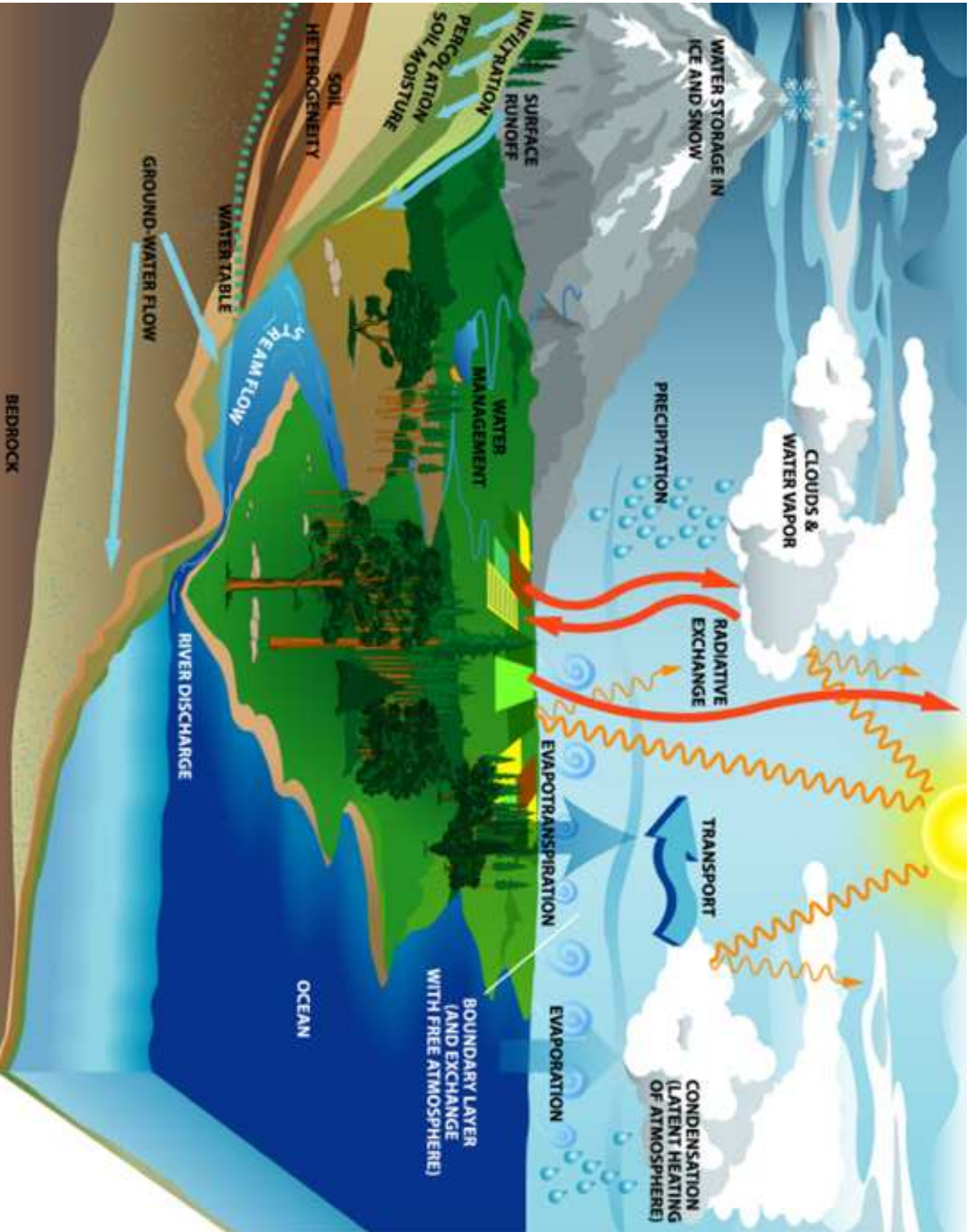


Review: Anaerobic Metabolism and Methane

- “Redox-Potential”
 - Measured against standard H₂-electrode (+- 400 mV)
 - Dominated by pO₂ in aerobic environments
- Anaerobic environments have depleted pO₂
- **Redox potential decreases as the following oxidizing species are “used”:**
 - **NO₃⁻ → Mn⁴⁺ → Fe³⁺ → SO₄²⁻ → (fermentation) HCO₃⁻ / CO₂**
... leading to the following gaseous emissions:
 - **N₂ + N₂O H₂S (+DMS) H₂ + CO₂ + CH₄**
- Methanogenesis “endproduct” of anaerobic metabolism
 - Major source of atmospheric **methane**
 - Anthropogenically disturbed (>doubled in atmosphere)
 - Ø increase in ruminant population = cattle/sheep for food production
 - Ø anthropogenic wetlands = rice fields for food production
 - Ø fossil fuel use and waste management



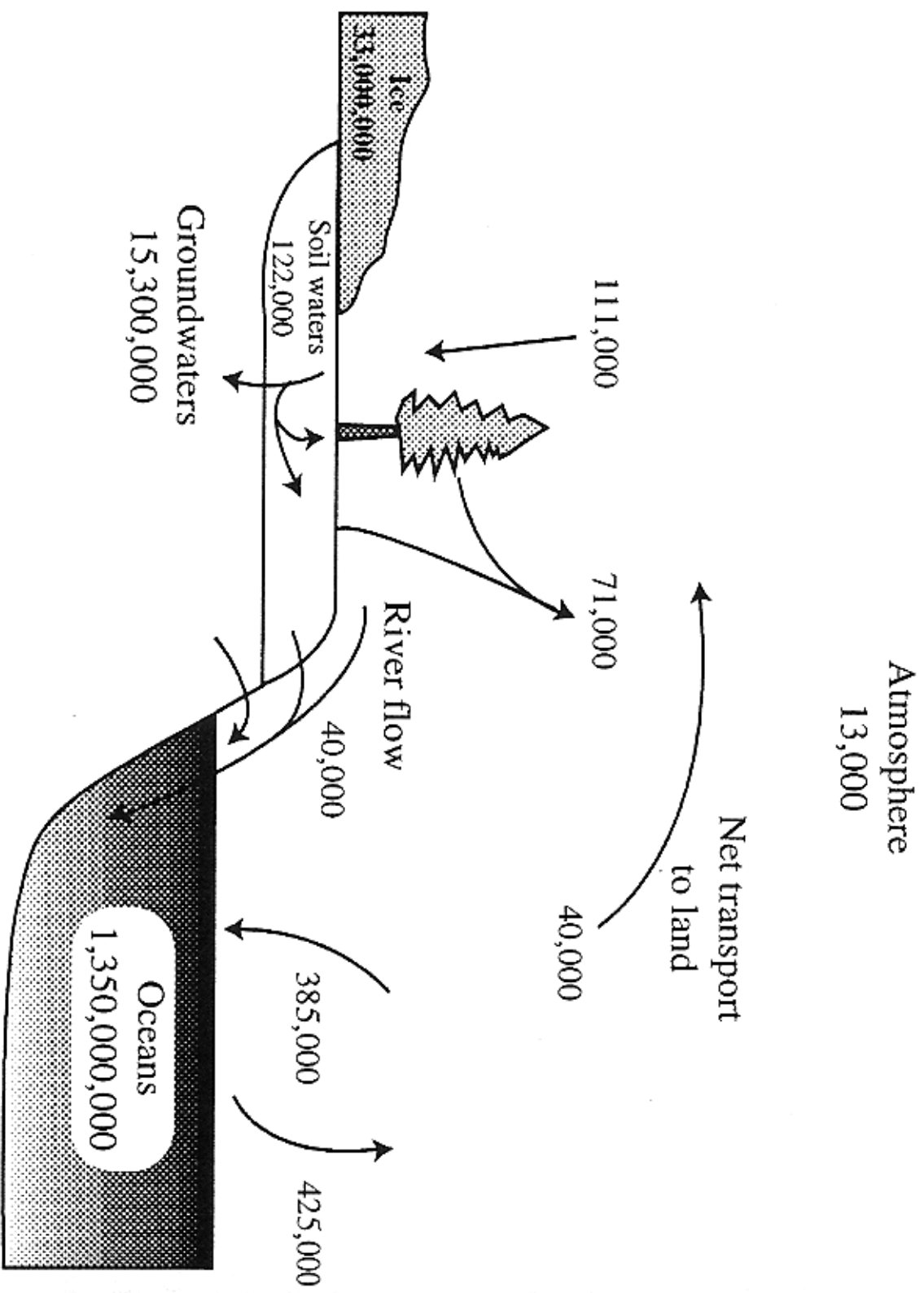
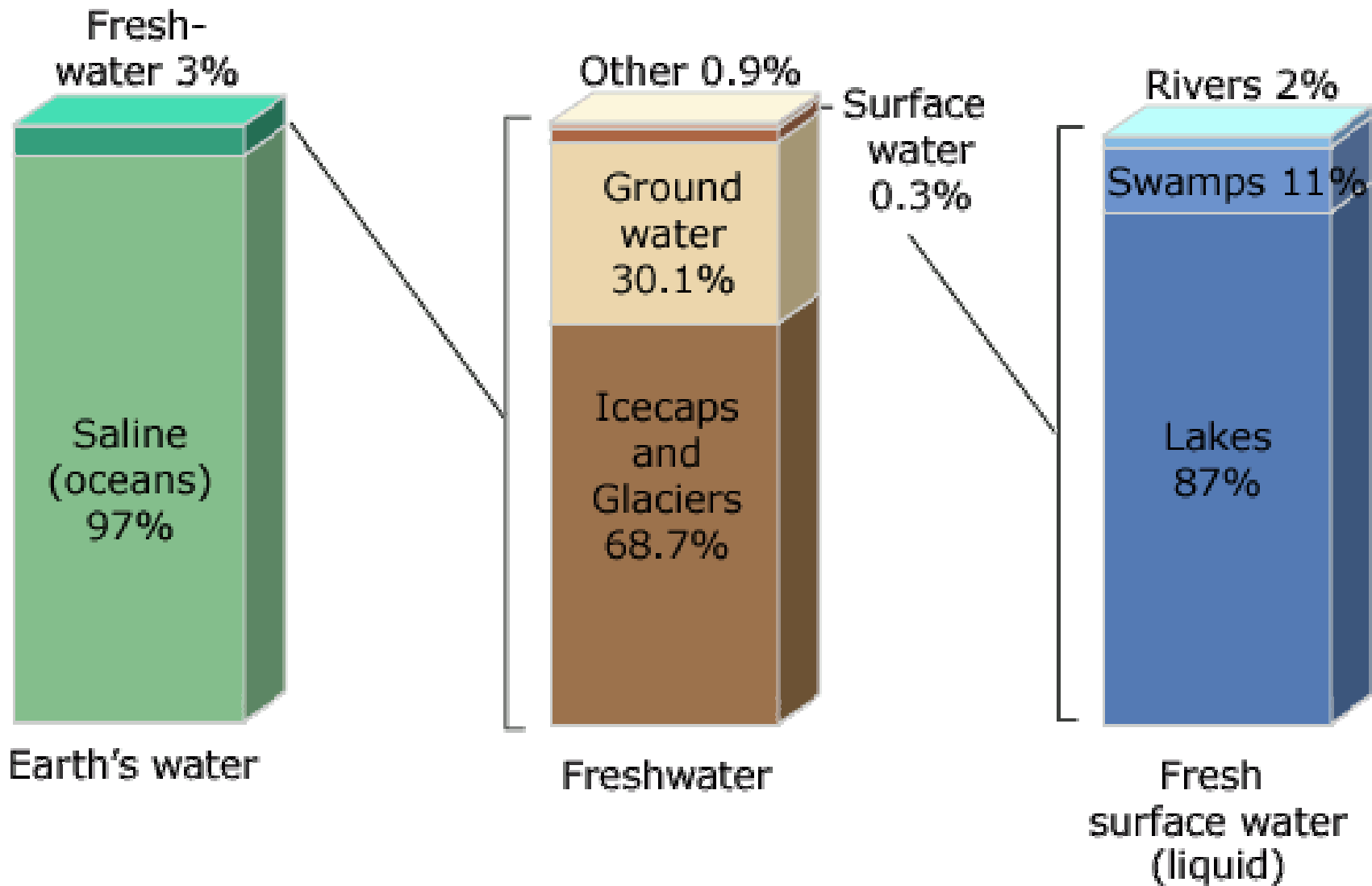
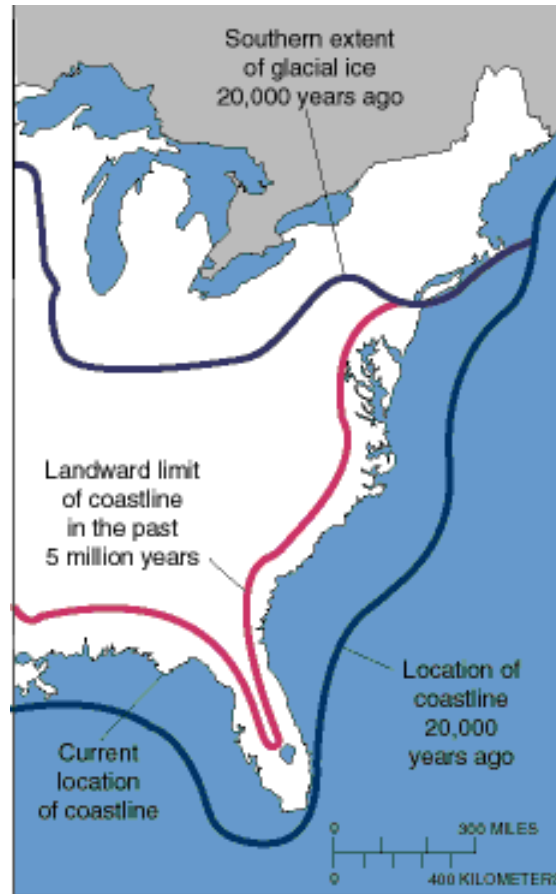


Figure 10.1 The global water cycle. Pools (km³) and flux (km³/yr) are mostly from Lvovich (1973) and Chahine (1992), with some newer values as derived from the text.

Distribution of Earth's Water



<http://ga.water.usgs.gov/edu/watercycle.html>



- sea level driven by T and land-based amount of water
 - Ø if all glaciers melted today, sea level would rise by ~70 m
- large fluctuations due to climate change over time

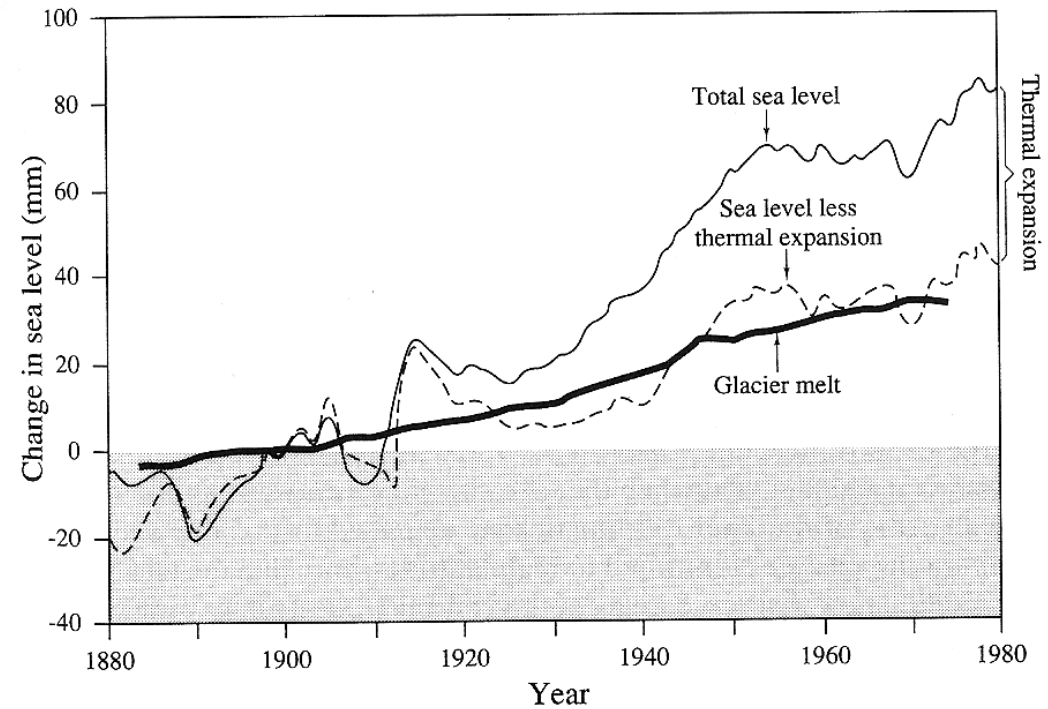
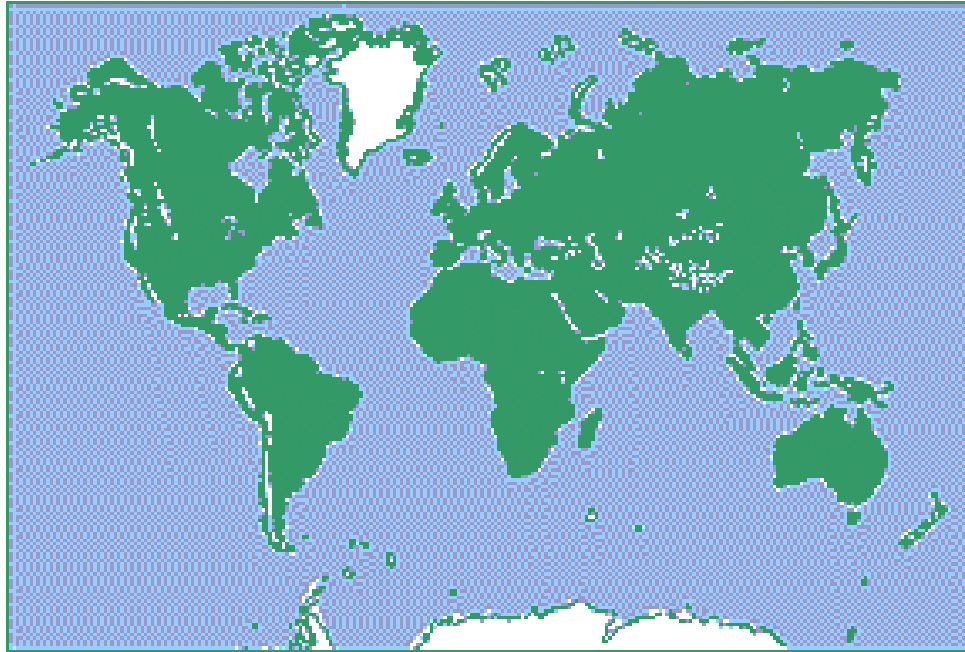


Figure 10.3 Changes in sea level during the last century (Gornitz et al. 1982), indicating the proportion due to thermal expansion of the oceans and that due to melting of glaciers. From Jacobs (1986), after Meier (1984). Copyright 1984 by the AAAS.



Some facts

- Glacial ice covers 10-11 % of all land area
- During the last ice age the sea level was about 122 m lower than it is today. Glaciers covered almost one-third of the land
- During the last warm spell, 125,000 years ago, the seas were about 5.5 m higher than they are today. About three million years ago the seas may have been up to 50.3 m higher



Stephens Glacier, Alaska.
Photo by Bruce Molina, USGS

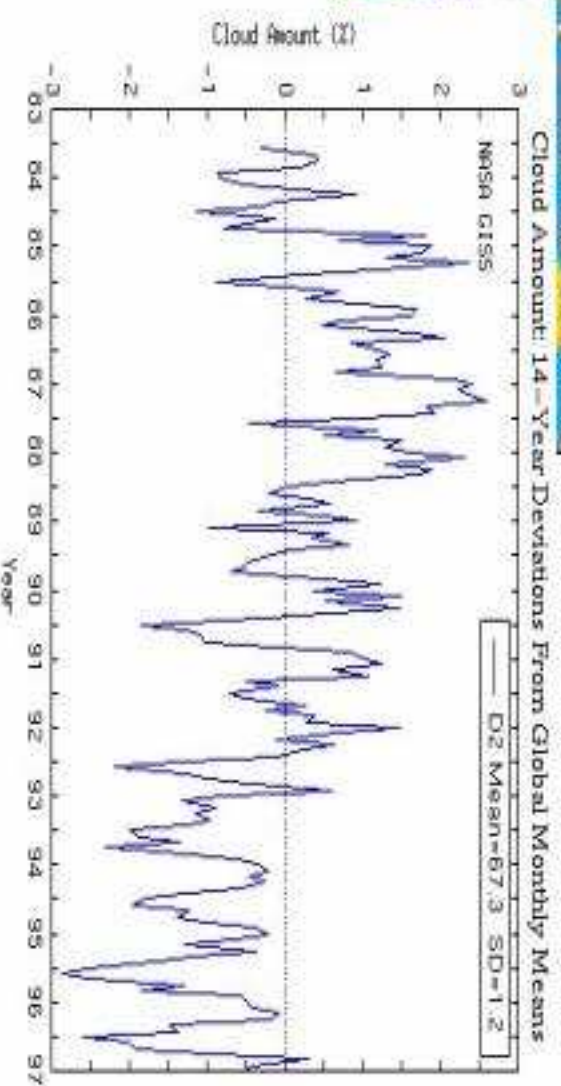
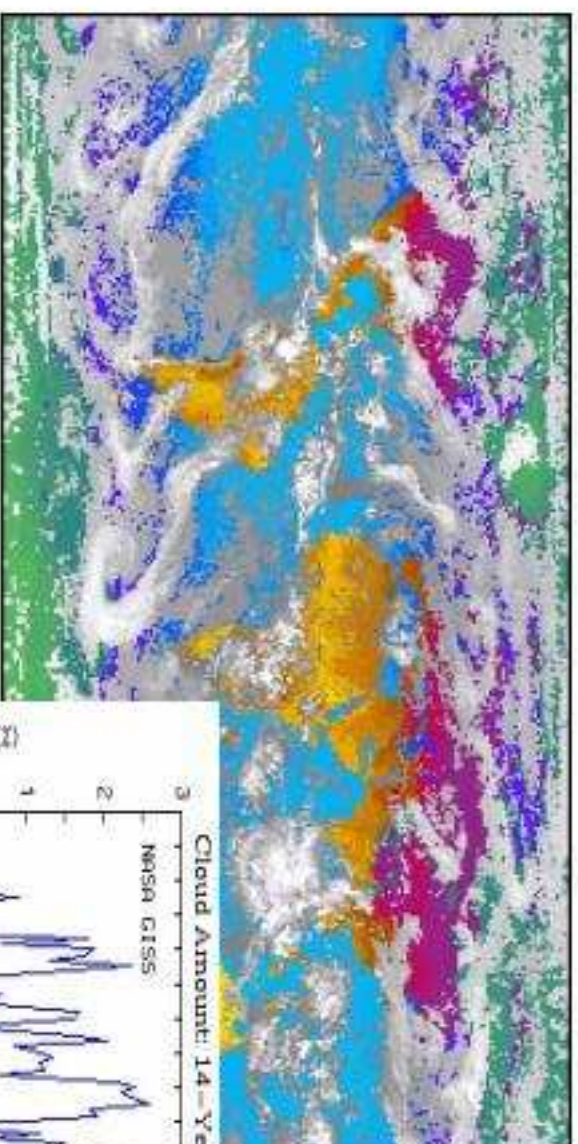
GEI/MEY ISCCP 14-17 yrs of Data Easily Available

WCRP #1111

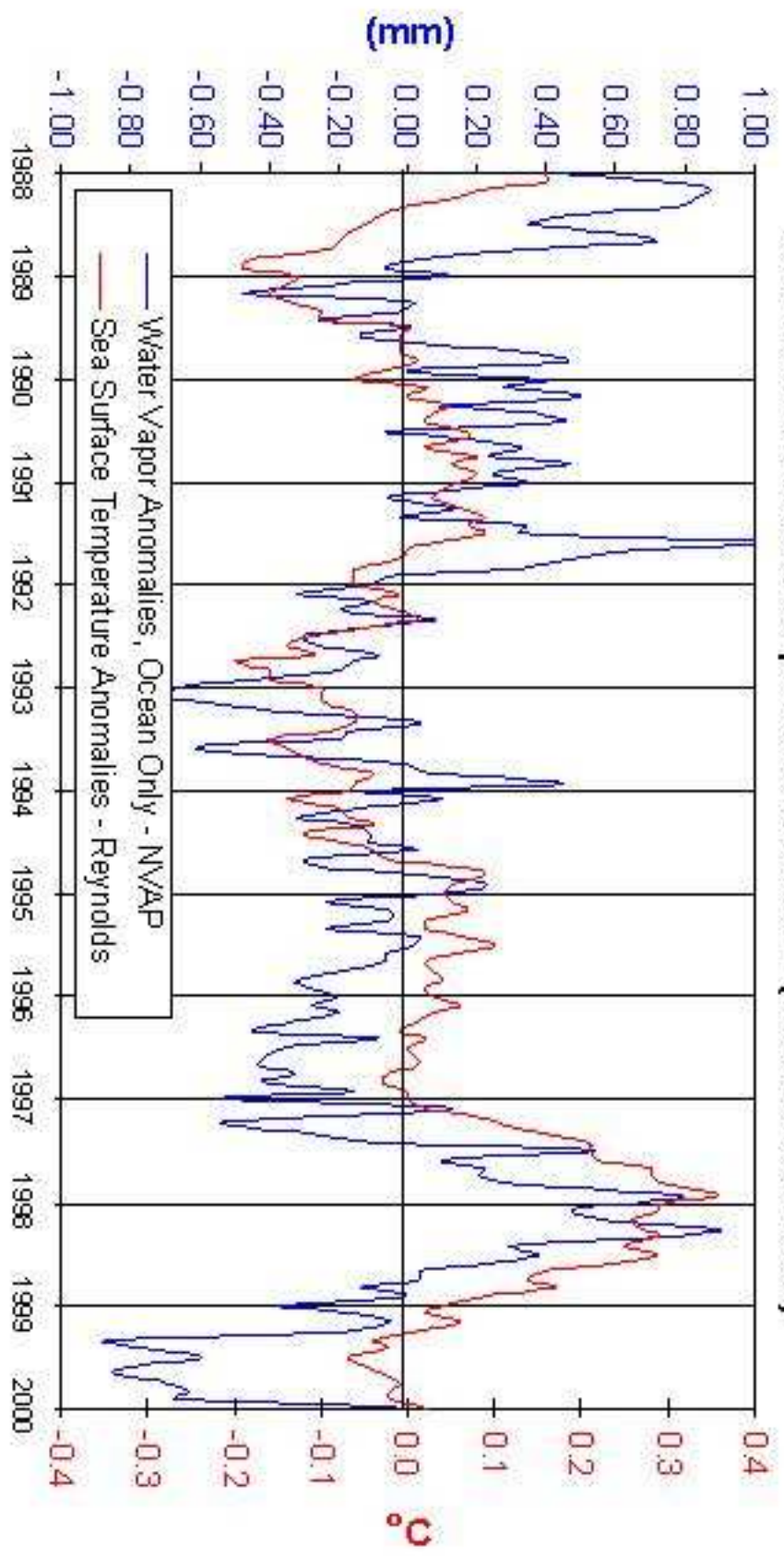
1983-1999 cloud and related parameter data set available

via www, CD ROM or ftp

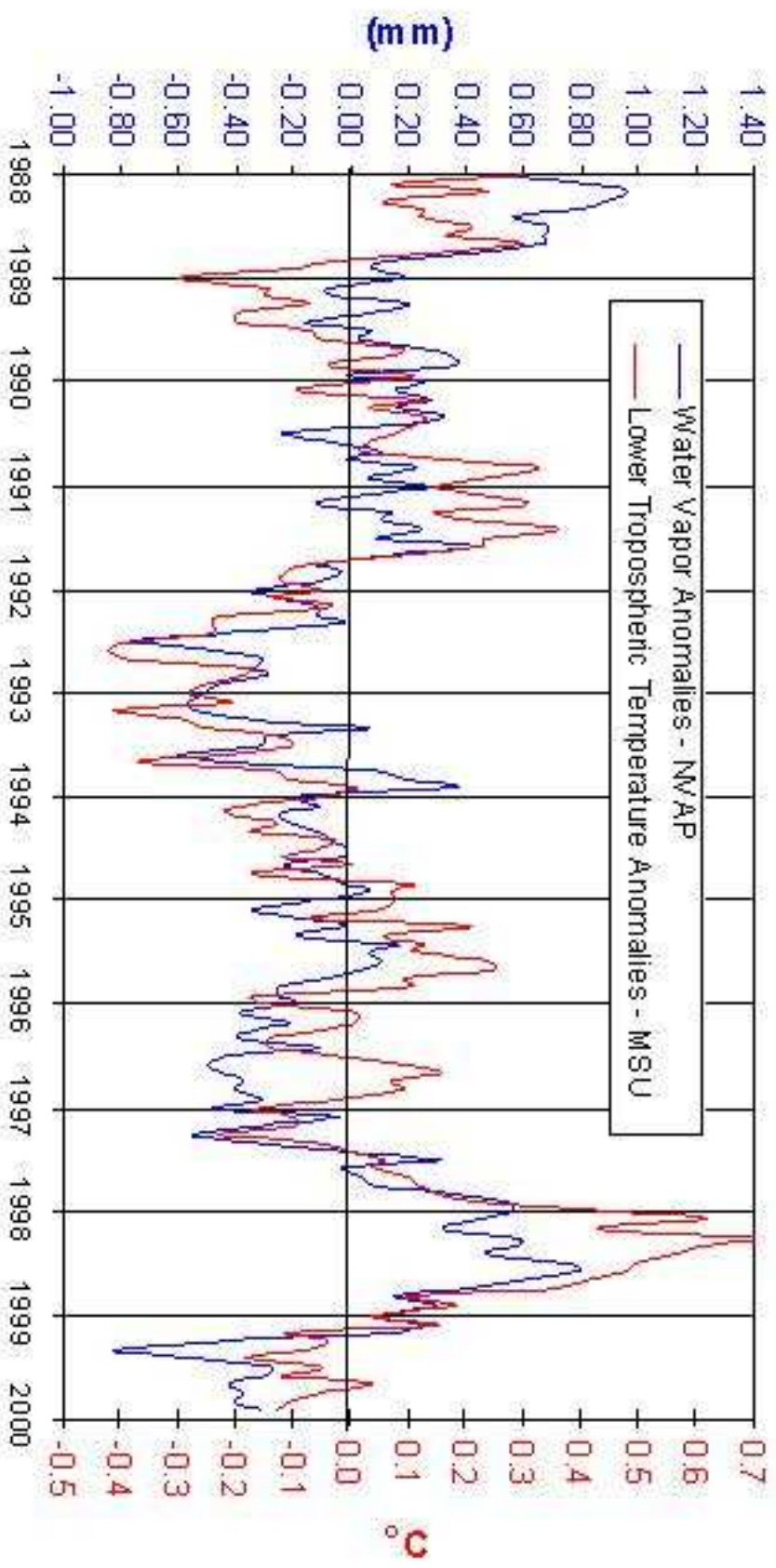
(e.g., cloud layers, types, opt depth and surface albedo/temperature)



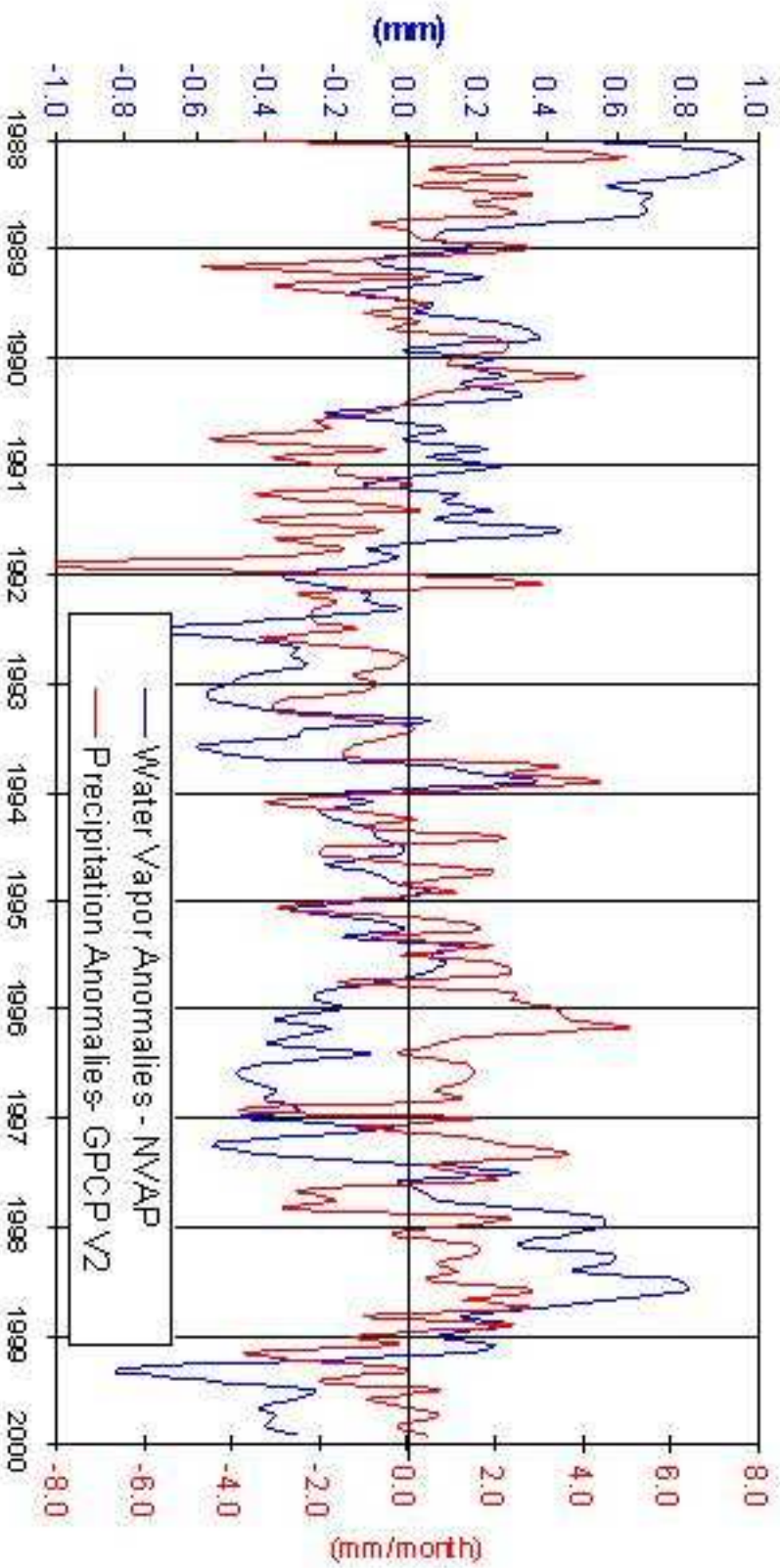
Comparison of the Sea Surface Temperature and Total Column Water Vapor Anomalies - (Ocean 60N - 60S)



Comparison of the Lower Tropospheric Temperature and Total Column Water Vapor Anomalies - Global Means

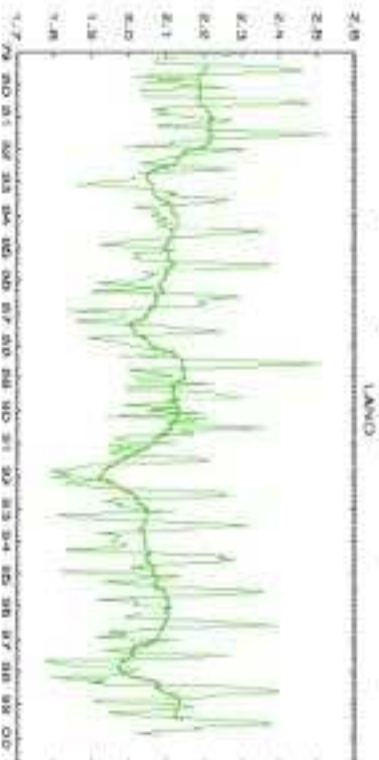


Comparison of the Precipitation and Total Column Water Vapor Anomalies (Global)



20 year pattern of global precipitation

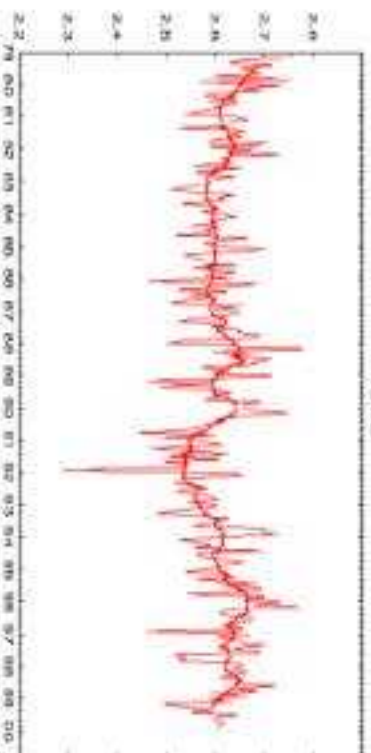
Globally Averaged Precipitation (90N-90S)



LAND

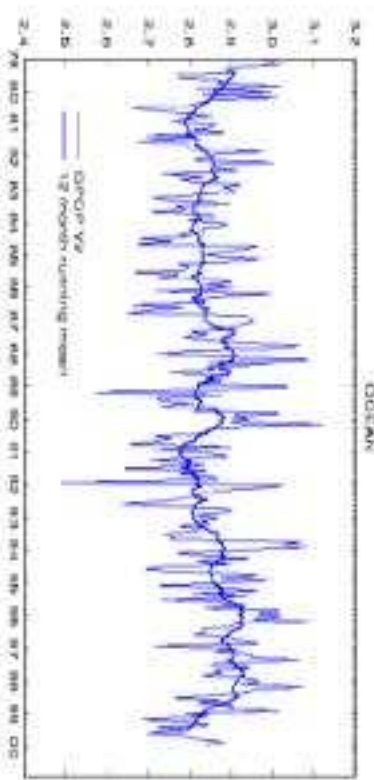
Globally Averaged Precipitation (90N-90S)

TOTAL



TOTAL

Globally Averaged Precipitation (90N-90S)



OCEAN

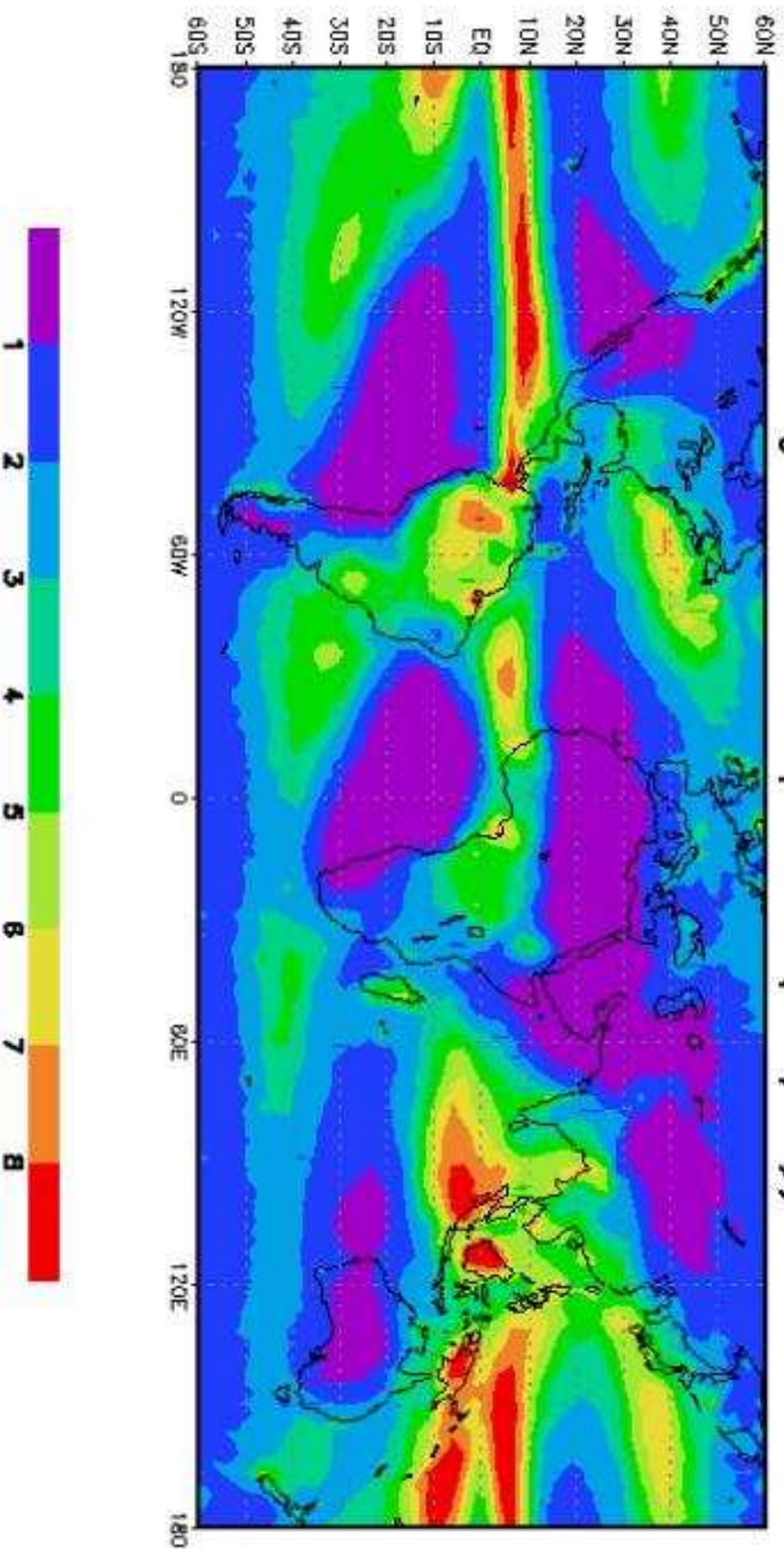
Three new GPCP products :

- 20 year monthly (2.5x2.5)
- 20 year Pentad (5 dy)
(shows MJO)
- 1x1 degree daily since '97



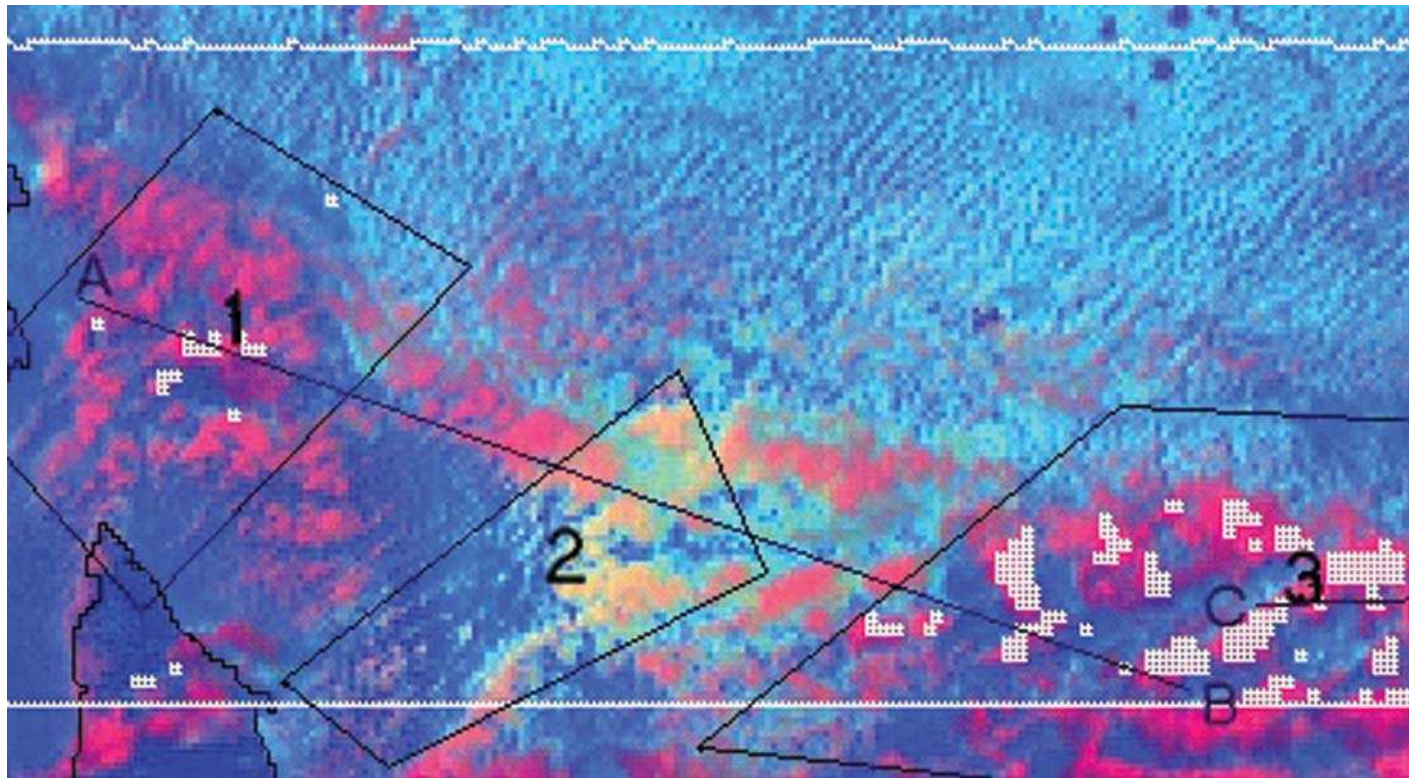
GPCP Global Precipitation

Annual Average GPCP Precipitation (mm/day): 1987-99



Anthropogenic influences

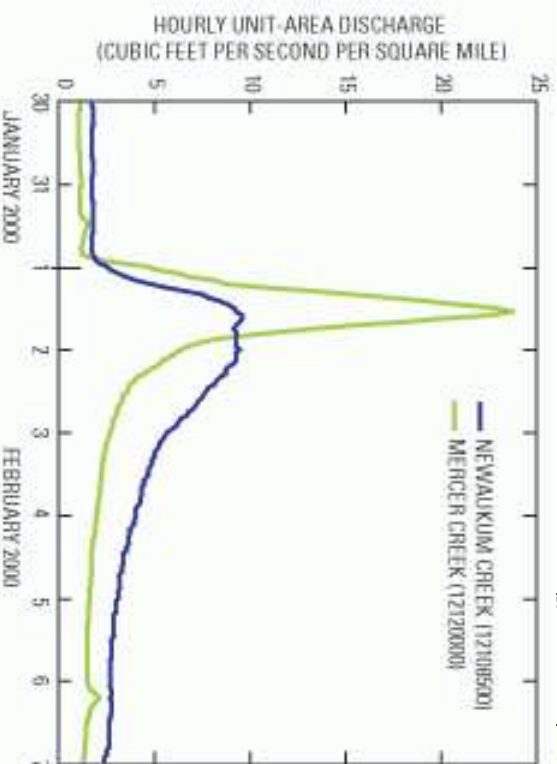
- more aerosols → direct aerosol effect (increased or decreased albedo depending on aerosol type)
- more condensation nuclei → indirect aerosol effect (more and smaller droplets → increased albedo from pollution)





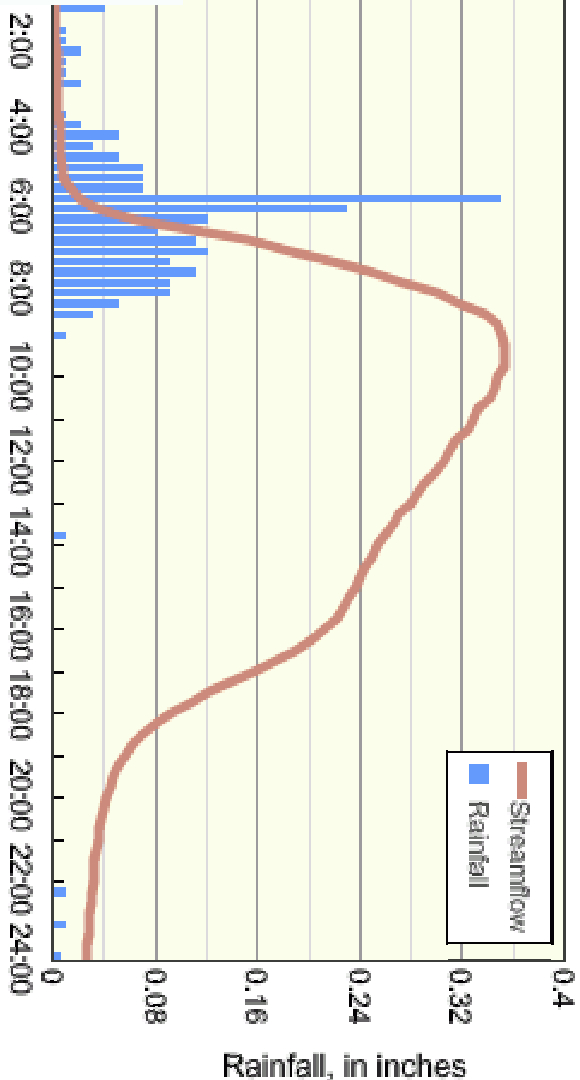
Overland runoff from disturbed areas often contains excessive sediment in addition to water. (USGS)

ow, in cubic feet per second

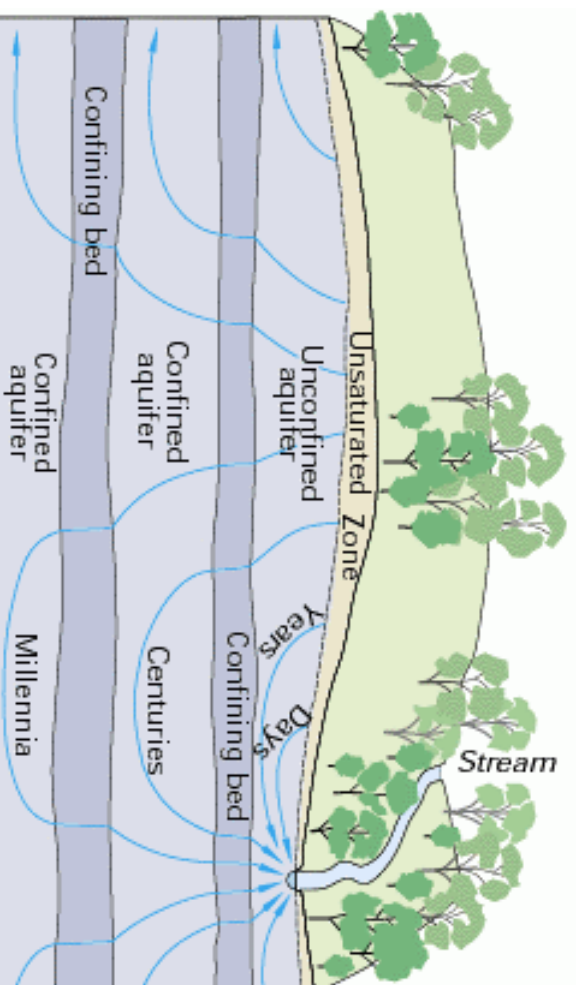
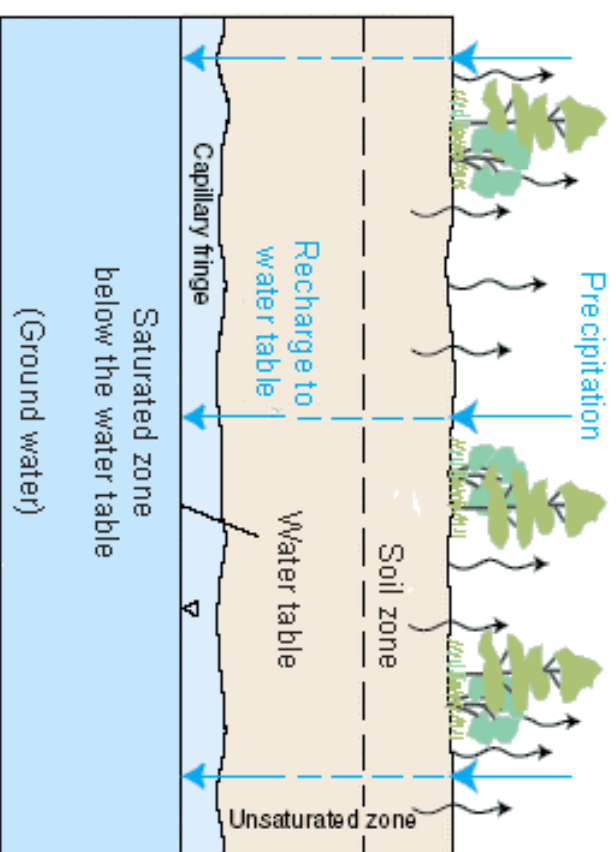
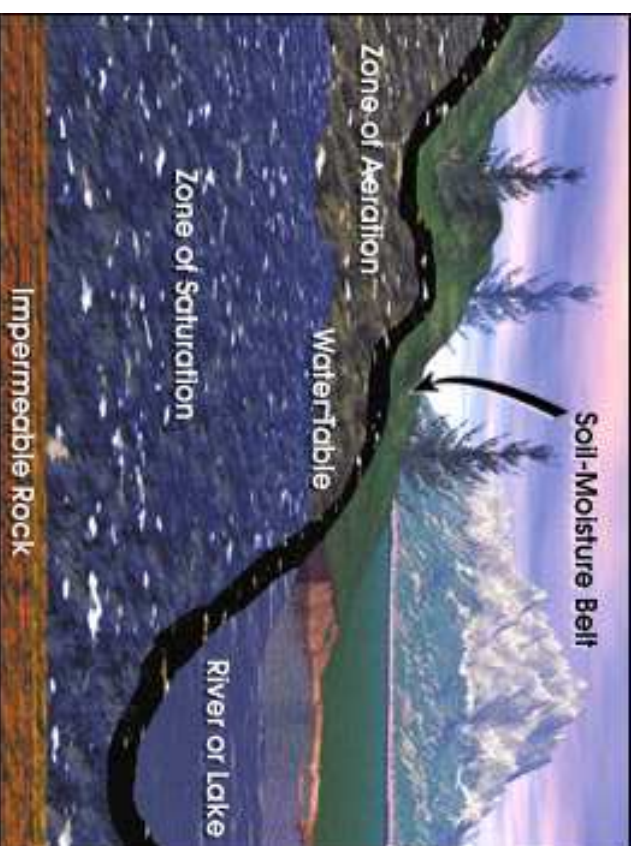


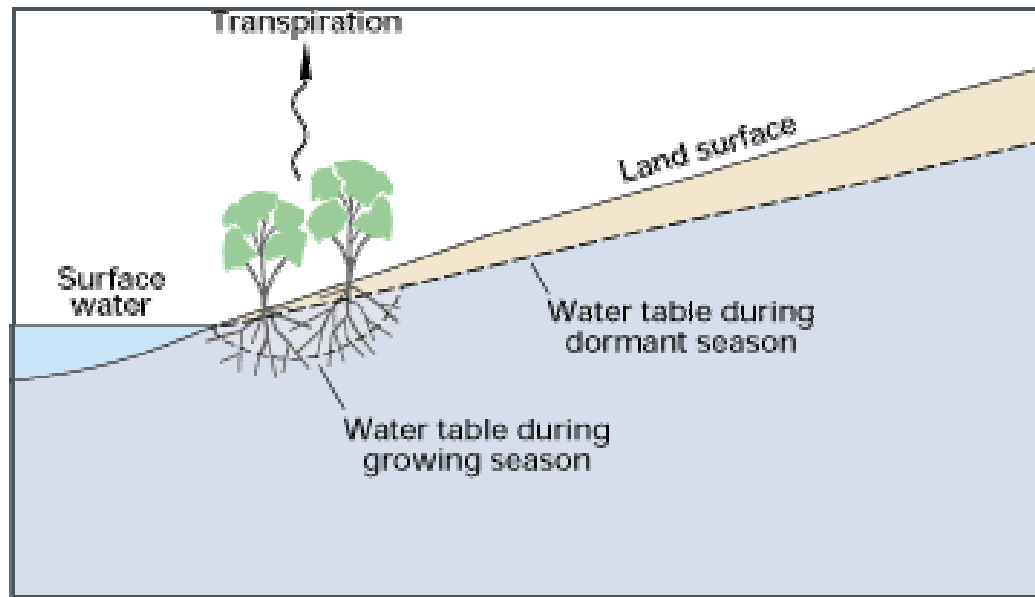
Streamflow in Mercer Creek, an urban stream in western Washington, increases more quickly, reaches a higher peak discharge, and has a larger volume during a one-day storm on February 1, 2000, than streamflow in Newaukum Creek, a nearby rural stream, a nearby rural stream that drains a basin of similar size.

Rainfall and streamflow at Peachtree Creek, Dec. 24, 2002



Erosion caused by surface runoff





Effect of plant transpiration

Anthropogenic
water table
reduction

