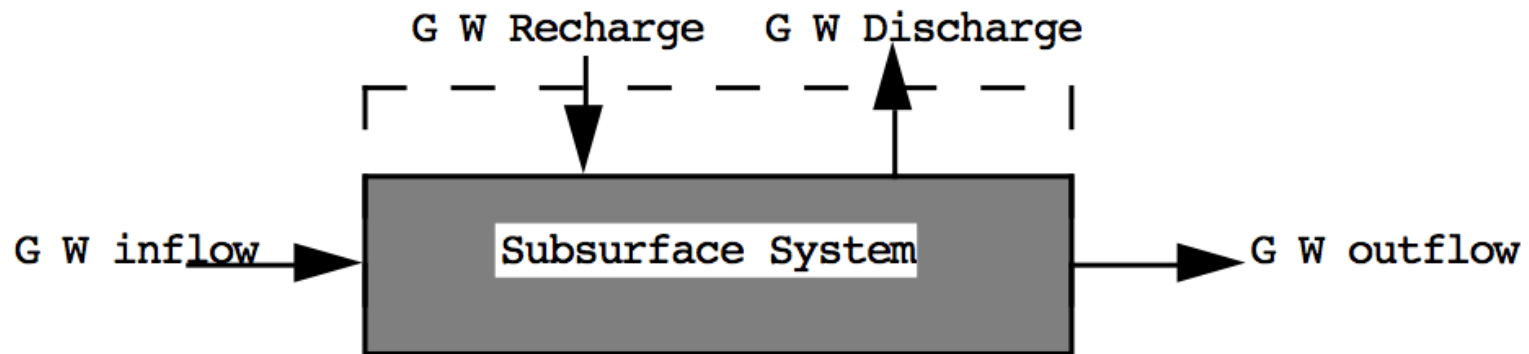
SURFACE WATER SYSTEMS



SURFACE WATER BUDGET

- From the surface water system diagram, an appropriate budget would be
 - Inflows: Rainfall; Surface water from outside boundary, recharge from Groundwater.
 - Outflows: Evapotranspiration; Surface water leaving boundary; Infiltration to groundwater.
 - Storage: Water levels in lakes, rivers, ponds within the boundary; water stored on leaves and other surfaces.

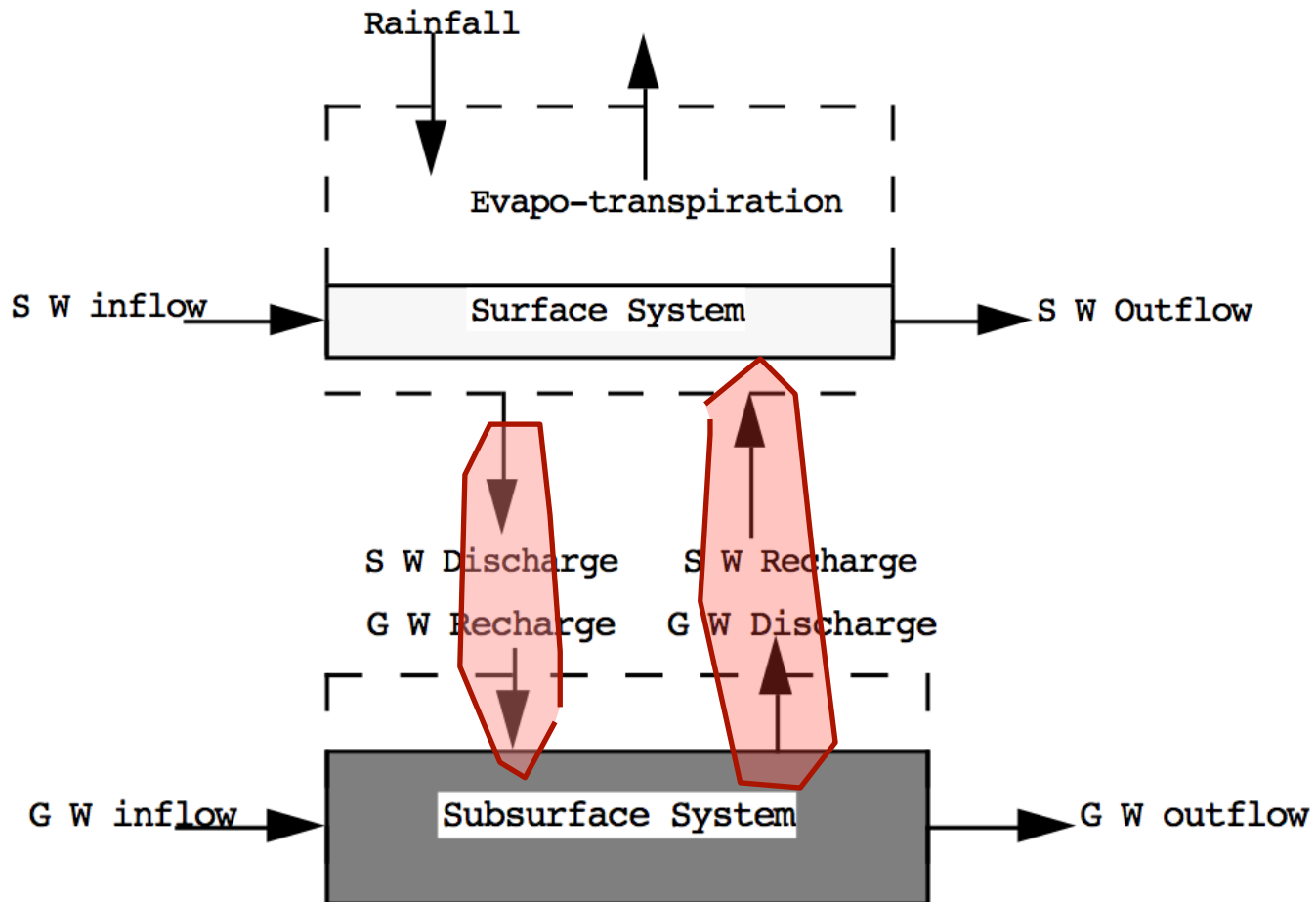
GROUND WATER SYSTEMS



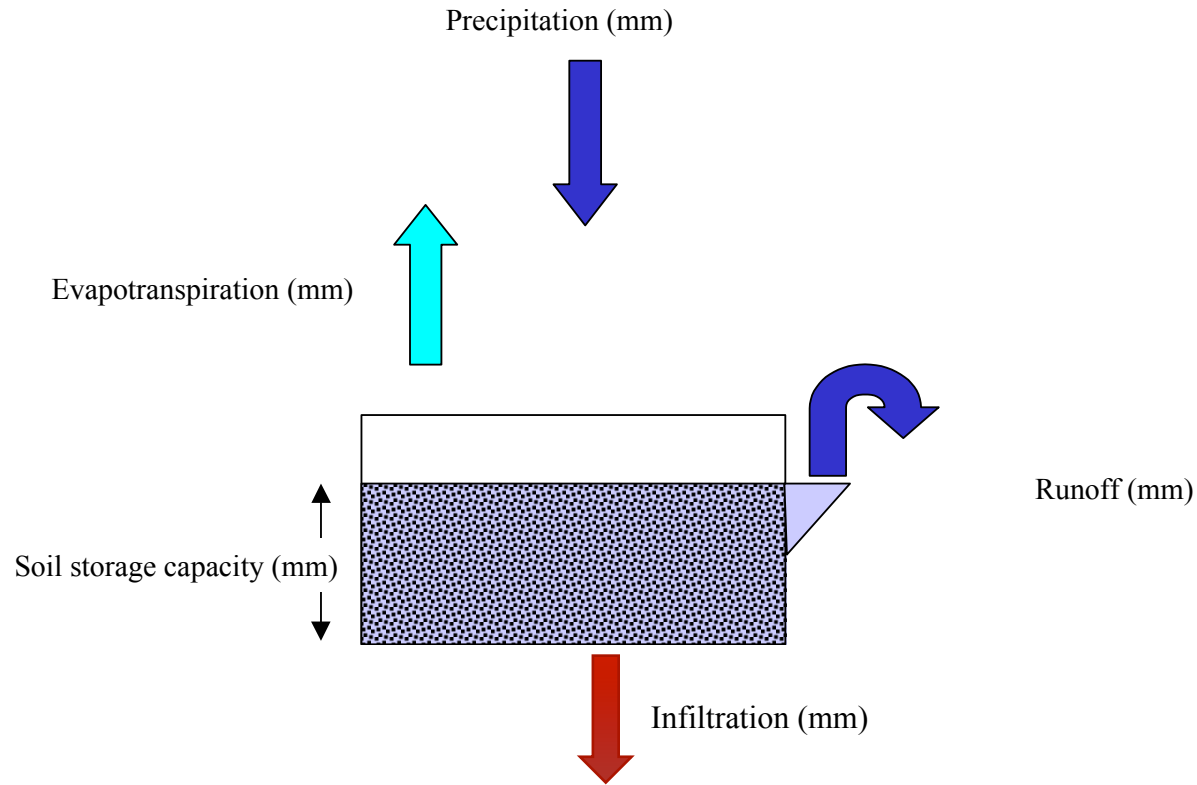
GROUND WATER BUDGET

- From the surface water system diagram, an appropriate budget would be
 - Inflows: Groundwater flow from outside boundary; Recharge from surface system (via infiltration)
 - Outflows: Groundwater flow out of the boundary; Discharge (pumping; springs) to surface system
 - Storage: Water levels in aquifers within the boundary

THE COMBINED SYSTEM



CONCEPTUAL MODEL OF SURFACE WATER BUDGET



NEXT TIME

- Water Budget (calculation example)
- Aquifers