

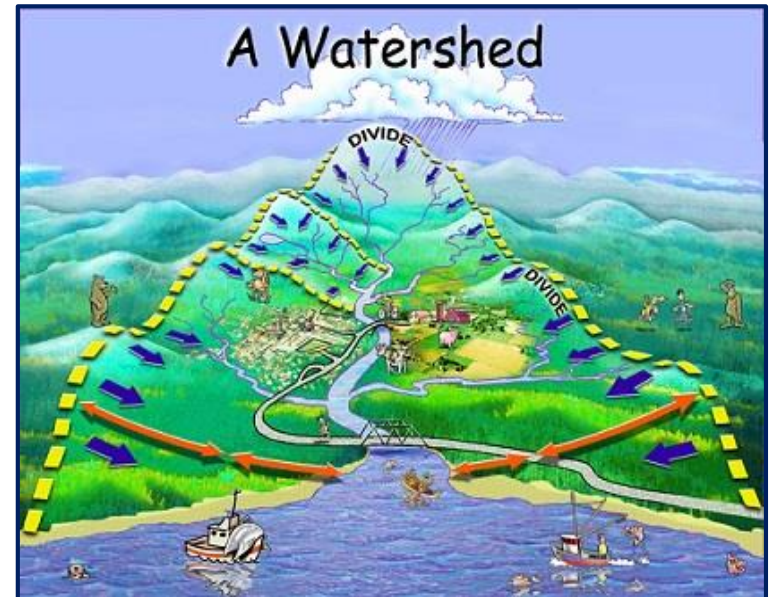
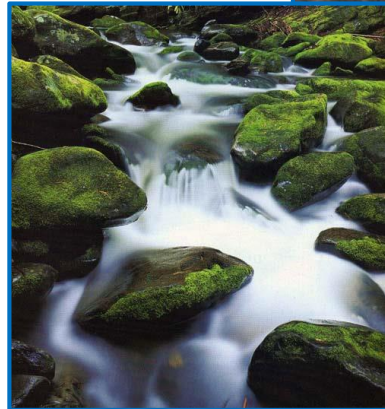
THE HYDROSPHERE



PART 3

Surface Freshwater: Rivers and Streams

- River is a large channel along which water is continually flowing down a slope; it is made of many *streams* that come together.
- Stream is a small channel along which water is continually flowing down a slope; it is made of small gullies.
- Watershed is an area that drains into a smaller river or stream.
- River Basin is an area that drains into a *large river*; larger river basins consist of many interconnected watersheds.



Largest Rivers in the USA

Mississippi: 2,340 mi (3,770 km) Missouri: 2,540 mi (4,090 km)



Longest River: Nile, Africa

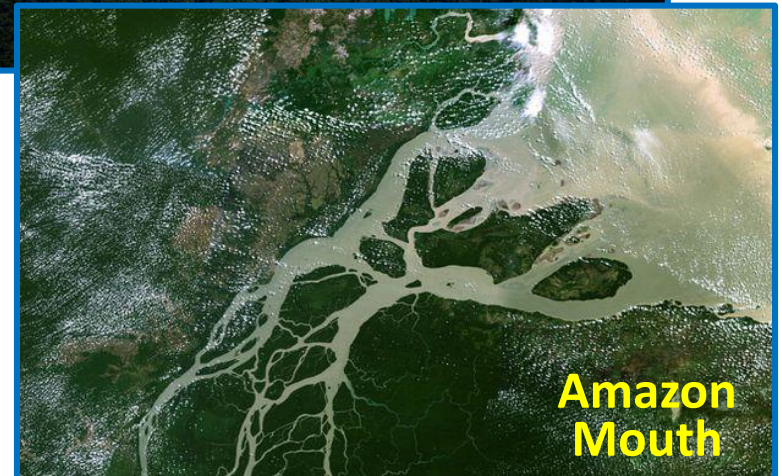
The **Nile River** is ~6,650 km (~4,130 miles) long, generally considered the **longest in the world**; it is located in northeastern Africa, and flows into the Mediterranean Sea. The drainage basin of the Nile covers about 10% of the area of Africa.



The **Nile Delta**, where the river spreads out and drains into the Mediterranean Sea, is **one of the world's largest river deltas** covering 240 km (150 mi) of the coastline - and is a rich agricultural region. The Nile has been the lifeline of civilization in Egypt since the Stone Age.

Amazon River Basin

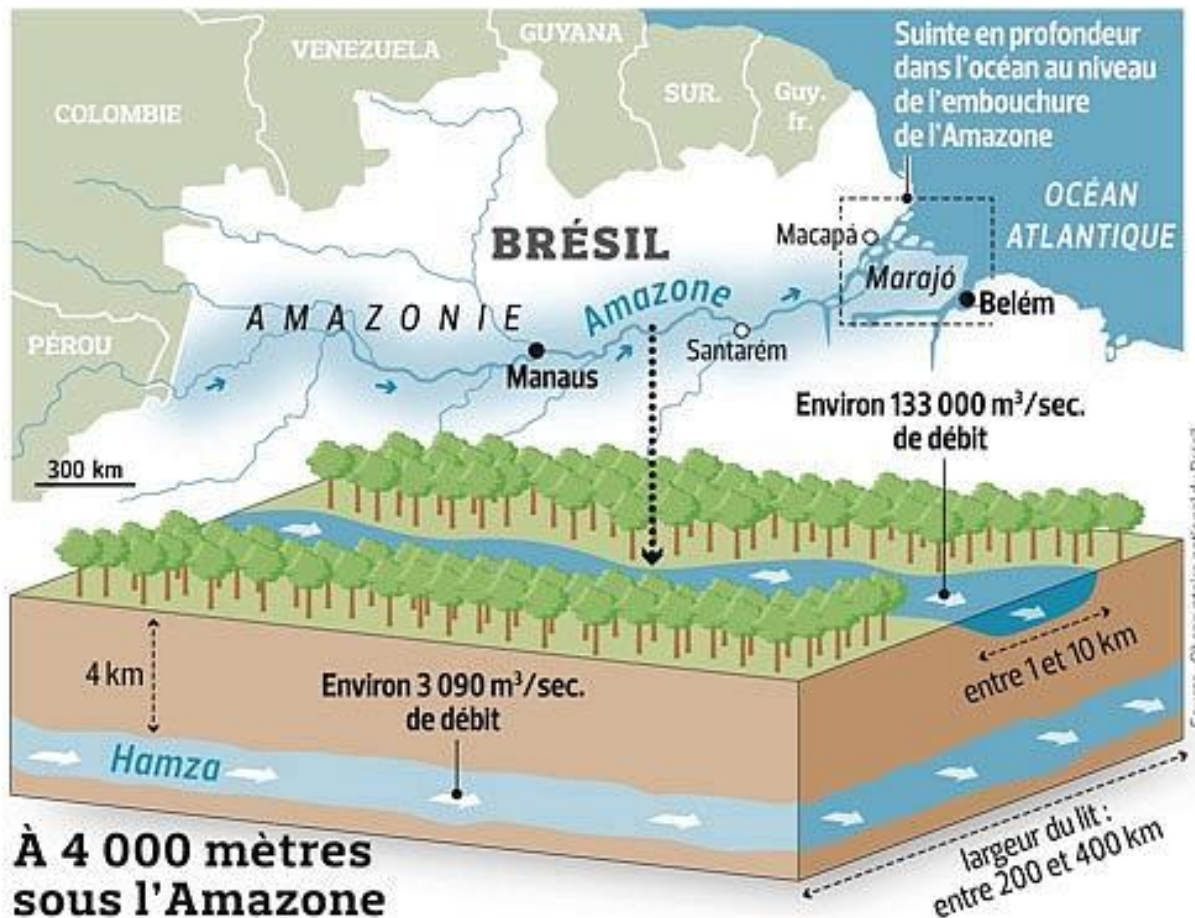
The **Amazon River** in South America is the **largest river by the discharge of water** and also the **second longest river** in the world (~6400 km). The **Amazon Basin**, the **largest drainage basin** in the world, covers about 40% of South America, an area of approximately 7,050,000 km² (2,720,000 sq mi). It drains from west to east, flowing into the Atlantic Ocean.



Rio Hamza

(slowly flowing
aquifer)

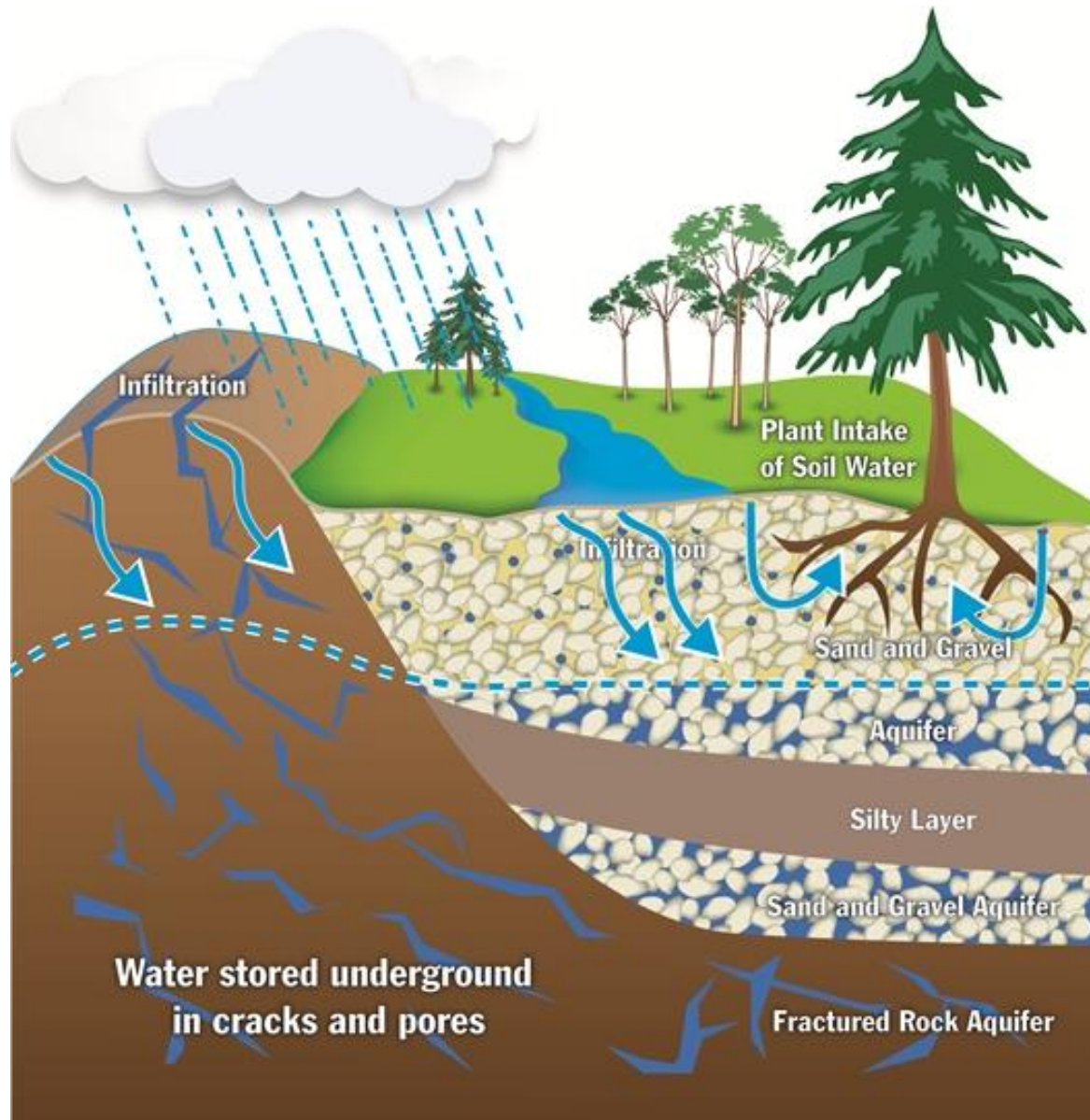
The Amazon River has an **underground** “**twin sister**” named **Hamza** (*discovered in 2011*)! It runs for a length of 6,000 km (3,700 mi) at a depth of nearly 4,000 m (13,000 feet).



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.

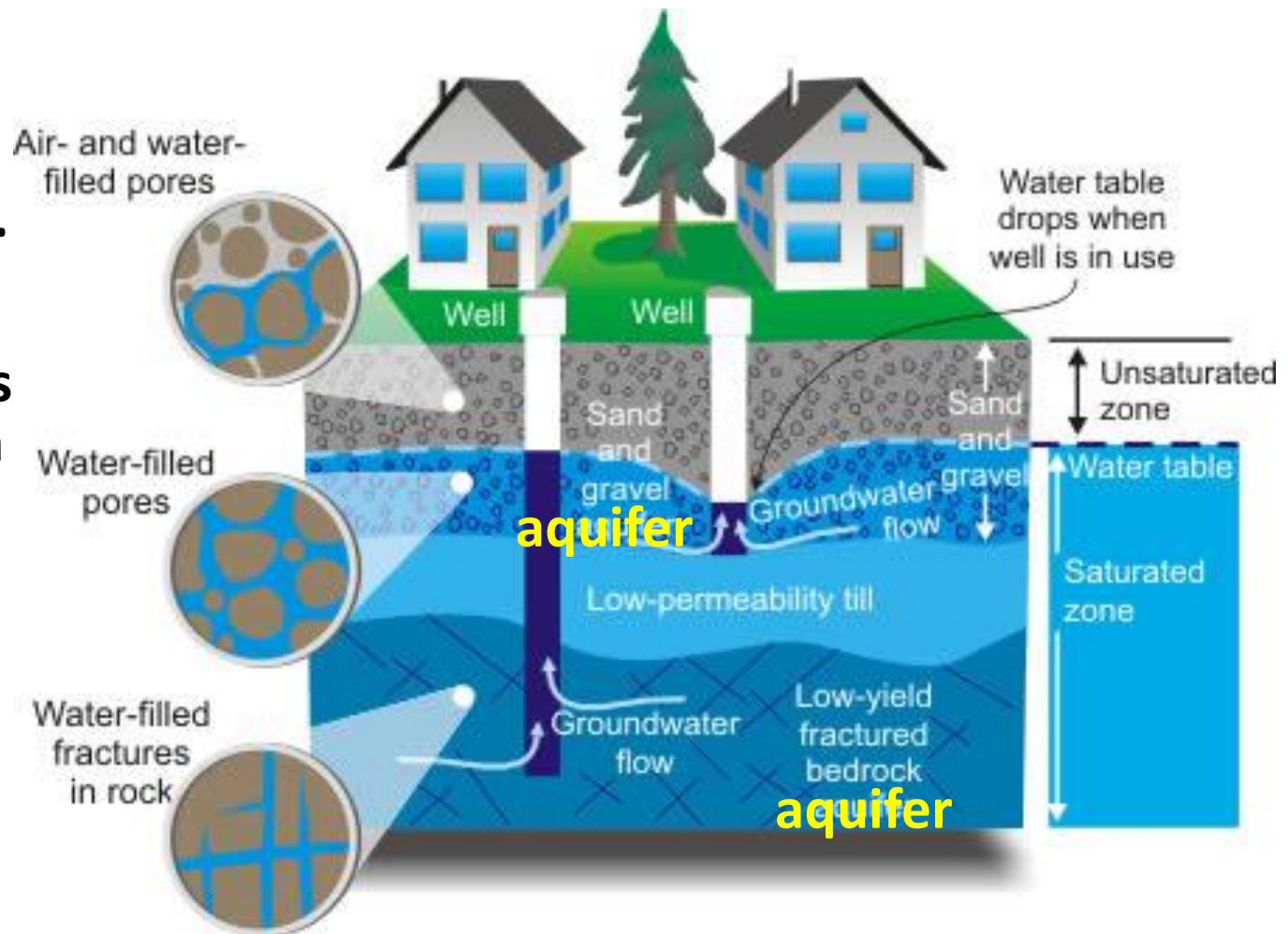


- Swamp: a wetland dominated by trees
- Bogs: a wetland dominated by peat moss
- Marshes: a wetland dominated by grasses

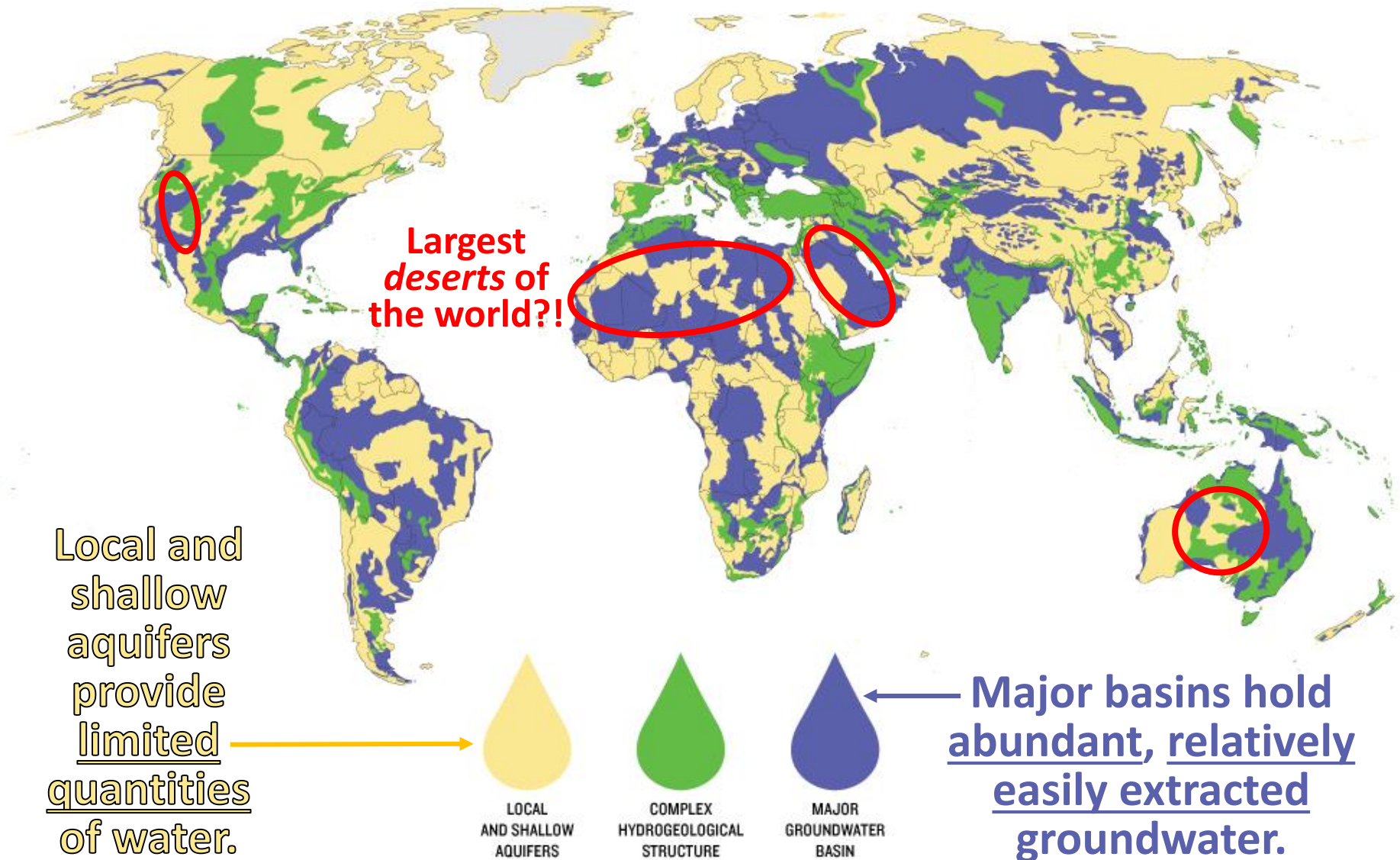
Freshwater: Groundwater Aquifer

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

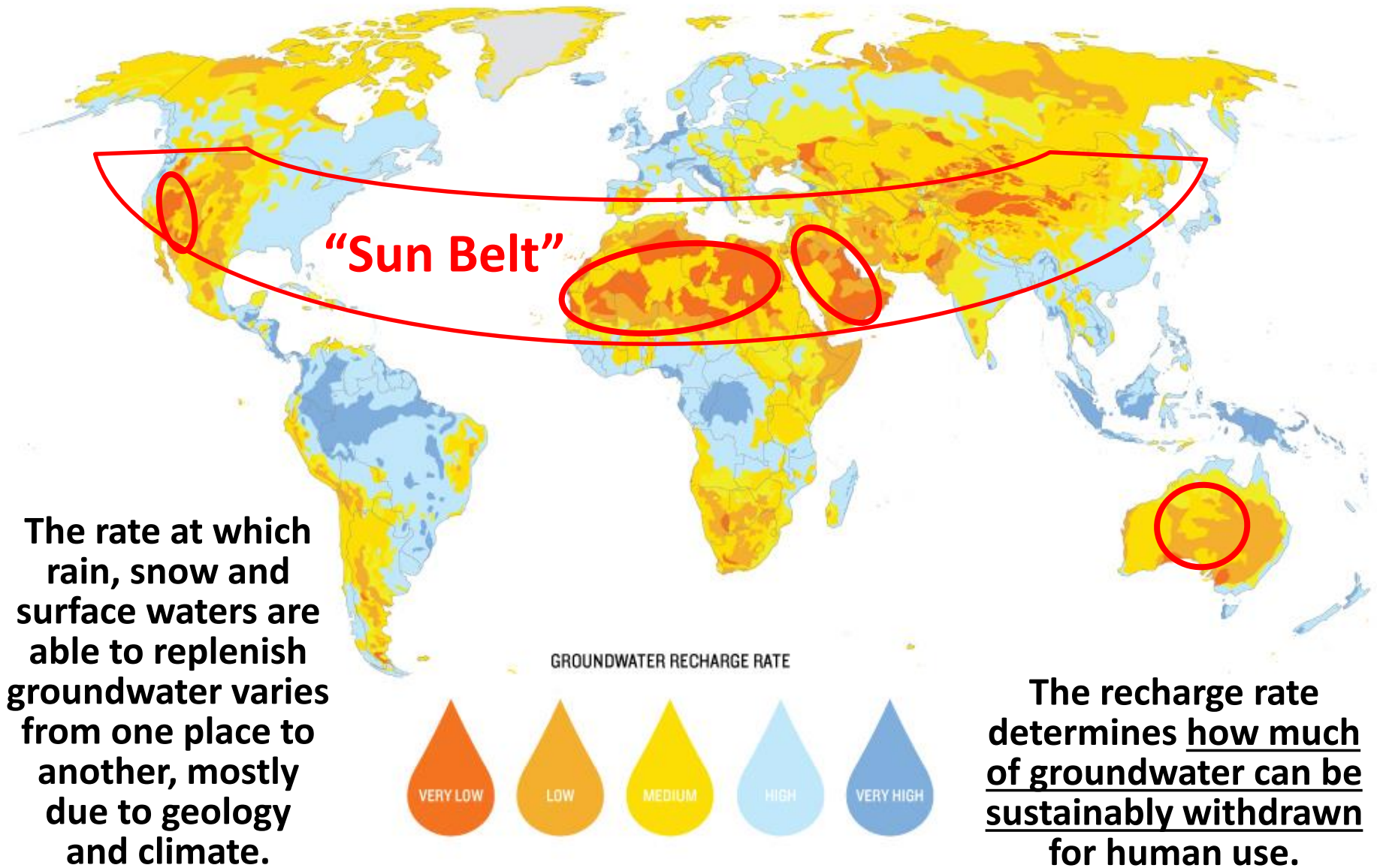
- **Drinking water** supply.
- Anyone who has a well gets water from an aquifer.
- About **half of all Americans** get *most* of their water from wells.



Global Groundwater Resources



Groundwater Recharge



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**

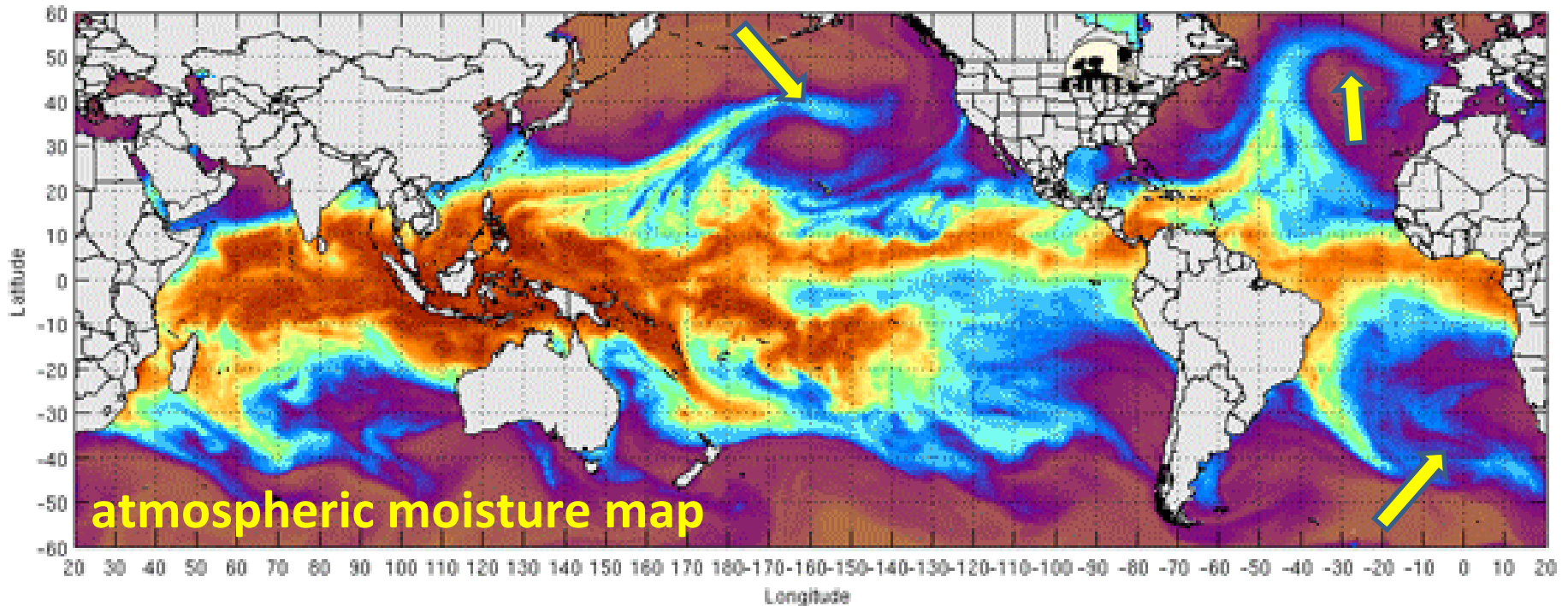
(gas lighter than air; continuously generated by evaporation and removed by condensation)



- 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**.

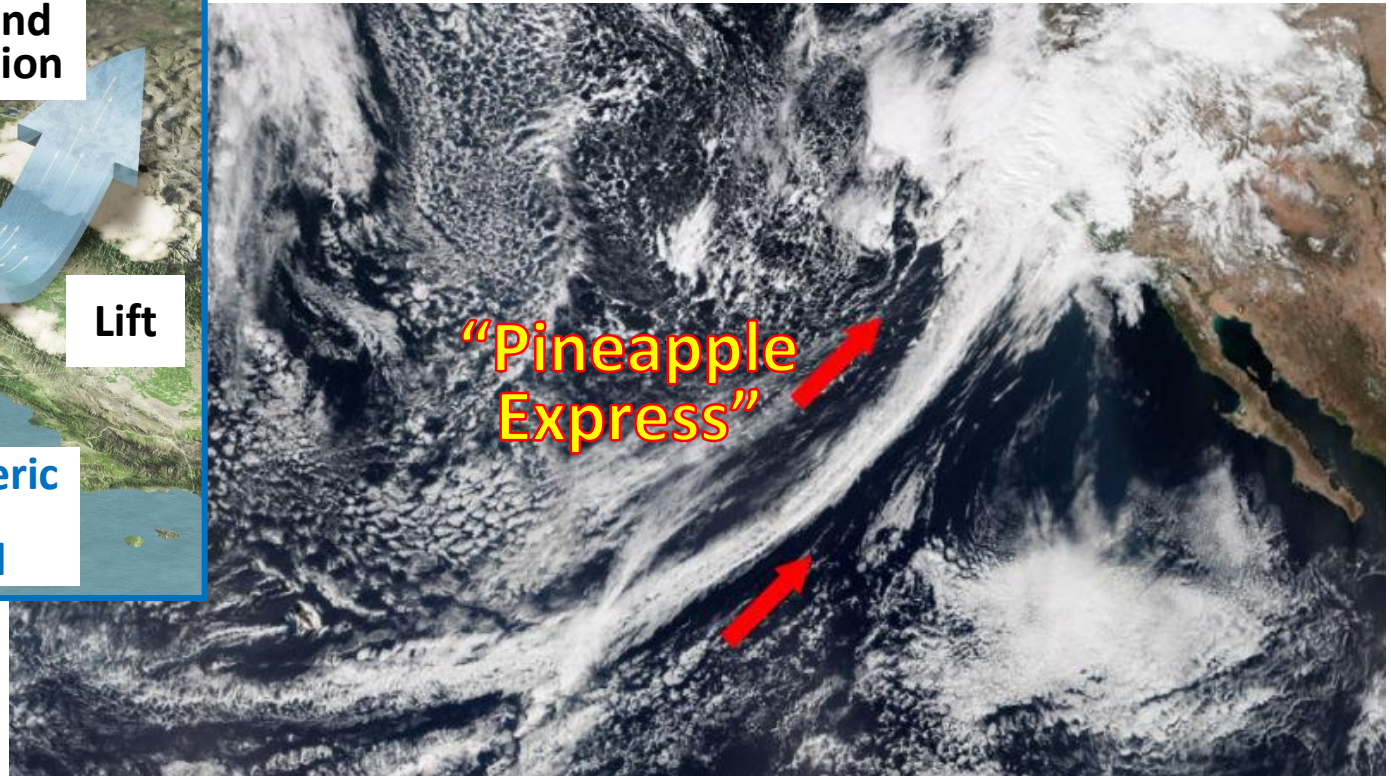
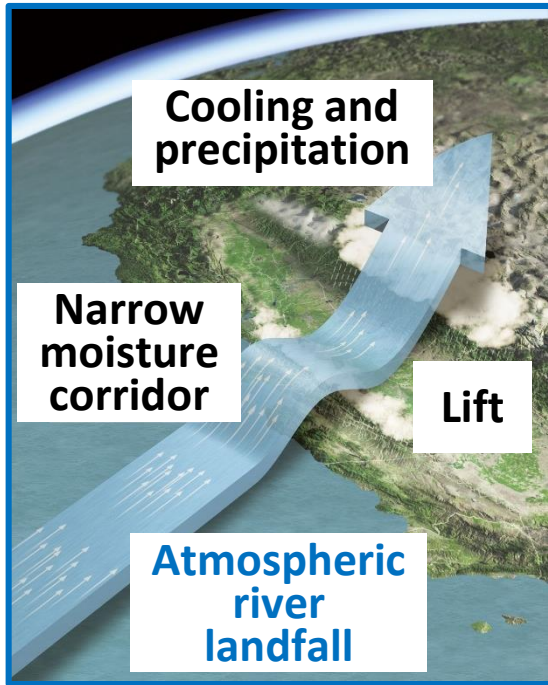
Rivers in the Sky?

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.