Active Multimedia Conferences

Mini-mural based on the concept of serious games:

LA FRESQUE DU CL!MAT
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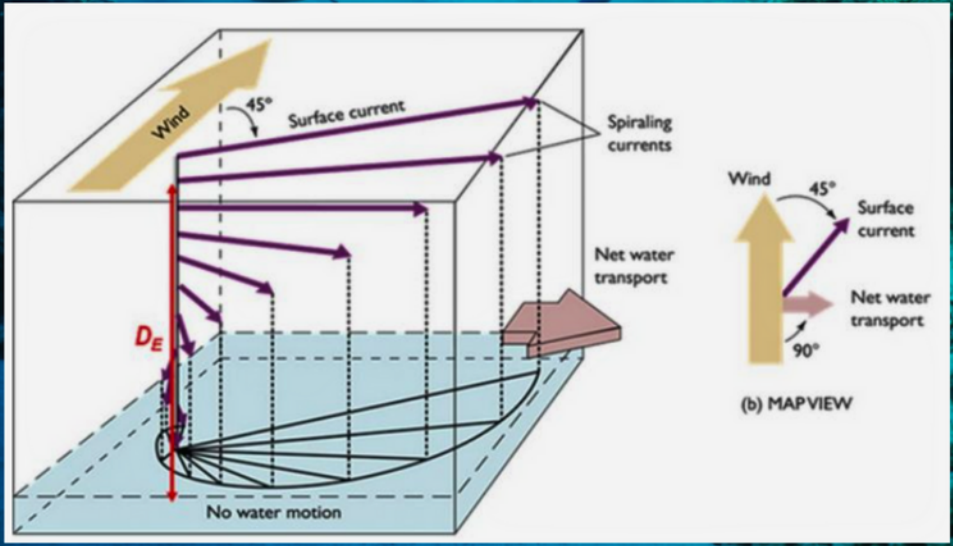
OCEANIC CURRENTS

This mini-mural details the main causes and consequences of marine currents.

Pauline ROBERT, Emy TLEMSANI, Léo DELMONT

EKMAN SPIRAL - WIND EFFECT



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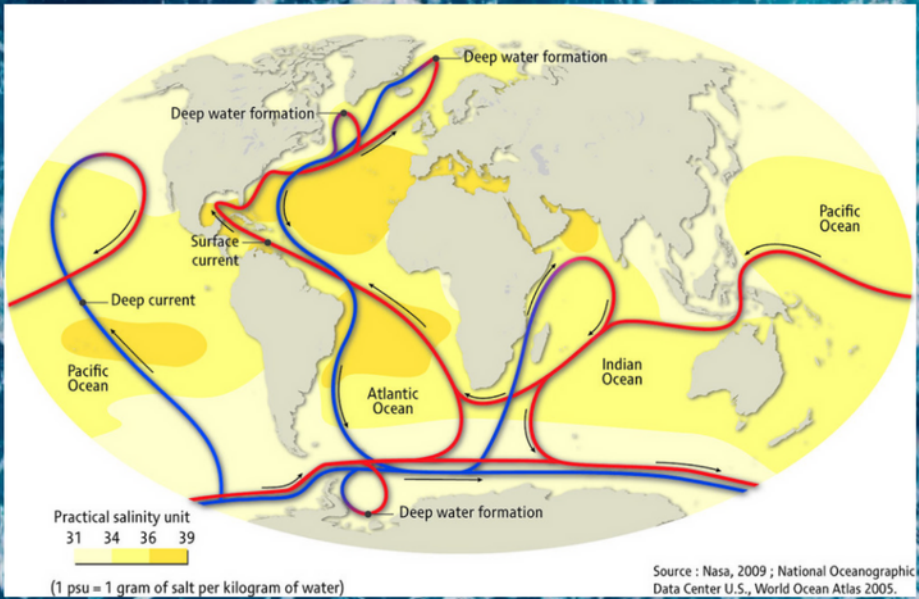
EKMAN SPIRAL - WIND EFFECT

It is a consequence of the Coriolis effect. When surface molecules are moved by the wind, they drag deeper layers of water molecules below them. Like surface water, the deeper water is deflected by the Coriolis effect - right on the North Hemisphere and left in the South Hemisphere. As a result, each successively deeper layer of water moves more slowly to the right and to left, creating a spiral effect, named an Ekman Spiral.

TERMOHALINE CIRCULATION



Source : Nasa, 2009 ; National Oceanographic Data Center U.S., World Ocean Atlas 2005.

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TERMOHALINE CIRCULATION

The thermohaline circulation is the term used to describe the movement of seawater globally as influenced by the contrast in temperature and salt concentration between the upper and lower ocean layers. This circulation begins with the sinking of cold, heavy water in the polar regions and moves along the ocean floor toward the equator. When it reaches other regions, such as the North Atlantic, it rises to the surface again, where it merges with warmer water to form a complex network of currents.

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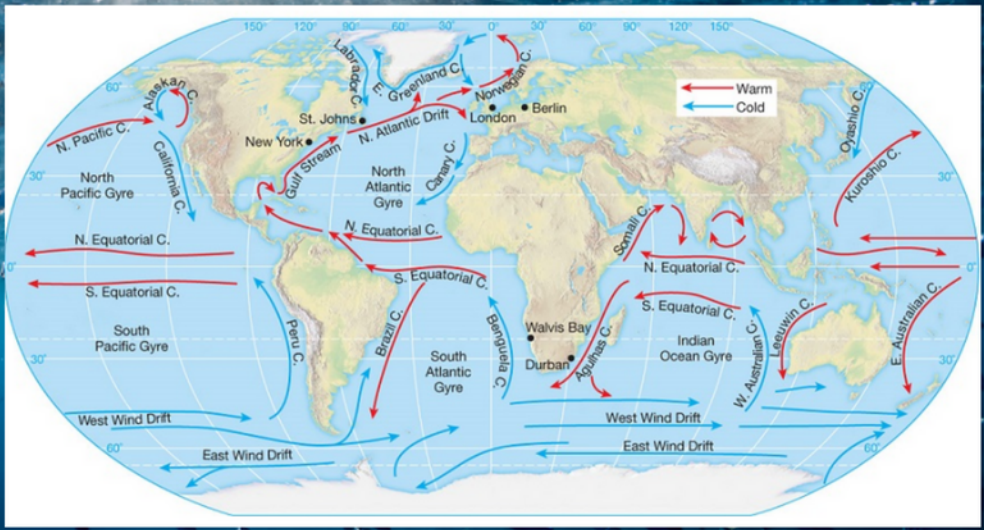
SURFACE AND SUB-SURFACE CURRENTS



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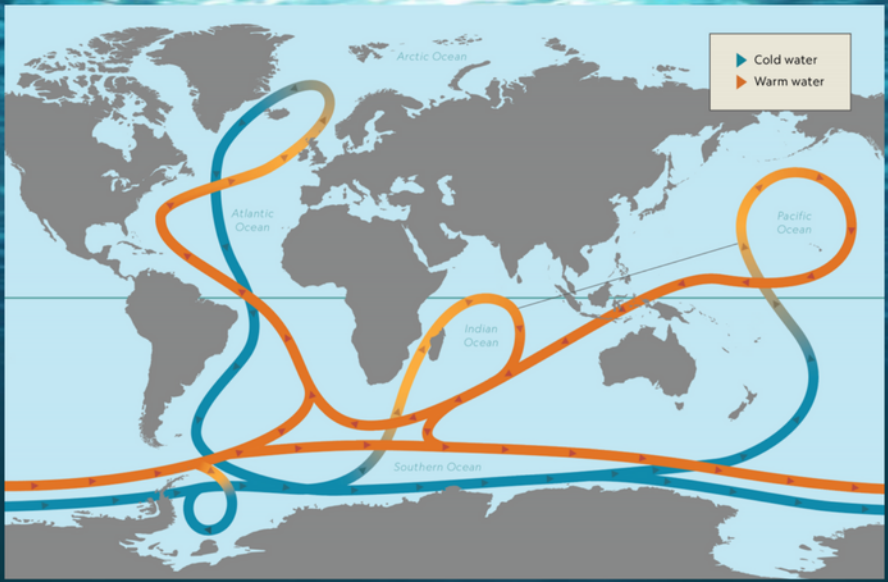
SURFACE AND SUB-SURFACE CURRENTS

The mains surface and subsurface currents are The Gulf Stream, The Kuroshio Current and The Antartic Circumpolar Current. They connect all the Ocean and have a crucial role in regulating the climate.

THE GLOBAL CONVEYOR BELT



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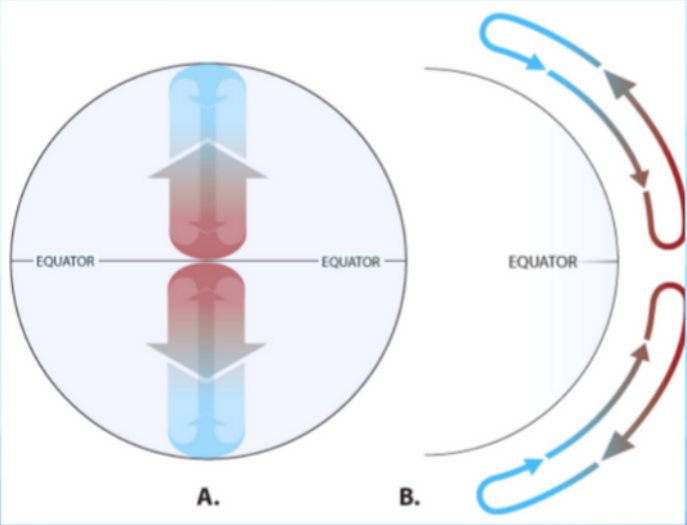
THE GLOBAL CONVEYOR BELT

It includes both surface and deep oceanic currents that circulate the globe in a 1000 year-cycle. It is a result of two simultaneous processes :

- from the poles to the Equator : deep ocean currents carrying denser water
- from the Equator to the poles : warm surface currents carrying less denser water

It plays a major role in the heat distributed around the Earth, the regulation of weather and climate, and the transportation of vital nutrients and gas.

THE CORIOLIS EFFECT



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THE CORIOLIS EFFECT

Due to the rotation of the Earth, the atmosphere is deflected either toward the right in the Northern Hemisphere and toward the left in the Southern Hemisphere, resulting in curved paths. It creats currents turning clockwise in the southern hemisphere and counterclockwise in the northern hemisphere.

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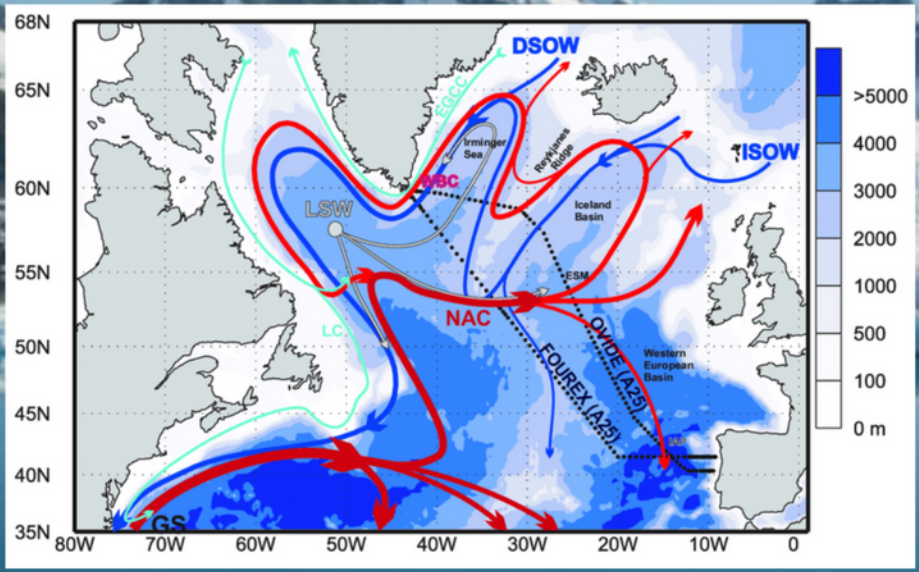
MERIDIONAL OVERTURNING CIRCULATION



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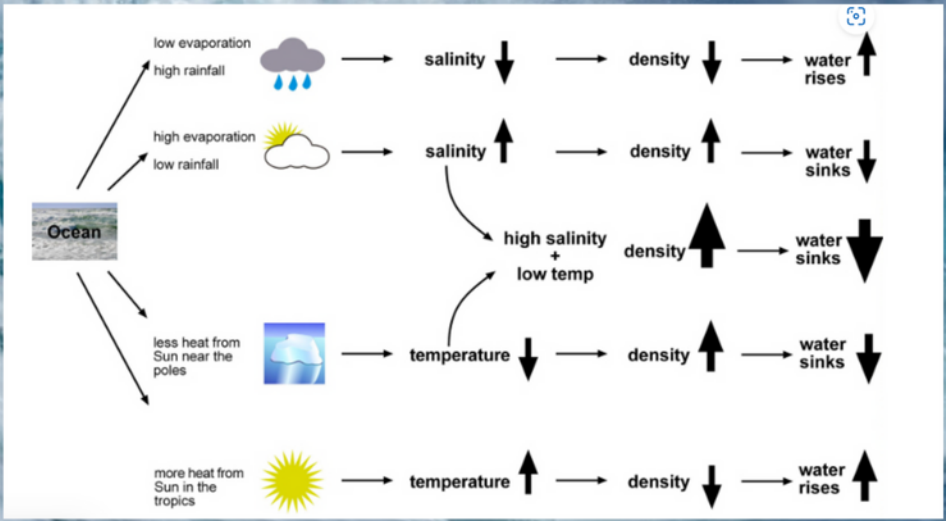
MERIDIONAL OVERTURNING CIRCULATION

The accumulation of greenhouse gases released by humans in the atmosphere is causing the Meridional Overturning Circulation (MOC) to become increasingly vital in its role of trapping anthropogenic heat and carbon in the deep ocean. As a result, it is able to regulate the trajectory of climate change.

WATER DENSITY



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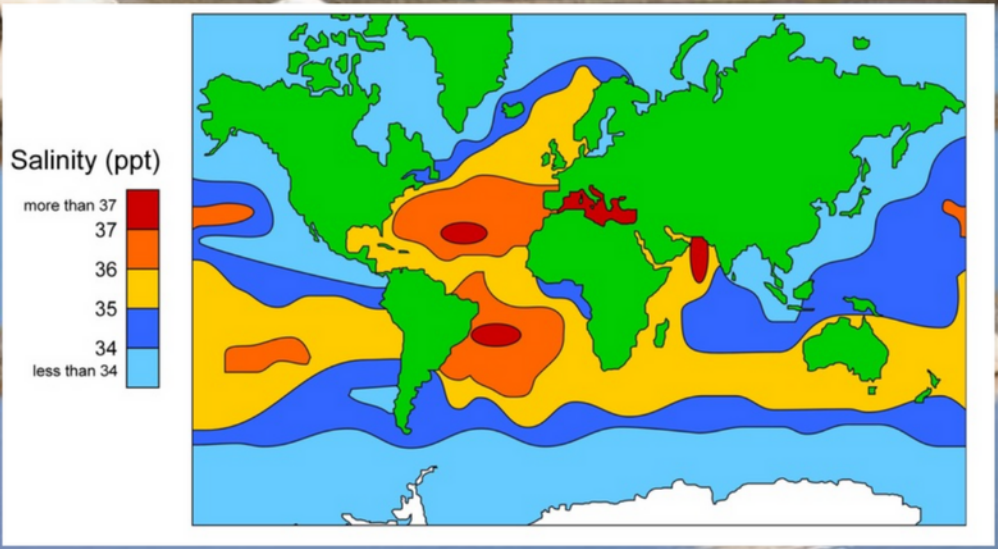
WATER DENSITY

Deep-sea currents are driven by differences in the density of water and differ in size, velocity and energy from surface currents. Colder and saltier water is denser and therefore sinks beneath less dense water. The greater the difference in density, the more intense the mixing and circulation. These variations in water density play a vital role in the operation of the global ocean circulation system, often referred to as the global conveyor belt.

SALTINESS



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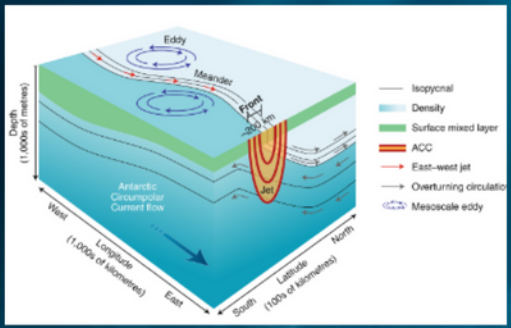
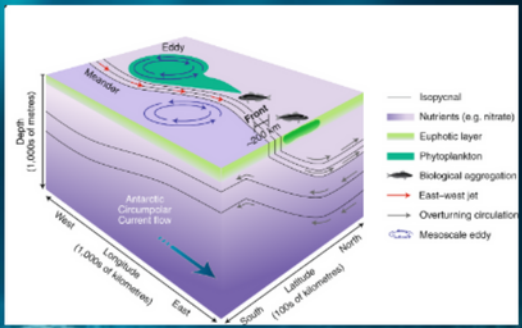
SATLINESS

The saltiness in the water has an impact on its density. The saltier the water the denser it will get, and the water will start to sink. Because of that, the surface water is pulled in to replace the deep water, getting eventually cold and salty enough to sink. It creates a circular pattern known as a convection current and initiates the deep-ocean current (thermohaline circulation) driving the global conveyor belt.

BIOLOGICAL INFLUENCE





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BIOLOGICAL INFLUENCE

The "liquid wind" has a significant impact on food webs, the reproduction of marine organisms, and the overall marine ecosystem. Numerous species with restricted mobility rely on this phenomenon to transport food and nutrients, as well as to disperse larvae and reproductive cells.

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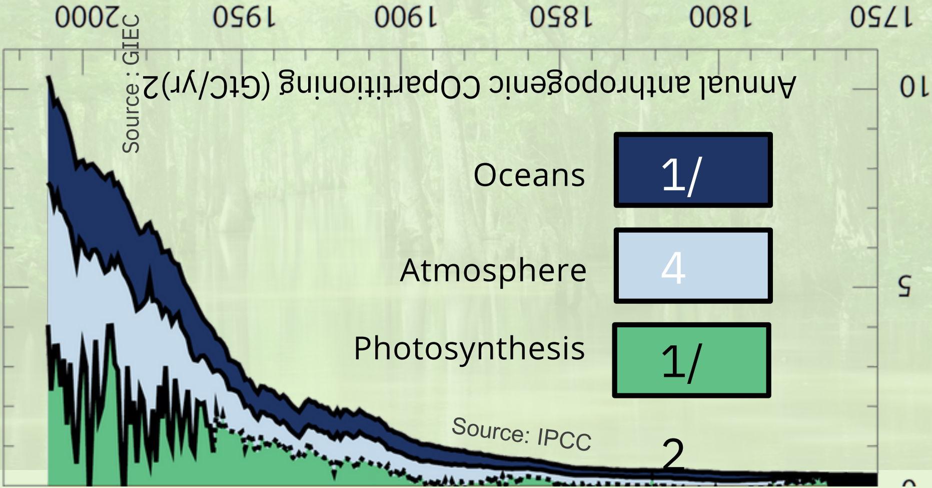
Carbon Sinks



Oceans 1/

Atmosphere 4

Photosynthesis 1/

2

Source: IPCC

Set 2

CLIMATE FRESK
www.climatefresk.org

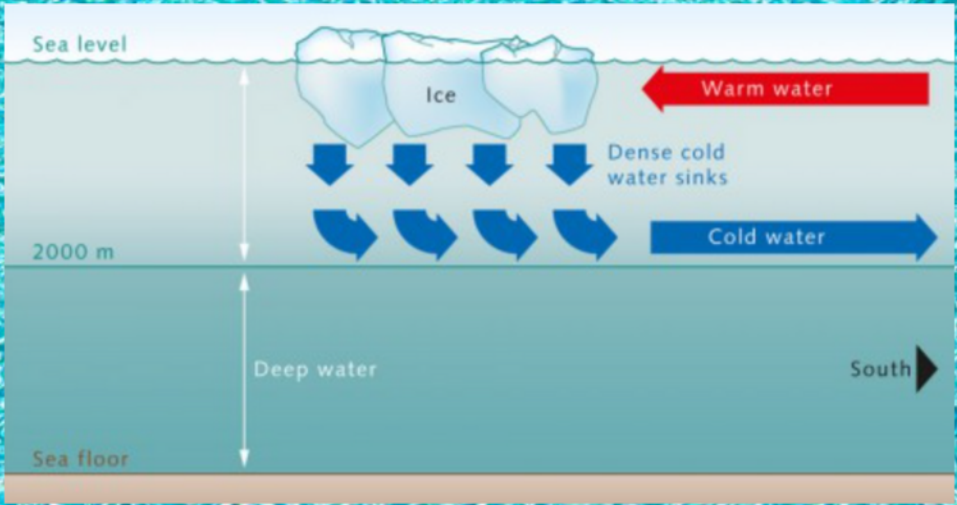
Half of the CO2we emit every year is absorbed by carbon sinks:

-1/4 by vegetation via photosynthesis

-1/4 by the oceans

The remaining half stays in the atmosphere.

WATER TEMPERATURE



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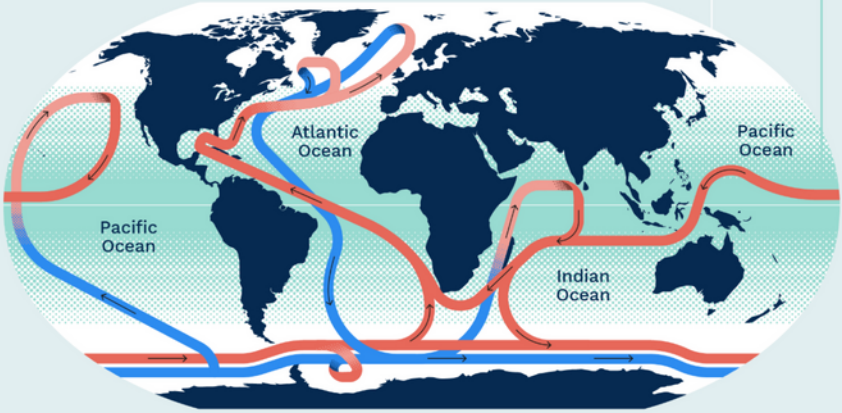
WATER TEMPERATURE

Temperature is a measure of energy. The greater the energy, the higher the temperature. On the molecular side, the higher the temperature, the more "excited" the atoms will become and they then start to expand. This expansion results in a lowered density creating the warm surface waters . Some regions of the globe receive more solar heating than others, especially around the Equator, beginning processes like gyres.

CLIMATE CHANGES

Melting polar ice is weakening ocean currents

Meltwater makes seawater less salty, and therefore lighter and slower to sink



Source: NASA

The great ocean conveyor belt

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CLIMATE CHANGES

Climate change is altering the ocean by increasing temperatures, causing sea ice to melt, and interfering with the ocean's conveyor belt. This can lead to the warm freshwater blocking the sinking of cold and salty water, disrupting the formation of sea ice and causing dramatic consequences, such as the Gulf Stream's disruption and a drop in temperature in Europe.