

THE HYDROSPHERE



PART 1

Water, the most exciting substance on Earth

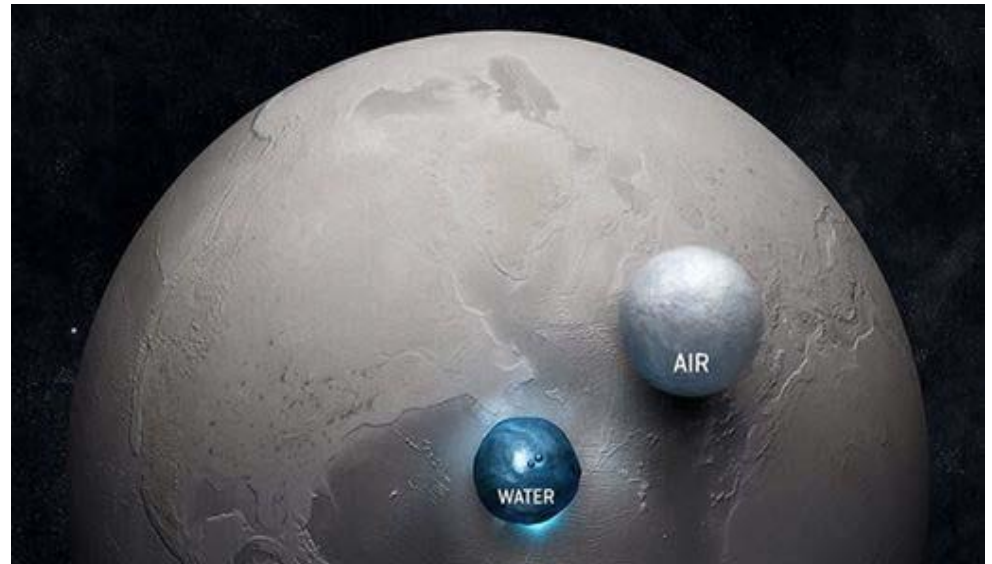
- Water is the only substance that naturally exists as solid and liquid and gas.



- Water is necessary for any known form of life.
- The Earth's liquid water constitutes the hydrosphere.

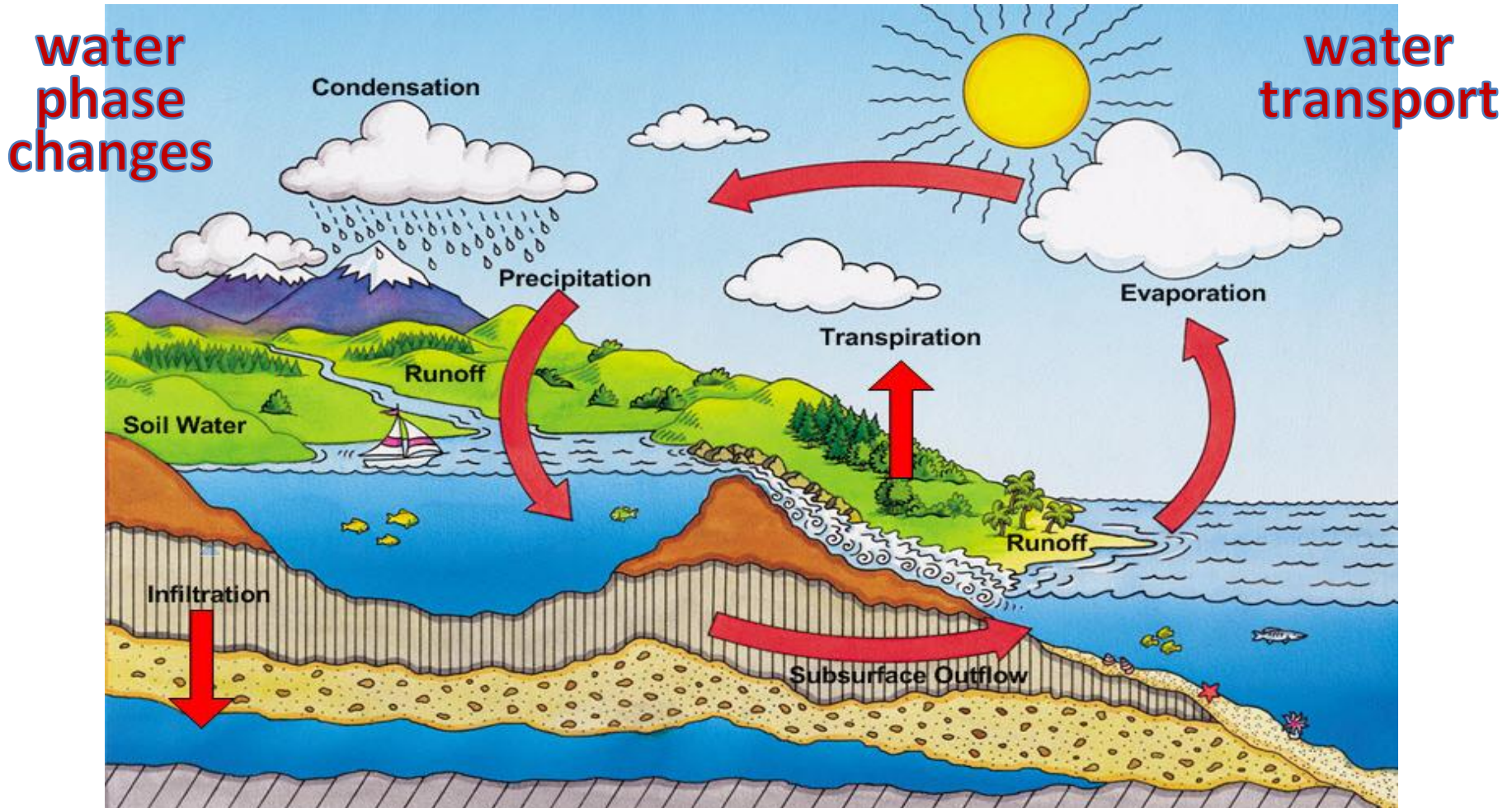
Water on Earth

- Total amount of water on Earth is **~1,386,000,000 cubic kilometers** (km³) 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*.

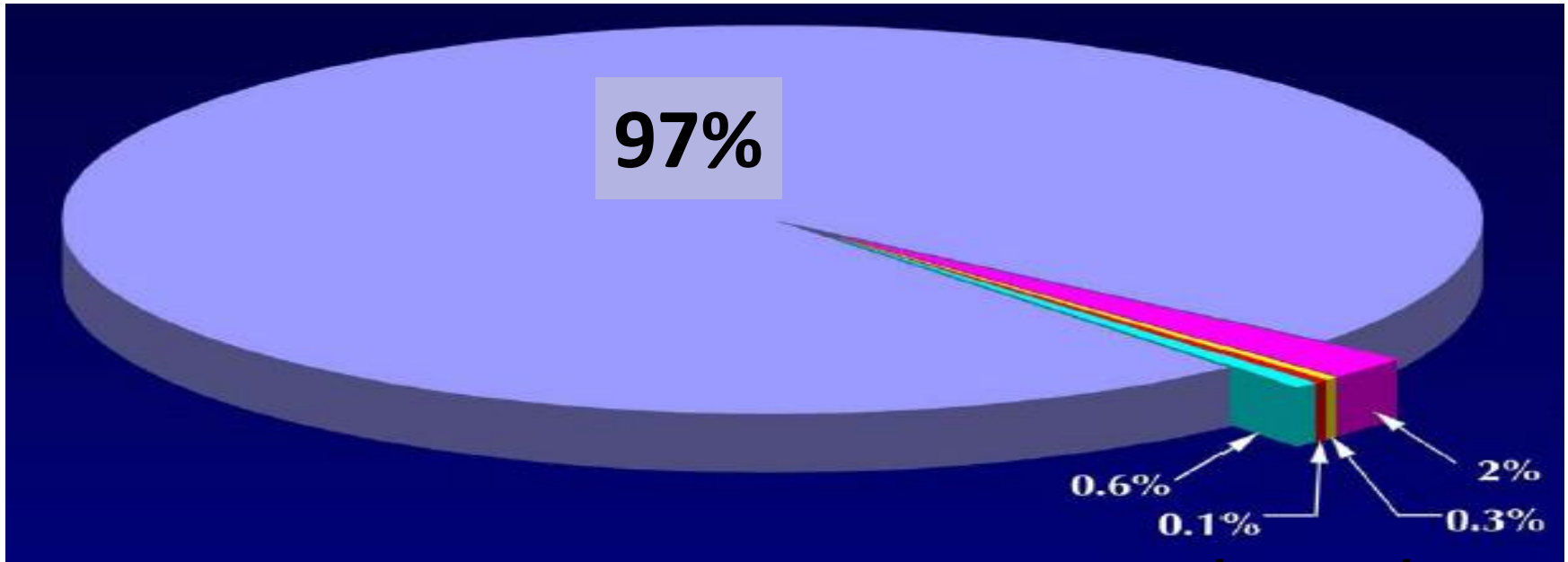
The Hydrologic (Water) Cycle



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.



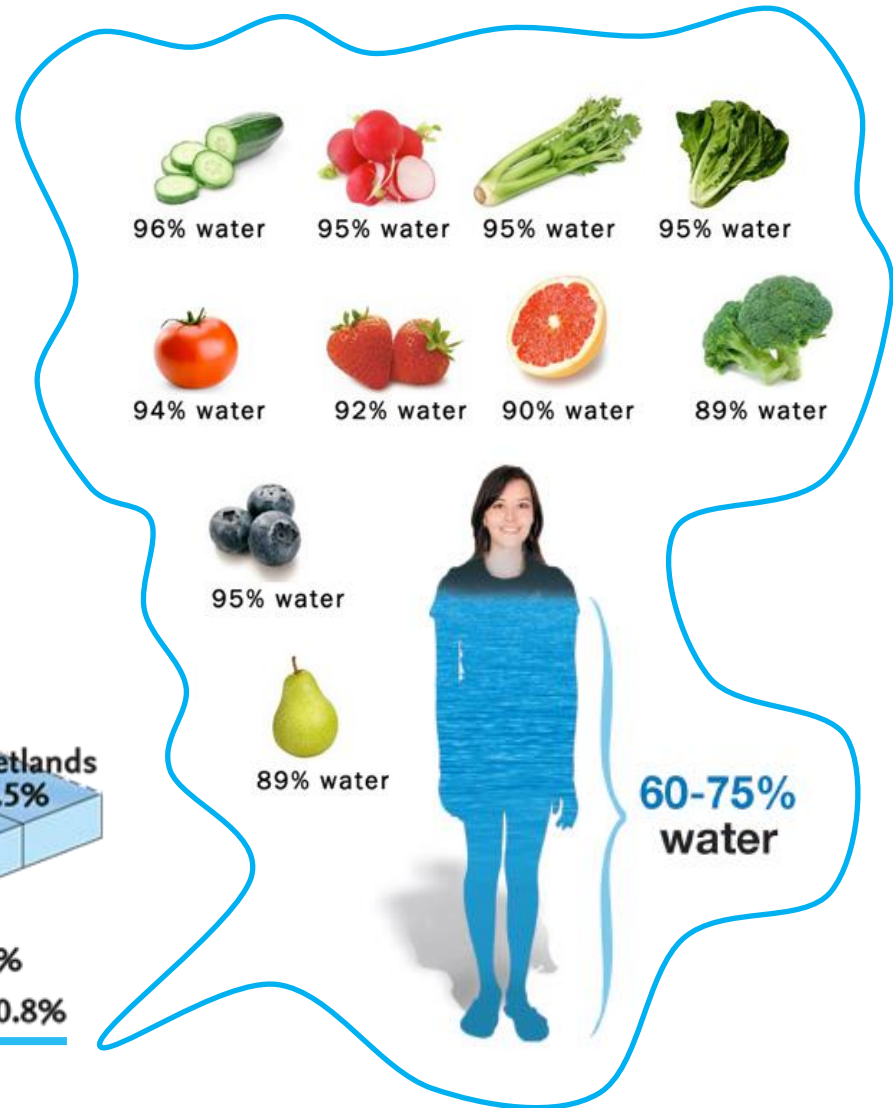
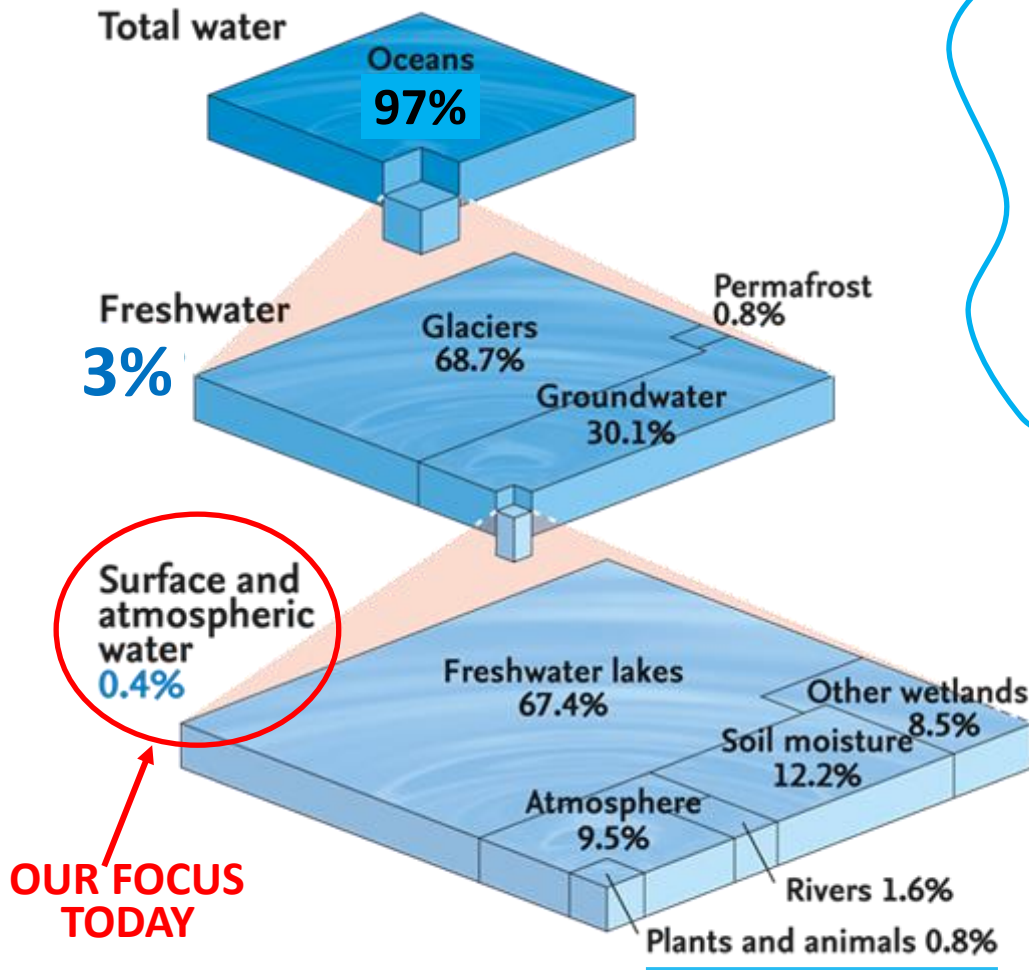
- 3% of water on Earth is fresh water:

- 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



Lakes - enclosed bodies 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 km²/143,200 square miles and a volume of 78,200 km³/18,800 cubic miles). **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 salt content** (about a third of that 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 km² (31,820 sq mi)
depth: 406 m (1,332 feet)
volume: 12,100 km³ (2,900 cu mi)

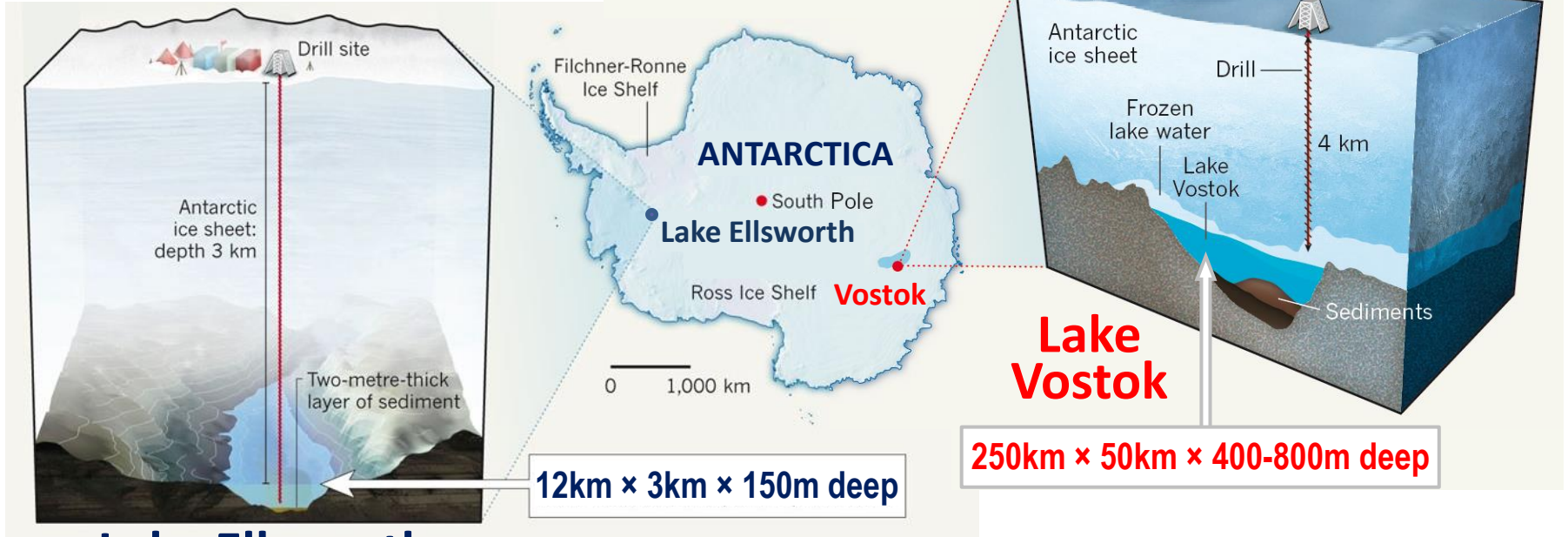


#1 in depth/fresh water
volume: Baikal, Russia
area: 31500 km² (12200 sq mi)
depth: 1,637 m (5,371 feet)
volume: 23,600 km³ (5,700 cu mi)

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.