

# THE HYDROSPHERE



**PART 1**

# Water, the most exciting substance on Earth

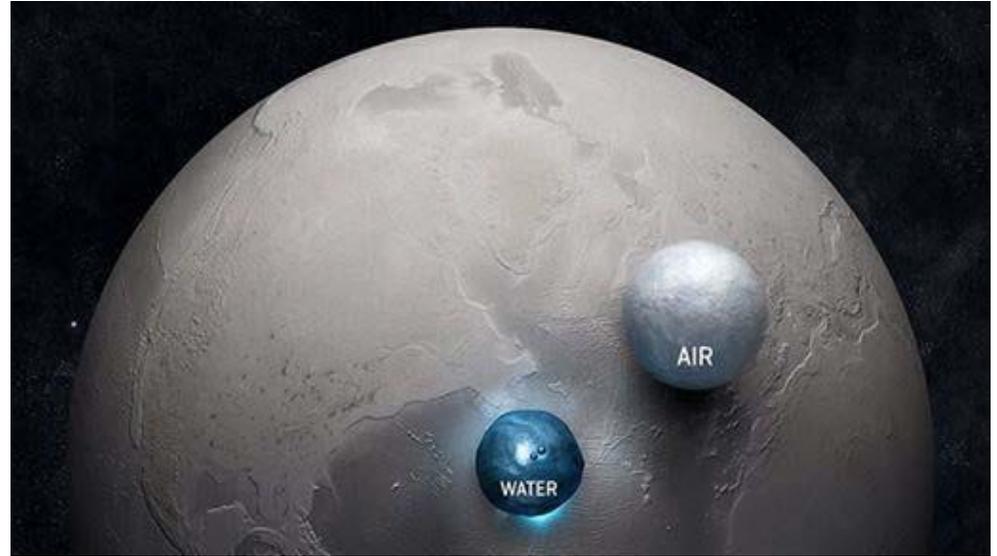
- Water is the only substance that naturally exists as solid and liquid and gas.



- Water is the substance that is necessary for any form of life as we know it.
- The Earth's liquid water constitutes the hydrosphere.

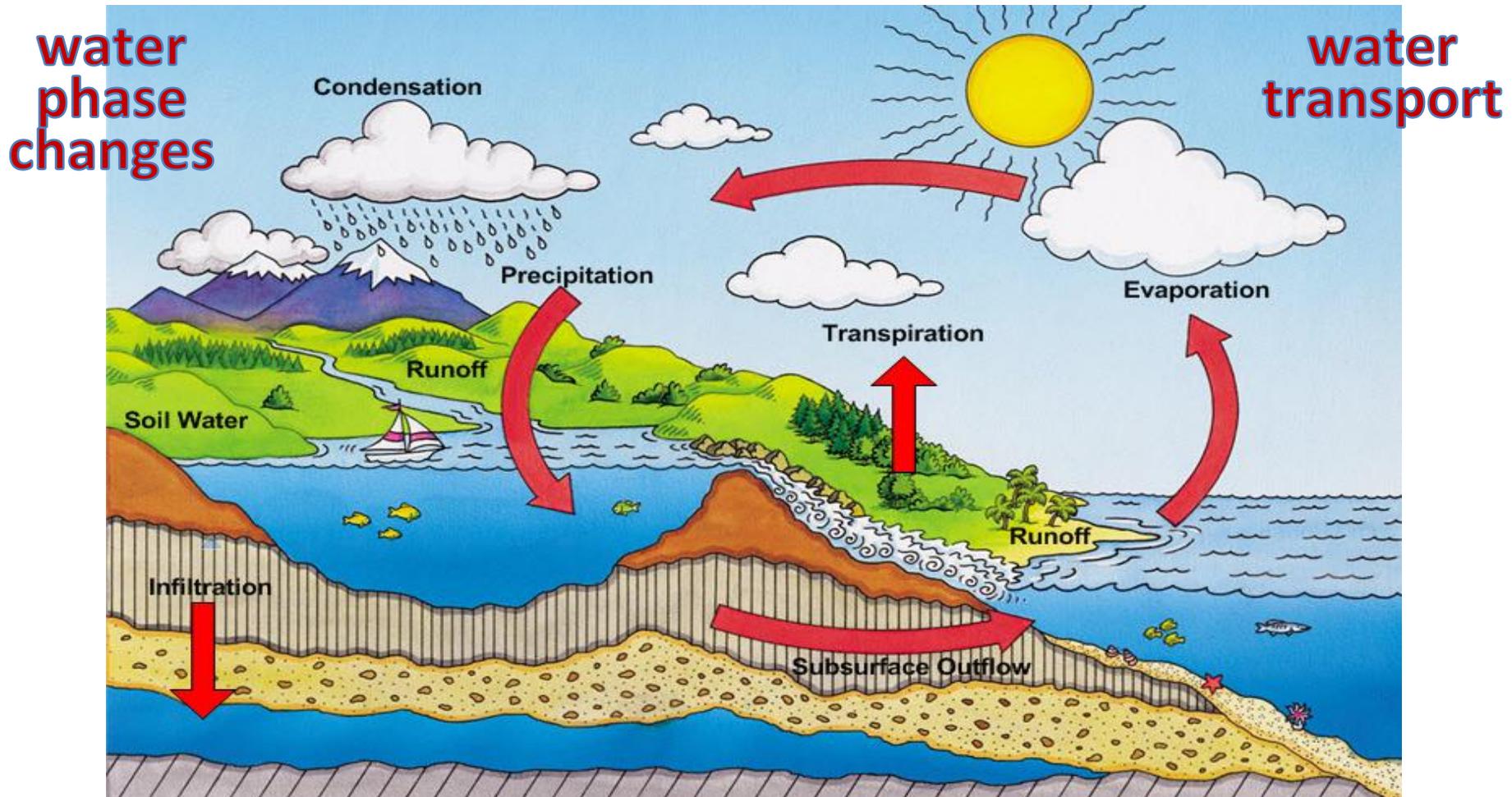
# Water on Earth

- Total amount of water on Earth is **~1,386,000,000 cubic kilometers** (km<sup>3</sup>) or about 366,000,000 trillion gallons (which is NOT a lot...think *apple skin* 😊).
- Liquid water covers **71%** of the Earth's surface.



- Water is a **Heat Storage**: specific heat of water is 5-fold higher than that of stone or sand; sunlight penetrates deep into the water but only the surface of stone, clay, or sand.
- Water is constantly moving on, above and below the surface of the Earth through the **hydrologic (water) cycle** which involves water transport and phase changes by the following physical processes: *evaporation, transpiration, condensation, precipitation, surface runoff, and infiltration*.

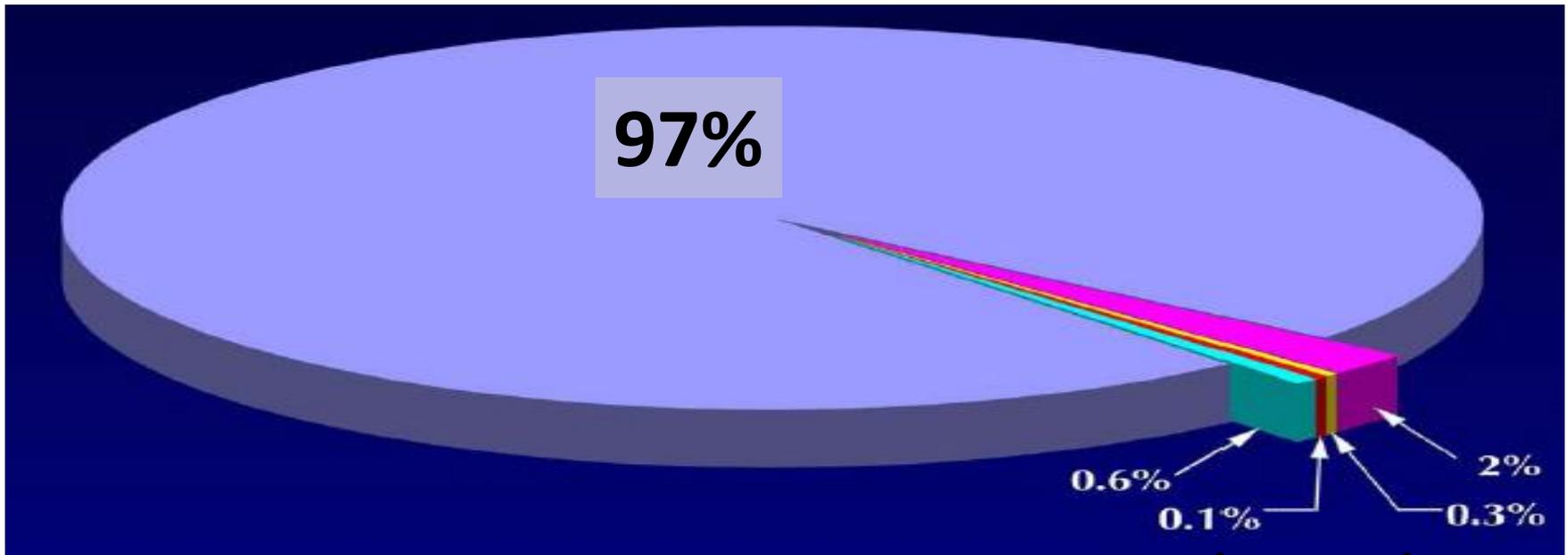
# The Hydrologic (Water) Cycle



The water cycle is **driven by the Sun** and involves the exchange of energy in the form of heat.

# Distribution of Water on Earth

- 97% of water on Earth is salt water: oceans and seas.



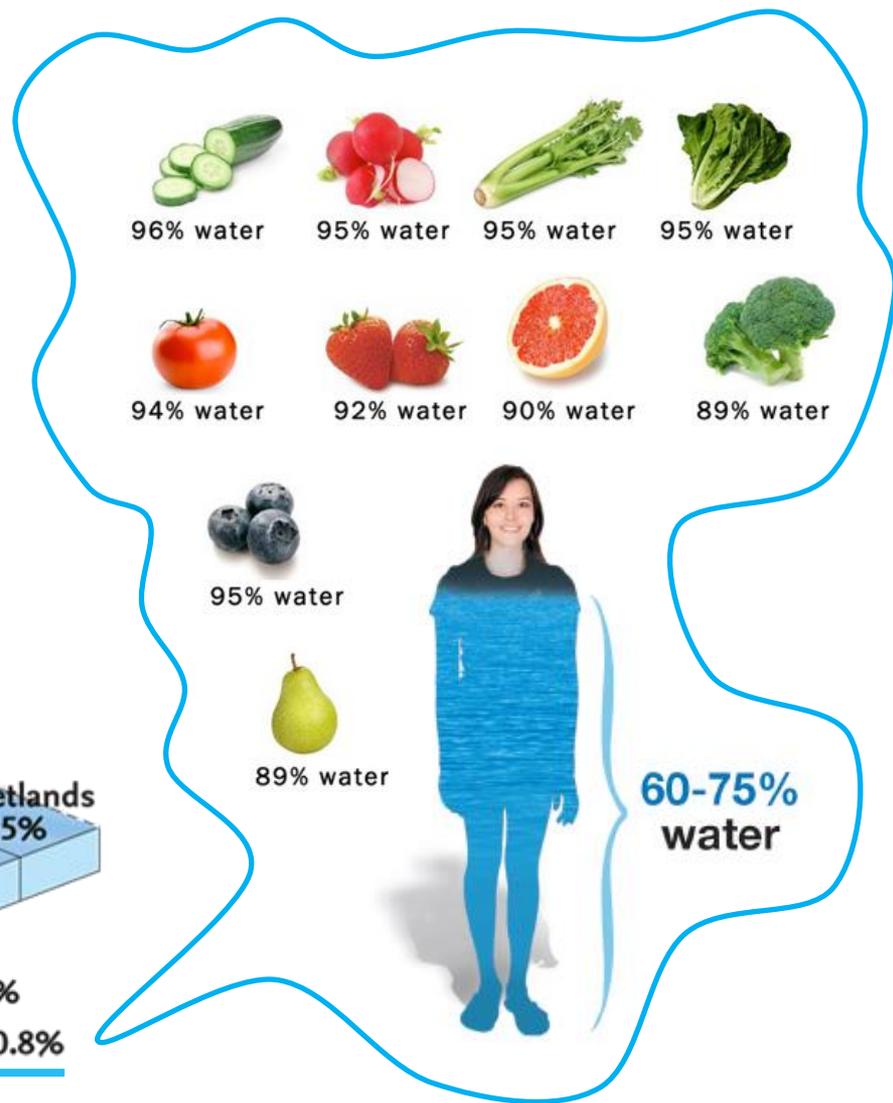
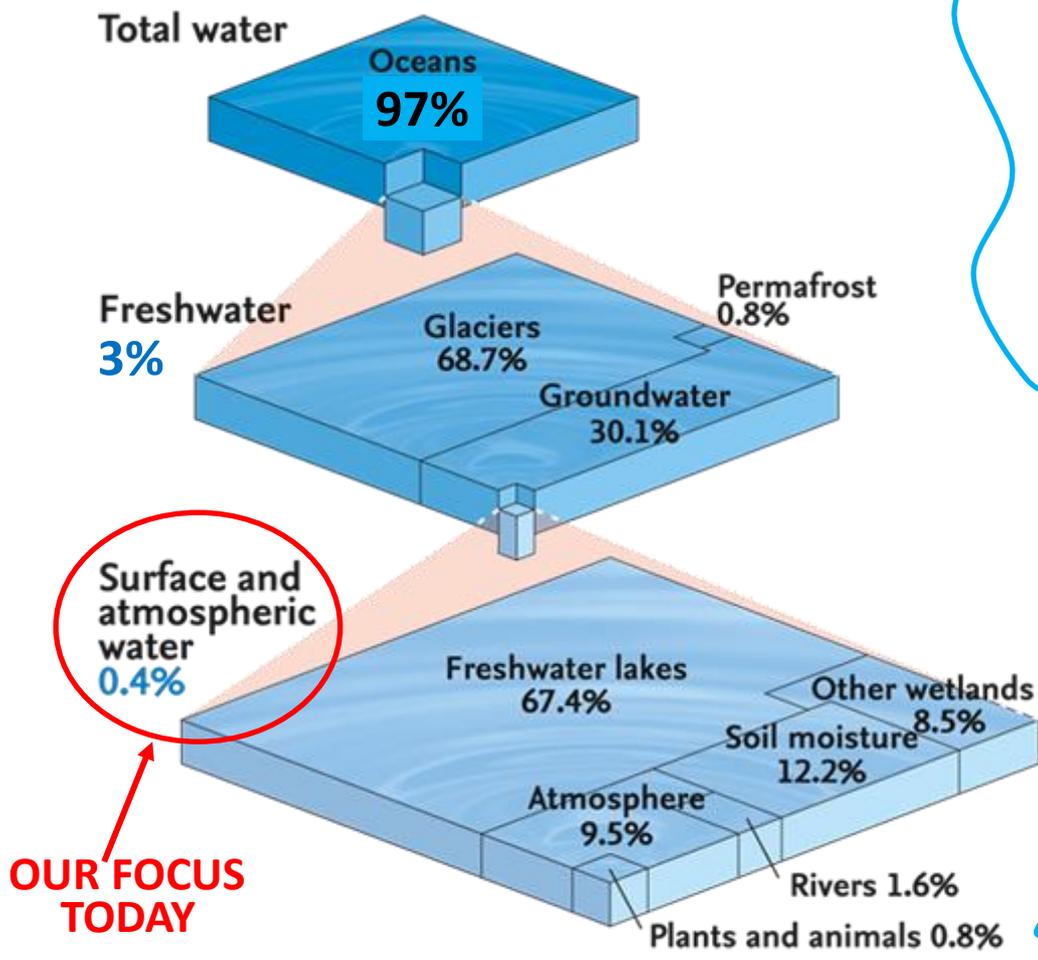
- 3% of water on Earth is fresh water:

- ice and snow (glaciers and polar caps)
- groundwater (aquifers)
- clouds and water vapor (atmospheric water)
- rivers and lakes
- living beings 😊



# Where is my Water?

## Freshwater Distribution on Earth



# Surface Freshwater: Lakes

Lake is a body of water of considerable size contained on a body of land. The *largest enclosed inland body of water* on Earth by area is the **Caspian Sea** (surface area of 371,000 km<sup>2</sup>/ 143,200 sq mi and a volume of 78,200 km<sup>3</sup>/ 18,800 cu mi). **Is it a lake or a sea?..**



- The Caspian Sea was once a part of the Thetis Ocean.
- It became landlocked ~5.5 million years ago.
- The Caspian Sea has **low average salinity** (about a third of the salinity of most seawater).
- Its **shallow northern part is almost completely freshwater** due to the current inflow of Volga and Ural rivers.

# Greatest Lakes



**#1 in size: Lake Superior,**  
Canada/USA, One of the Great Lakes  
**area: 82,414 km<sup>2</sup> (31,820 sq mi)**  
**depth: 406 m (1,332 feet)**  
**volume: 12,100 km<sup>3</sup> (2,900 cu mi)**



**#1 in depth/fresh water**  
**volume: Baikal,** Russia  
**area: 31500 km<sup>2</sup> (12200 sq mi)**  
**depth: 1,637 m (5,371 feet)**  
**volume: 23,600 km<sup>3</sup> (5,700 cu mi)**

# Subglacial Lakes of Antarctica

Antarctica is home to 387 subglacial freshwater lakes.

(not to scale)



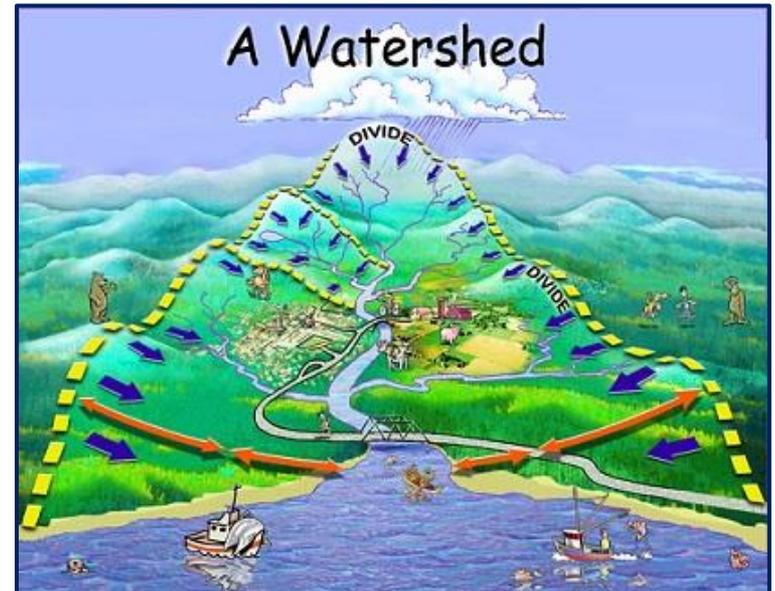
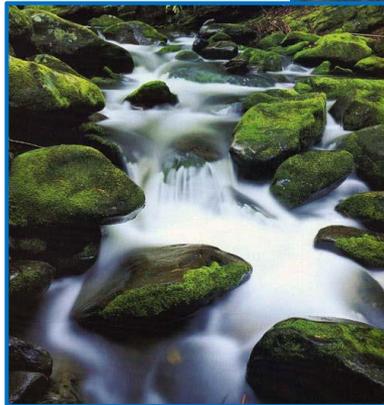
## Lake Ellsworth

2012: an attempt to drill into **Lake Ellsworth** using hot-water drilling technique faced **technical difficulties**; project called off.

1998-2015: research drilling into **Lake Vostok** by Russian team; in 2012 the **longest ever ice core of 3,768 m** was obtained and **lake surface reached**; **samples of lake water were taken** in 2013 (found contaminated) and 2015.

# 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 of the world consist of multiple interconnected watersheds.





# Largest Rivers in the USA

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

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

