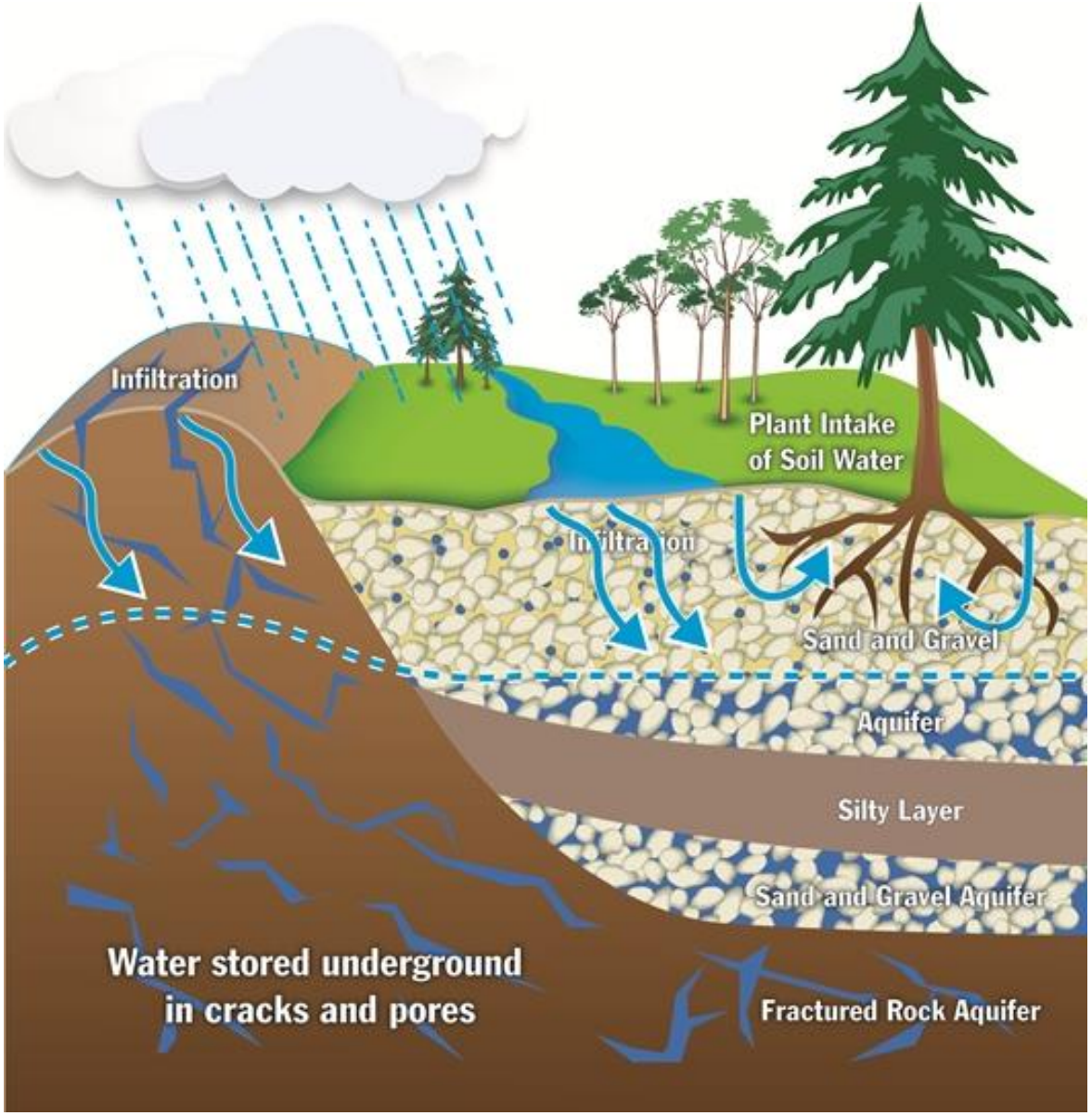
Groundwater



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

Part air part water **unsaturated zone**

Water table

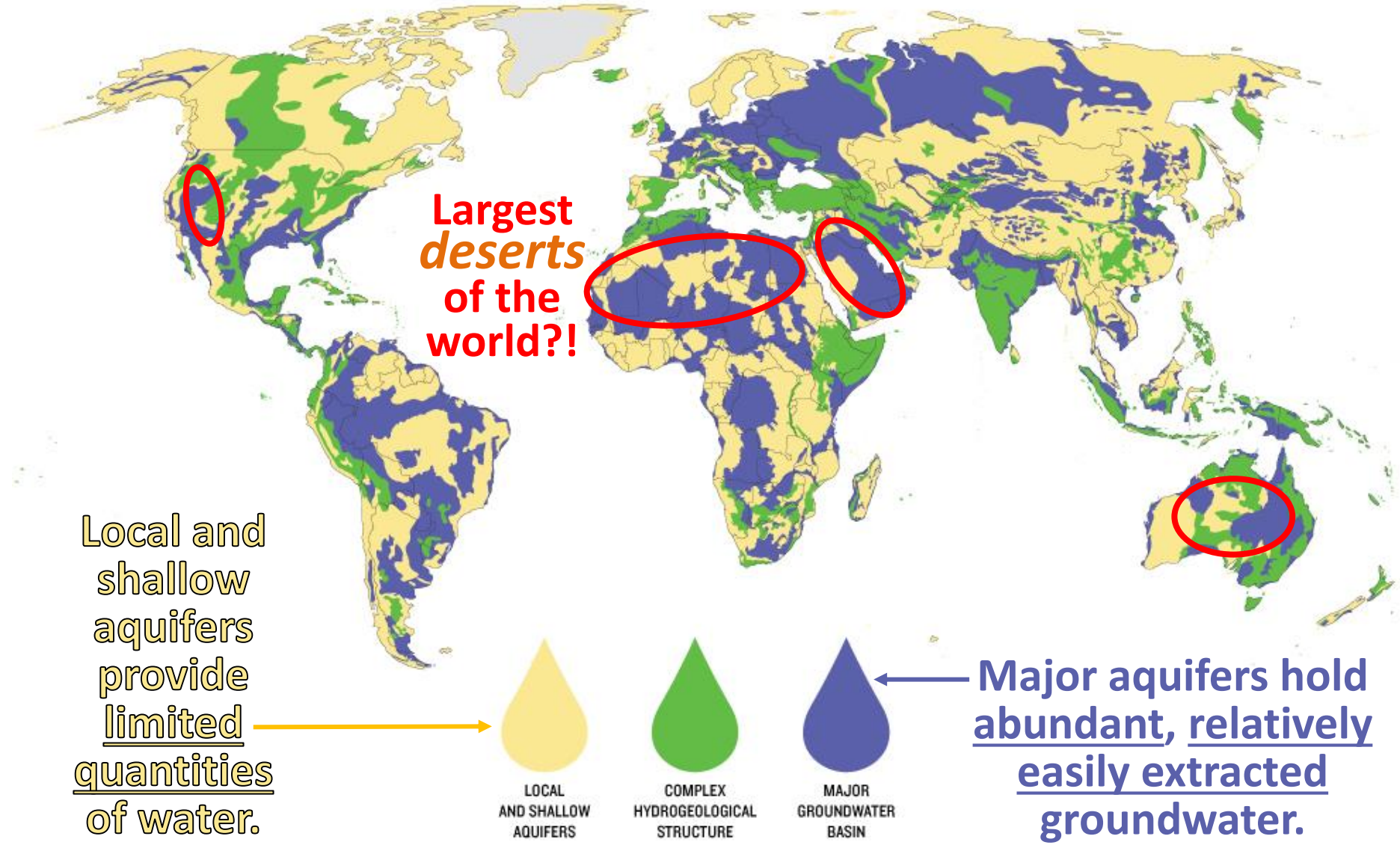
Saturated zone: water fills all pores and cracks

Wetlands

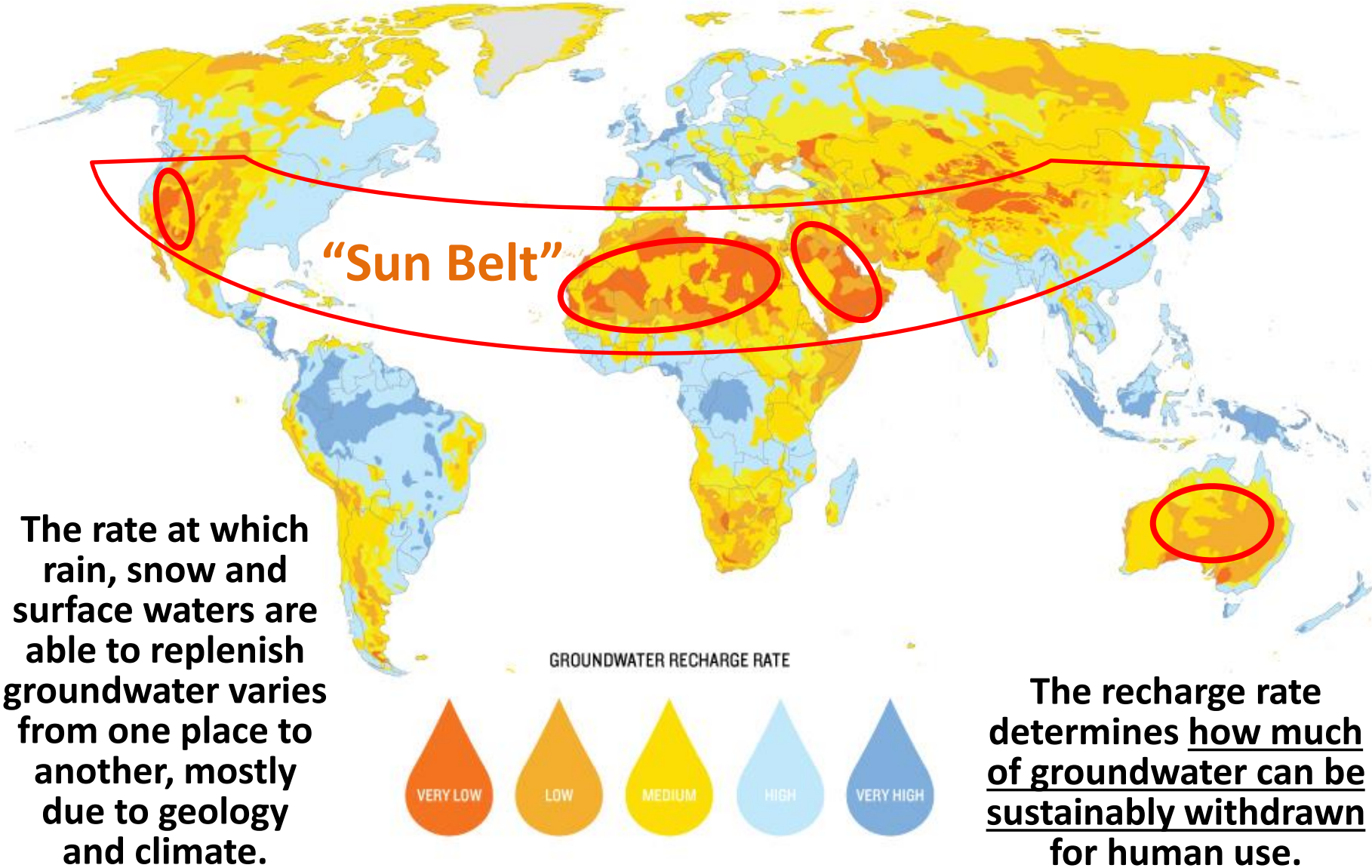
Wetland is an area where the water table is at, near or above the land surface long enough during the year to support adapted plant growth.

- **Swamp: a wetland dominated by trees**
- **Bog: a wetland dominated by peat moss**
- **Marsh: a wetland dominated by grasses**

Global Groundwater Resources



Groundwater Recharge

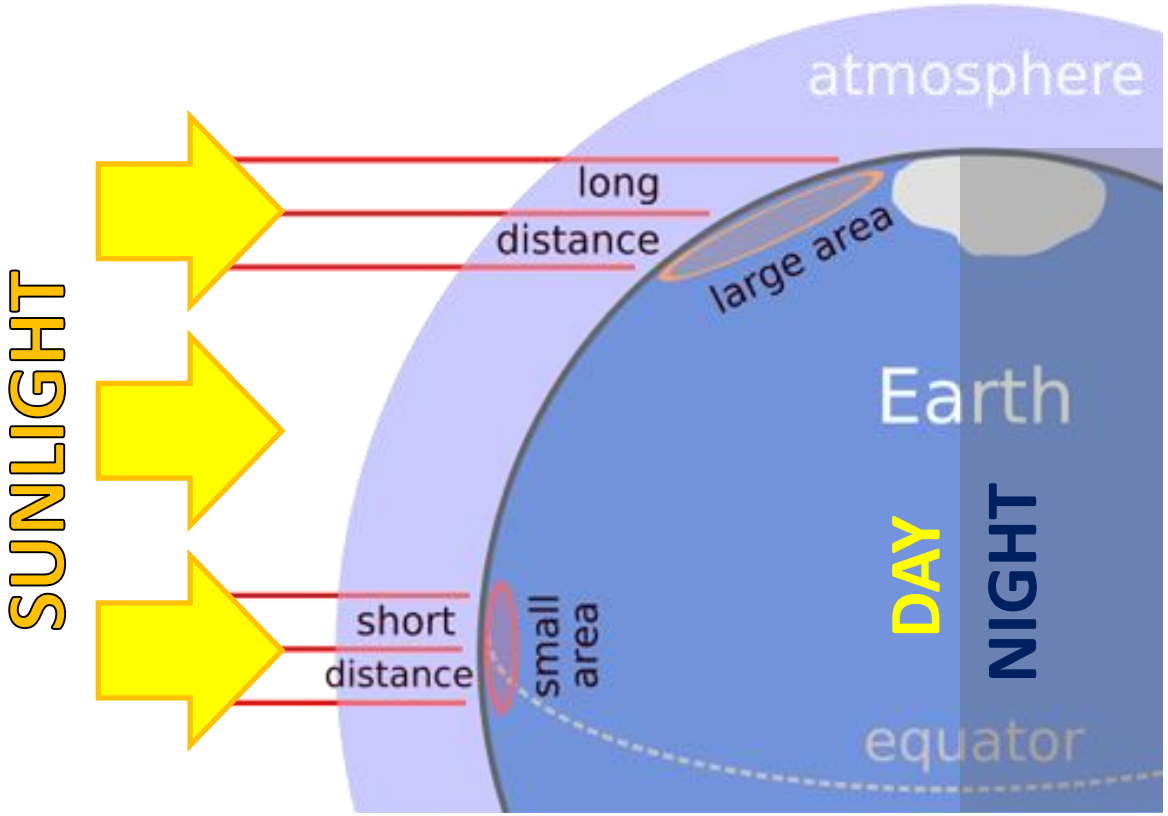


The rate at which rain, snow and surface waters are able to replenish groundwater varies from one place to another, mostly due to geology and climate.

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how much of groundwater can be sustainably withdrawn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

Angle of Sunlight

Due to the Earth's curvature, the amount of sunlight (*energy*) reaching any given point on the surface varies greatly with latitude.



- Regions near the **Equator** receive most direct, that is concentrated Sun rays.
- At **high latitudes**, the same amount of the incoming Sun energy is spread over much greater area of surface.

Sun Belt deserts combine relatively low average precipitation with high moisture removal due to very effective evaporation.

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)

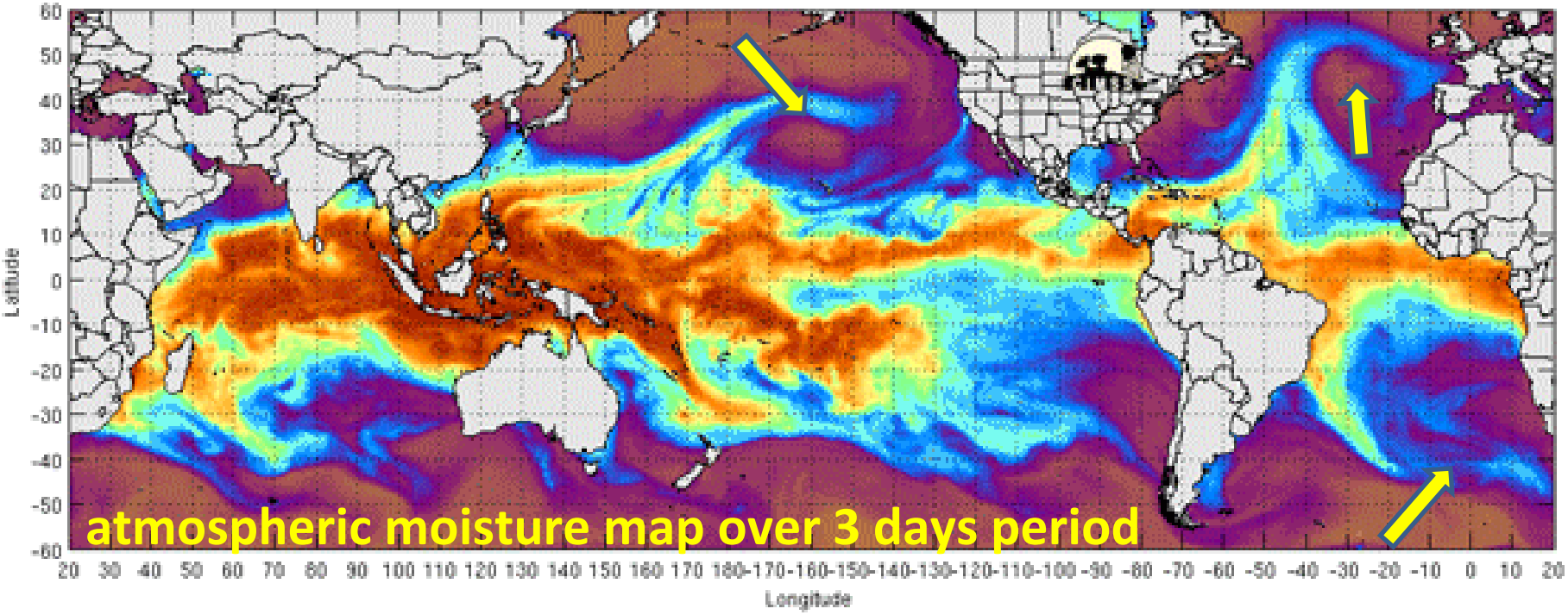
Water vapor →

(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.

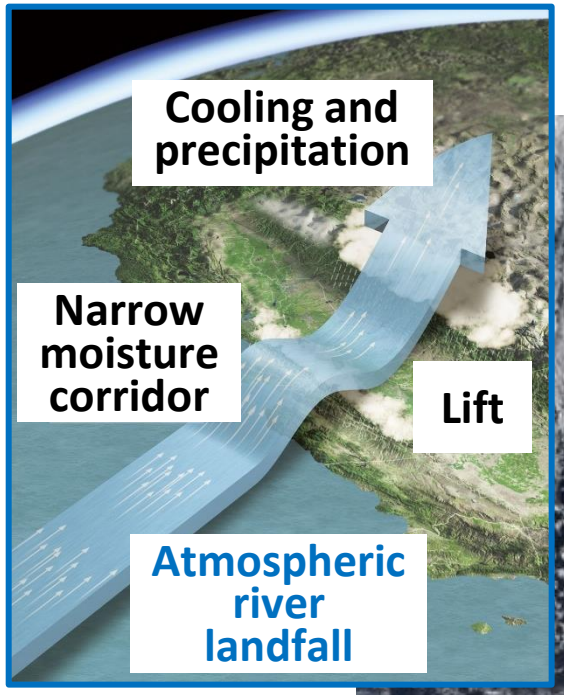
Rivers in the Sky?

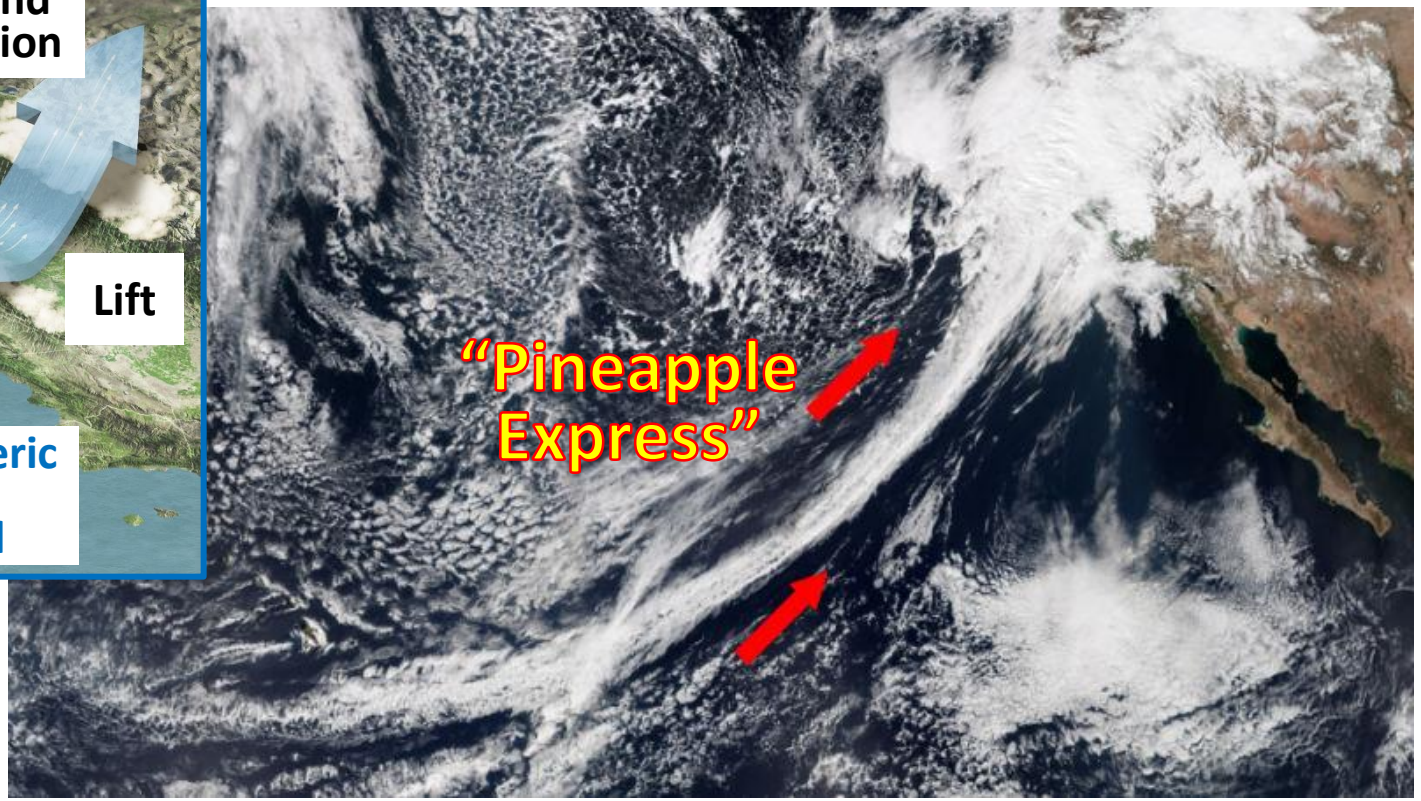
An atmospheric river is a moving narrow corridor of concentrated moisture in the atmosphere.



- 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





- **Not enough atmospheric rivers: the region gradually falls into drought which may last *years*.**
- **Too many atmospheric rivers: floods can occur.**