The Hydrosphere

- Earth's outer layer of water found as liquid gas or solid.

Stats:

- 71% of earth is water
- 97.5% of this water is in the oceans
- 2.5% left is rivers, lakes, icecaps and glaciers
- 79% of the 2.5% is frozen

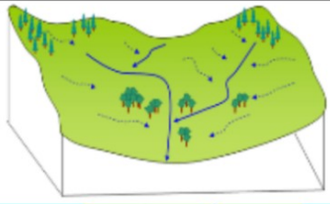
We can “separate” the hydrosphere into 3 general categories:

1. Inland water

Bodies of freshwater found on the continents. It unites rivers, lakes and groundwater.

Catchment Area or watershed

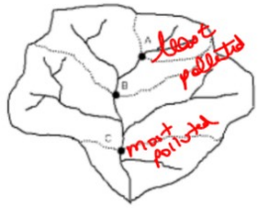
All the area from which water empties into the same large body of water.



USDA Watershed Learning Animation - For ASI Communications by VFX Direct.mp4

How pollutants affect catchment areas and watersheds

The more catchment areas a river has the more polluted the water river may become. The lower the catchment area is the more polluted it will be.



Whats's a Watershed.mp4

Aspects which affect watersheds

- topography: Natural and artificial features of the area
- geology: rocks
- climate
- vegetation: plant life
- agriculture: farming

increases filtration of water.

2. The cryosphere

def: Frozen water on earth's surface.

- **The cryosphere is made up of:** ice floes, glaciers, permafrost, frozen lakes and rivers and snow

Glaciers vs Ice floes vs Icebergs

	Glaciers	Ice floes (pack ice)	Icebergs
Formation	Formed as a slow sliding mass of ice formed on land which does not float in the water.	Are composed of slabs of ice and snow floating on the surface of the water. Travels from the poles and then melts when gets to the equator.	Pieces of glaciers breaking off into the sea.
Picture			
Type of water	Freshwater	Freshwater	Freshwater
Affect Salinity?	No since does not mix with ocean water	Yes since it is freshwater and floats, when it reaches the equator it will melt and decrease salinity	Yes because the freshwater will melt and mix with ocean water
Affect sea level?	No since not part of the water	No since it's volume is part of the water	Yes since you are adding volume to the water.

3. The oceans

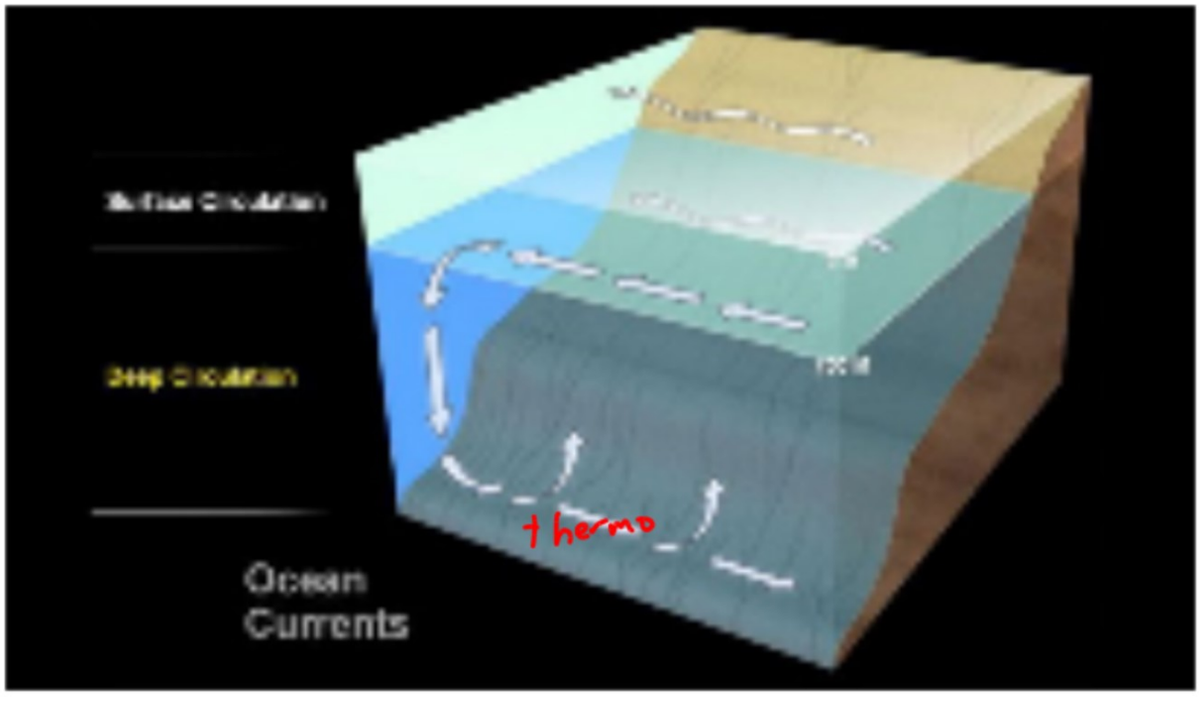
- Large masses of salt water
- There are two types of currents

  1- Surface currents

  2- Subsurface currents (Deep currents) also called thermohaline circulation.

Surface Currents

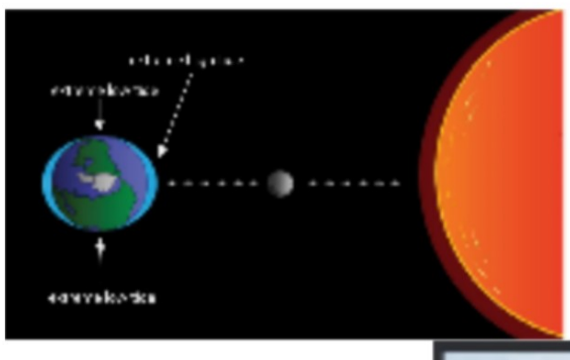
- Only go 400 m deep
- Are controlled by wind
- Also affected by the rotation of the earth

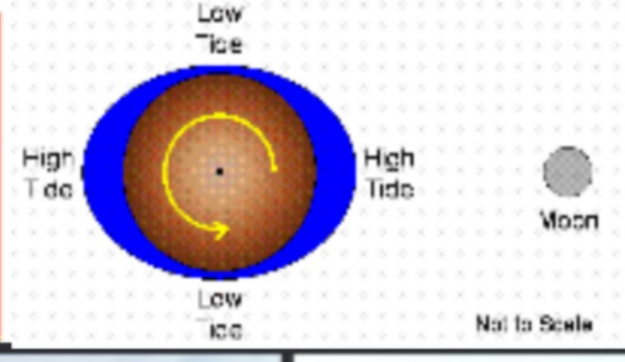


How does the rotation of the earth affect surface currents?

The moons gravitational pull causes tides to be created.

- There are 2 high tides and 2 low tides per day
- When facing the moon = high tide
- When the moon and sun are aligned Spring tides are created which are the highest tides.





Subsurface currents -

Thermohaline circulation

Function: Acts as a conveyer belt which connects all oceans of the world and it controls the WORLD'S temperature

Controlled by:

1	Differences in salt content in the ocean.
2	Differences in ocean's temperature.

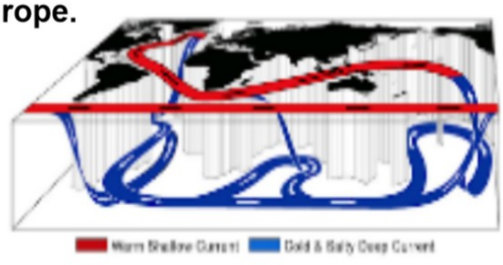
Water density

Most dense water (sink)	Cold and salty
Least dense water (float)	Warm and less salty

How it works

In the polar regions, cold dense salty water sinks to the bottom of the ocean floor and travels along the ocean floor. When it gets to warmer regions (such as the equator) the warmer less dense water is heated and rises back up to the surface. Then the warm water travels along the surface due to wind and the moon. When it gets to the polar regions, the warm water gets cooled once more and sinks. The process repeats itself again (1000 years

Ex: The gulf stream is controlled by surface currents and brings warm water to Europe.



As thermohaline circulation occurs it brings **warm water** along with **warm air** to the **poles** which makes the **poles less cold**. It also brings **cold water** along with **cold air** to the **tropics** which makes the **tropics less hot**. It not only controls the water's temperature, **but the world's temperature.**

https://www.youtube.com/watch?v=ju_2NuK5O-E
https://www.youtube.com/watch?v=tv42E_0PnAs

https://www.youtube.com/watch?v=Yomf5pBN8dY

Salt differences:

Salt in the ocean comes from?	The erosion of rocks
When water evaporates the ocean becomes?	More salty
When it rains the ocean becomes?	Less salty
When pack ice and glaciers melt the ocean becomes?	Less salty

What affect will pack ice and glaciers melting have on thermohaline circulation?

As the glaciers and pack ice melt, they decrease the salinity of the water. Decreased salinity means water is less dense. If the water is less dense it will not sink and go to the bottom of the ocean = less thermohaline circulation and the Gulf Stream would not work as well.

Past Exam Questions

1. Which of the following statements describes the impact of thermohaline circulation on climate?

A) It regulates the world's climate
B) It decreases the world's average temperature
C) It increases the world's average temperature
D) It has no notable impact on the world's climate.

2. The diagram below shows four different locations (1,2,3 and 4) and the site of a toxic spill identified by the letter X.

Which statement about the impact of the toxic spill is TRUE?

A) Location 1 will be the most affected, since the flow of water will carry the toxic substance into the lake.

B) Location 2 will be only slightly affected, since the current will prevent the toxic substance from accumulating.

C) Because of the terrain, only location 3 will be affected.

D) Location 4 will be affected the most, since it is downstream from the spill.

3. The average salinity of the ocean is 35 g/L, but may vary from one area to another depending on certain conditions. The following table lists observations regarding four different areas of an ocean.

Area	Observation
1	Area that receives water from a melting coastal glacier
2	Tropical area with strong surface winds
3	Area with a large amount of water is lost through evaporation
4	Arctic area where pack ice is formed

Which area of this ocean has the lowest salinity level?

A) Area 1 B) Area 2 C) Area 3 D Area 4

4. What do glaciers and pack ice have in common?

A) They float on the ocean
B) They are made up of water whose salinity level is below that of seawater
C) They are always located near the poles
D) When they melt, they do not affect the salinity of the oceans

5. Ocean circulation involves two types of ocean currents: surface currents and deep currents. The following table lists the four factors that influence ocean circulation.

Factors influencing ocean currents

Which choice correctly matches the factors that influence ocean circulation with the types of currents they affect?

1	Rotation of the earth
2	Differences in water salinity
3	Differences in water temperature
4	Prevailing winds

	Surface currents	Deep currents
A	1 and 3	2 and 4
B	1 and 4	2 and 3
C	2 and 3	1 and 4
D	2 and 4	1 and 3

6. On December 6, 2010, a major storm devastated the Lower St. Lawrence and Gaspe Peninsula. This storm, combined with extremely high tides, produced powerful waves and caused extensive damage.

Which of the following diagrams best illustrates the formation of the tides during this storm?