

# THE HYDROSPHERE



**PART 2**

# Largest Rivers in the USA

Mississippi: 2,340 mi (3,770 km)

Missouri: 2,540 mi (4,090 km)

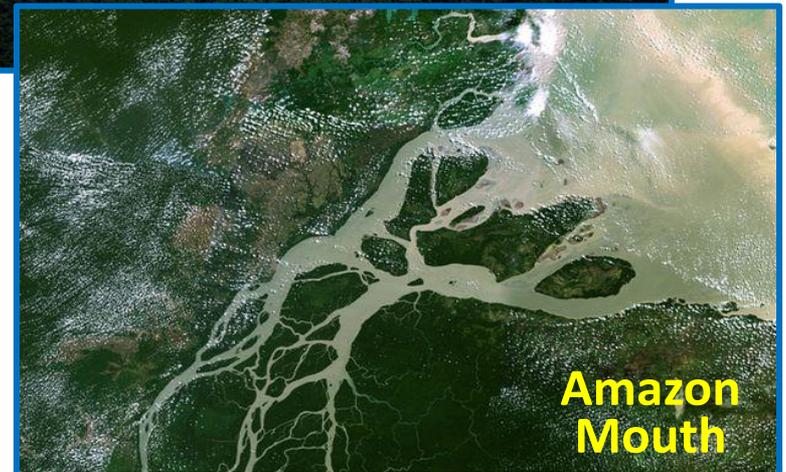


Heart River, North Dakota

Mississippi River "Birdfoot" Delta

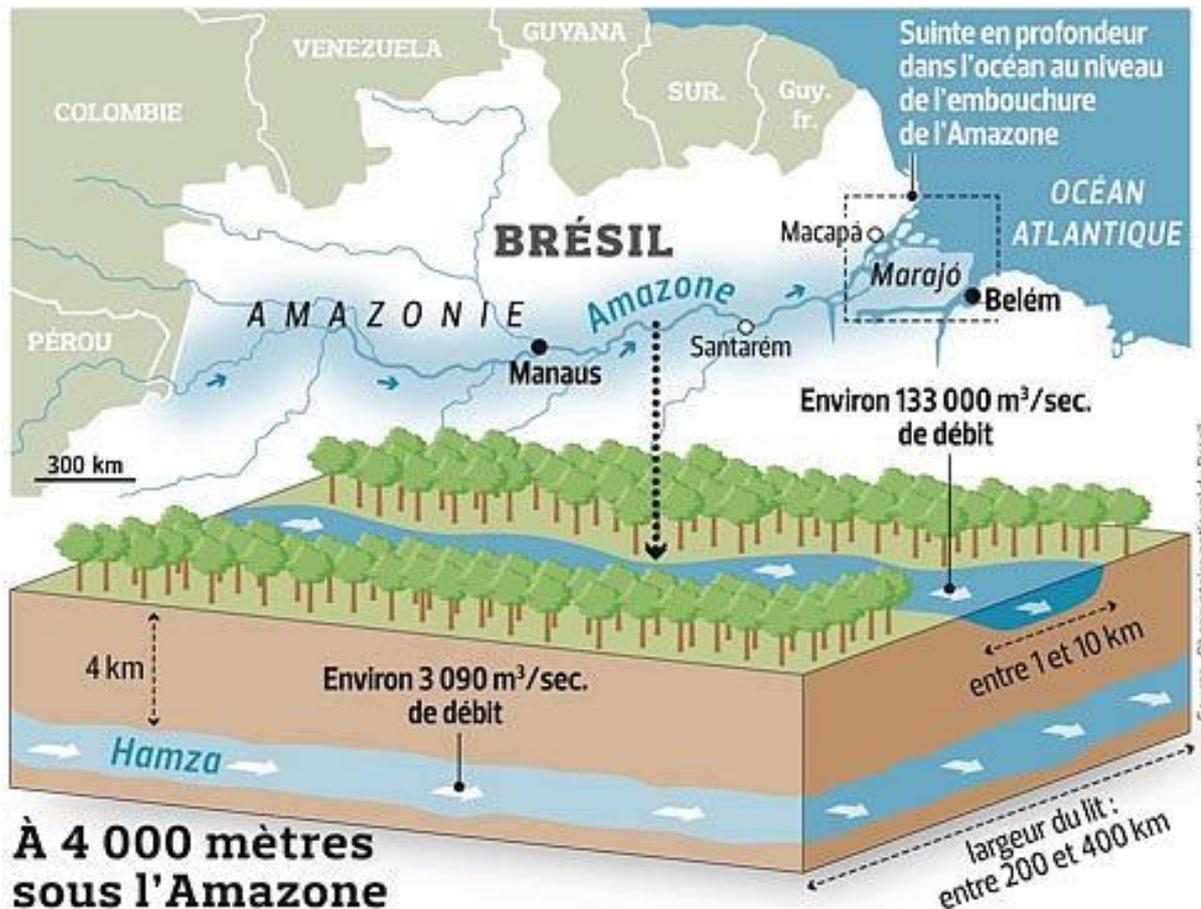
# Amazon River Basin

The **Amazon River** in South America is the **largest river by the discharge of water** and also the **second longest river** in the world (~6400 km). The **Amazon Basin**, the **largest drainage basin** in the world, covers about 40% of South America, an area of approximately 7,050,000 km<sup>2</sup> (2,720,000 sq mi). It drains from west to east, flowing into the Atlantic Ocean.



# Rio Hamza (slowly flowing aquifer)

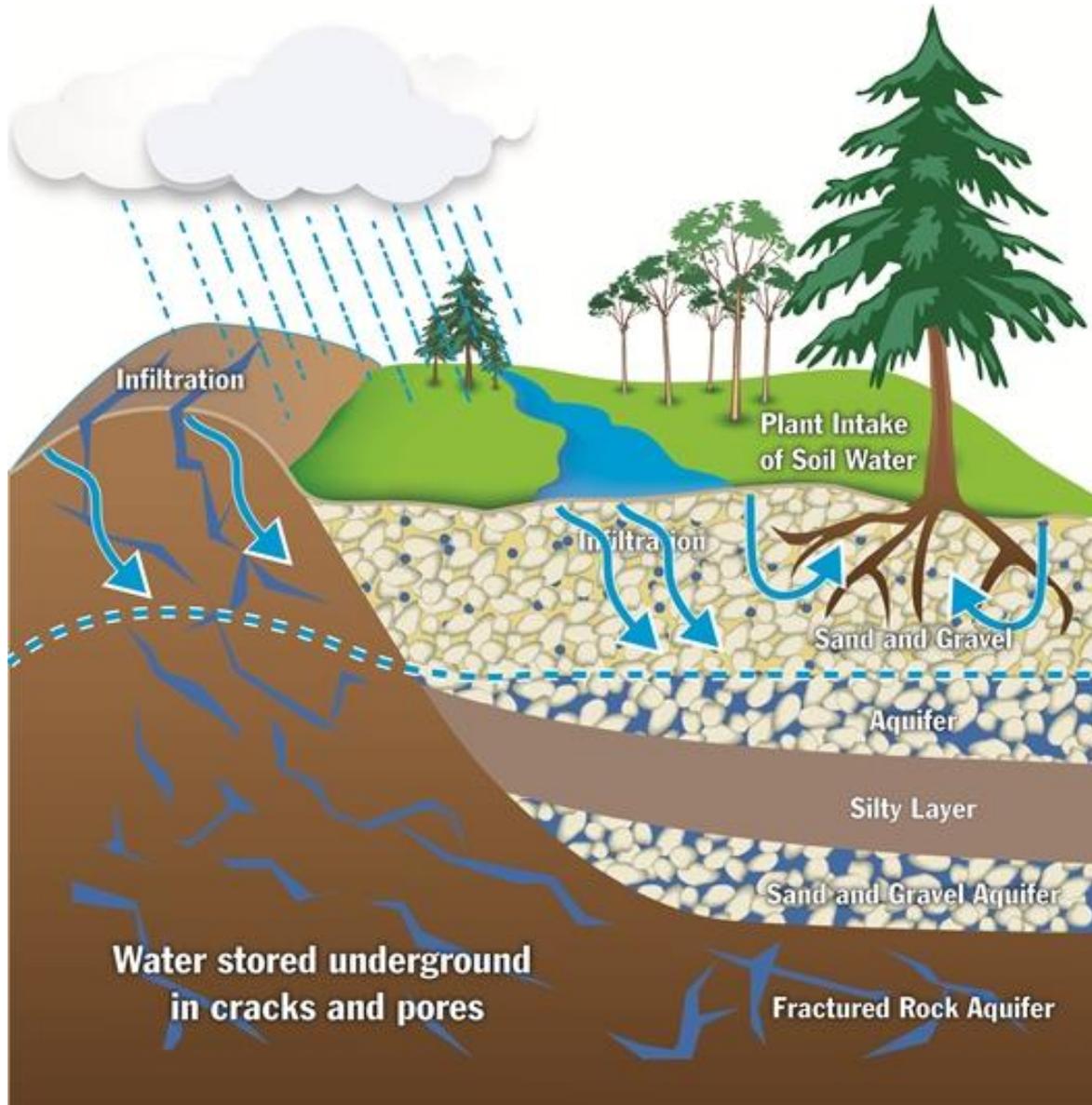
The Amazon River has an **underground “twin sister”** named **Hamza** (*discovered in 2011*)! It runs for a length of 6,000 km (3,700 mi) at a depth of nearly 4,000 m (13,000 feet).



Except for the flow direction, the rivers have very different characteristics:

- **flow speed** - it is **5 m/s (16 feet/s)** in the Amazon and **less than 1 mm/s (0.039 in/s)** in the Hamza
- **width** - the Amazon is **1 km (0.62 mi) to 100 km (62 mi)** wide, the Hamza is **200 km (120 mi) to 400 km (250 mi)**, much wider

# Groundwater



About **1/3** of **all freshwater on the planet** is found underground.

Part air part water  
**unsaturated zone**

--- **Water table**

**Saturated zone:** water fills all pores and cracks

# Wetlands

Wetland is an area where the **water table is at, near or above the land surface long enough** during the year to support adapted plant growth.

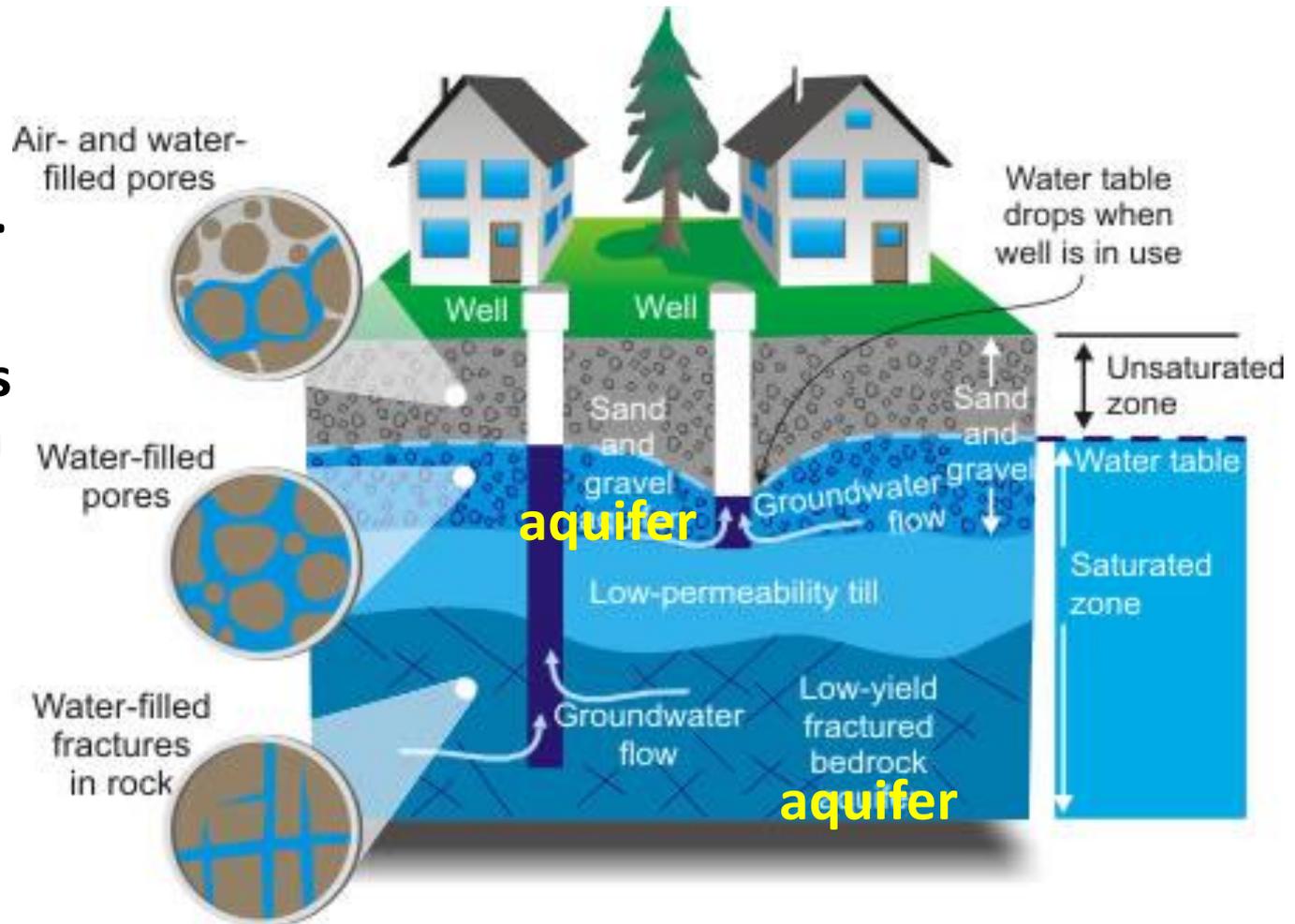


- Swamp: a wetland dominated by trees
- Bogs: a wetland dominated by peat moss
- Marshes: a wetland dominated by grasses

# Freshwater: Groundwater Aquifer

Aquifer is an underground sand/gravel or rock layer that stores water and allows water to flow through it.

- **Drinking water** supply.
- Anyone who has a well gets water from an aquifer.
- About **half of all Americans** get *most* of their water from wells.



# Global Groundwater Resources



Largest deserts of the world?!

Local and shallow aquifers provide limited quantities of water.



LOCAL AND SHALLOW AQUIFERS



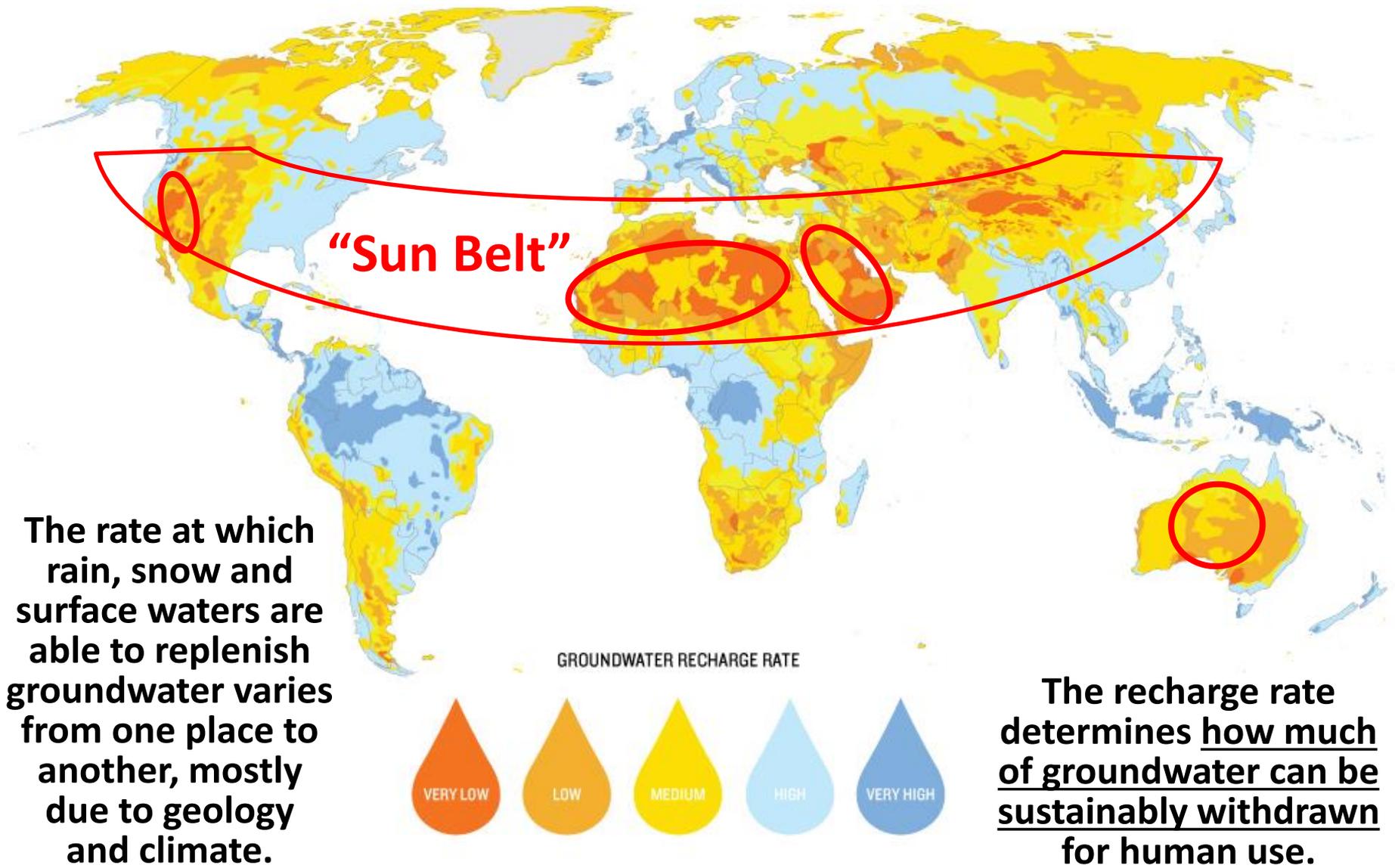
COMPLEX HYDROGEOLOGICAL STRUCTURE



MAJOR GROUNDWATER BASIN

Major basins hold abundant, relatively easily extracted groundwater.

# Groundwater Recharge

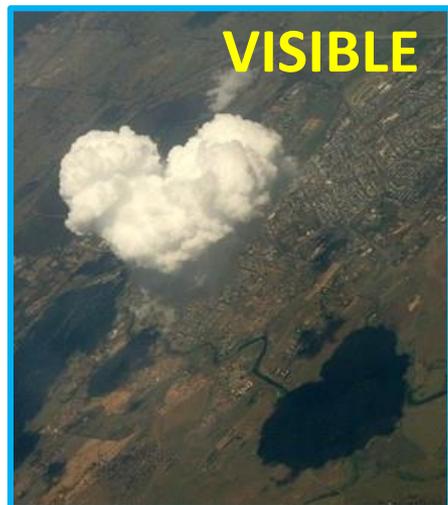


The rate at which rain, snow and surface waters are able to replenish groundwater varies from one place to another, mostly due to geology and climate.

The recharge rate determines how much of groundwater can be sustainably withdrawn for human use.

# Atmospheric Water

Atmospheric water plays a **crucial role** in the **weather**.



➤ **Clouds and precipitation**

(water droplets and ice crystals or a mixture of the two)

➤ **Water vapor**

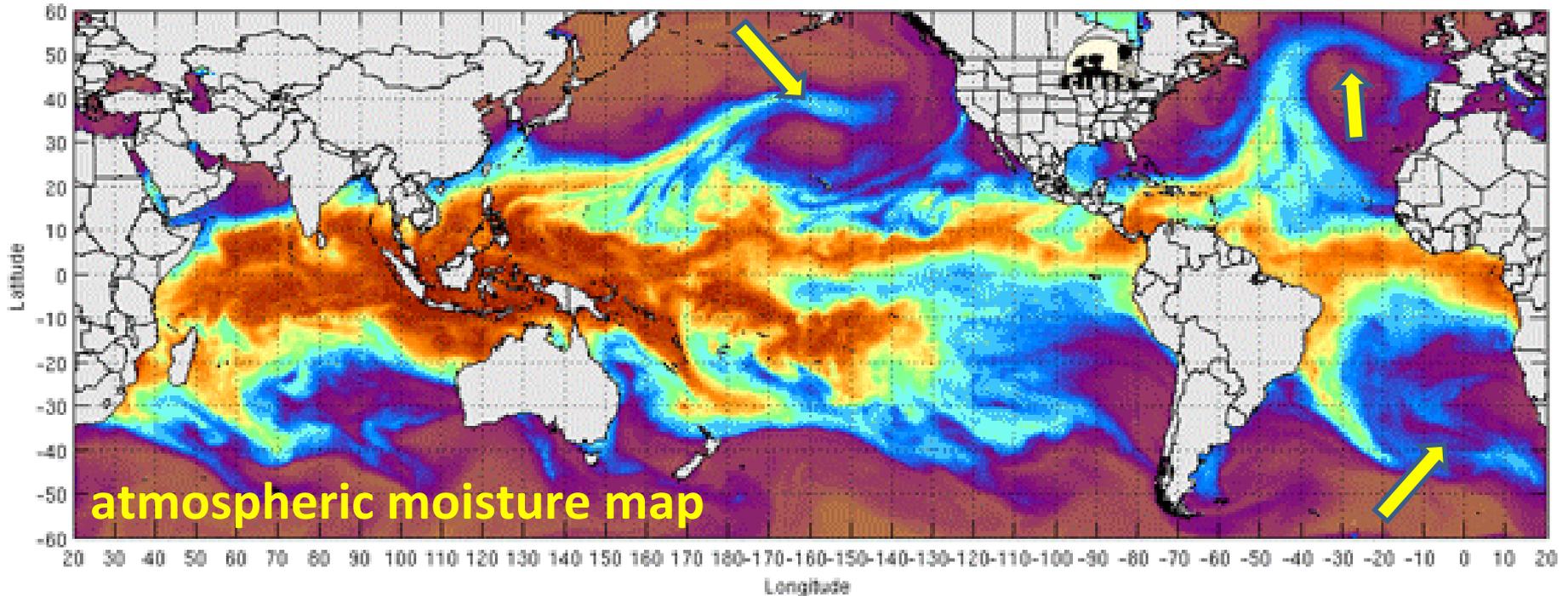
(gas lighter than air; continuously generated by evaporation and removed by condensation)



- The mean global amount of water vapor in the atmosphere is roughly sufficient to cover the surface of the planet with a layer of liquid water about one inch (25 mm) deep.
- On average, the **residence time of a water molecule in the troposphere** is about **9 to 10 days**.

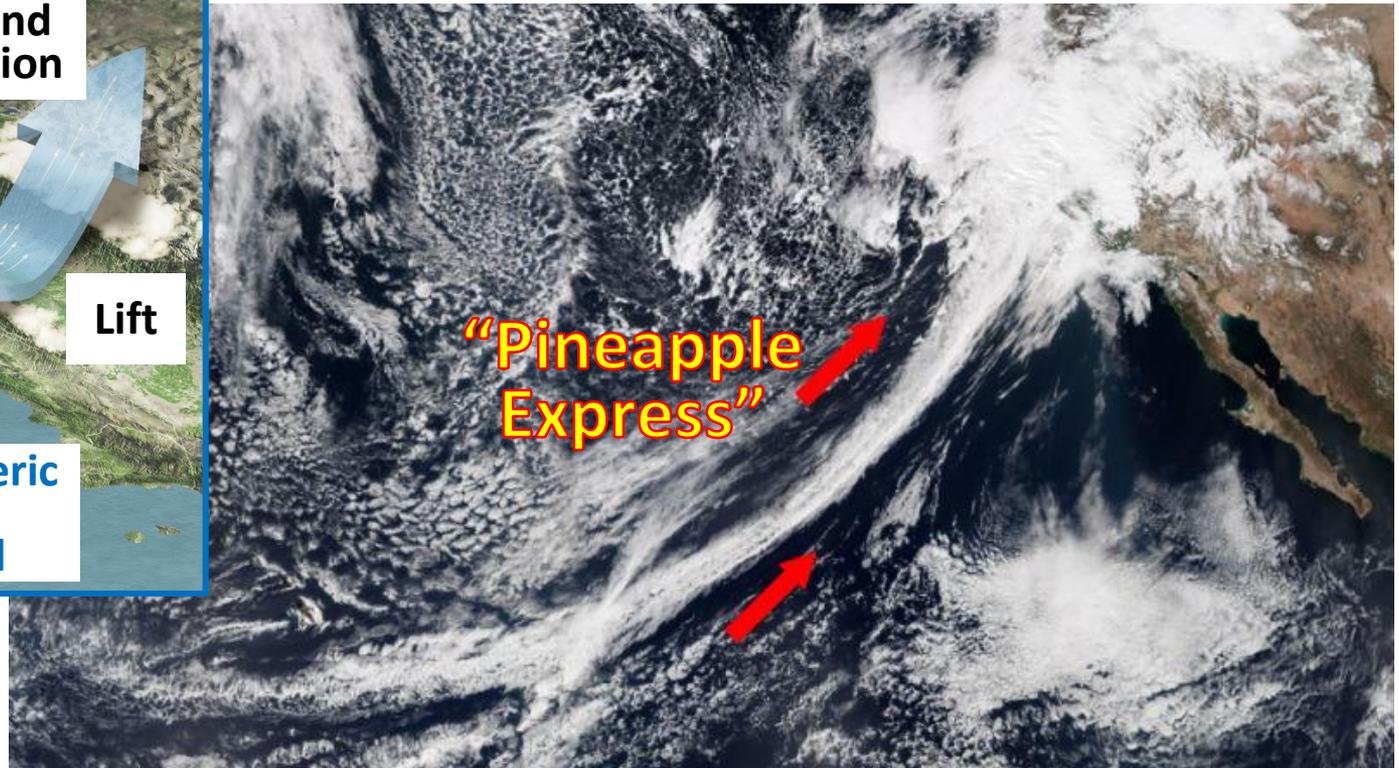
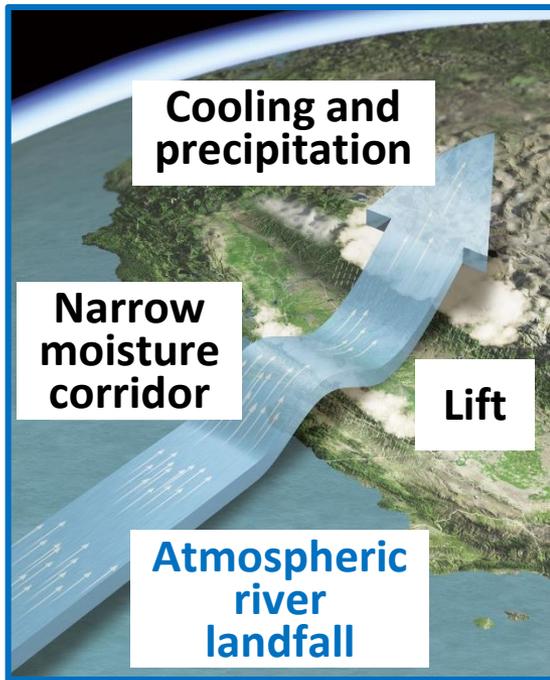
# Rivers in the Sky?

An **atmospheric river** is a moving narrow corridor of concentrated moisture in the atmosphere.



- get their start over warm tropical waters
- flow eastwards and towards the poles about a mile above the ocean surface
- may extend for thousands of miles, but are only a few hundred miles wide
- can transport up to 10 times more water than the Mississippi river
- when making landfall, often release a lot of precipitation

# California: from drought to flood



- In early October 2016, **after nearly five years of drought**, California has faced **an ambush of atmospheric rivers**.
- Flood and landslide warnings have been issued in many counties, at least 30 major roads have been flooded, and spillways have been opened at the Oroville, Anderson, and Monticello dams.