MARINE CURRENTS

Physics | Geology | Geography | Mathematics | Chemistry

CLIMATE CHANGE

PEDAGOGIC CONTENT:

- Sea currents experimentation
- Melting ice simulation
- Water temperature
- Salinity

PRE-REQUISITES:

Knowledge about climate change and ocean circulation (O1 draft)

NEW COMPETENCIES TARGETED/LEARNING OUTCOMES:

STUDENTS WILL BE ABLE TO:

- Carry out a scientific protocol (hypothesis, experiment, observation)
- Relate the experiments carried out with the functioning of the ocean circulation
- Identify surface and deep water currents
- Understand the consequences of the melting ice on sea currents

MARINE CURRENTS

MED EDUC

Erasmus+

DESCRIPTION:

IMPLEMENTATION

#1: The teacher introduces the activity and divides students in 2/3-scholars groups.

#2: The students begin the first experimental activity following the instructions below: *"Put some water in two different beakers. Chose one of the two beaker and color the water in blue. Heat blue water on a hot plate. Use the thermometer to monitor the hot water temperature. When it reaches 60 °C, take a small amount of the blue water with a micropipette. Then, release the hot water into the second beaker with cold water."*

#3: The teacher lets the students map the stages of the first experiment and debate about what do they observe, trying to explain the observed phenomenon due to the water temperature.

#4: The students conduct the second experimental activity following the instructions below: *"Prepare a beaker of fresh water and another of salt water. Pour in 2 teaspoons of coarse salt in one of the two beakers to get salt water and stir to dissolve the salt. Color the salt water in green. Take a small amount of the green salt water using another micropipette. Then, release the salt water into the second beaker with fresh water."*

#5: The teacher lets the students map the stages of the second experiment and debate about what do they observe, trying to explain the observed phenomenon due to the water salinity.

#6: The students do the third experimental activity following the instructions below: *"Prepare a beaker of tap water and another of salt water. Pour in 2 teaspoons of coarse salt in one of the two beakers to get salt water and stir to dissolve the salt. Dip a colored ice cube in each of the two beakers."*

#7: The teacher lets the students map the stages of the third experiment and debate about what do they observe, trying to explain the observed phenomenon which consists in the modelling of a melted iceberg.

#8: Let's the students have the following read on sea currents: *"A sea current is a movement of sea water characterized by its direction, speed and flow. There are two types of currents: surface currents and depth currents. The Earth receives solar energy unevenly: it is not the same depending on whether we are at the pole (because the rays arrive in a very inclined way) or at the equator. The intertropical zone thus receives as much energy as the rest of the planet. This imbalance sets in motion the atmosphere and the oceans which will thermally rebalance the whole. It also generates winds which are the main factors of surface currents. These movements are influenced by a force due to the rotation of the Earth, called the Coriolis force. This imbalance also causes temperature differences depending on the latitude. This difference in temperature causes a difference in the salinity of the water and therefore in density, thus creating the depth currents"*

DESCRIPTION:

IMPLEMENTATION

#9: Let's the student answer to the following questions:
1 – What is a sea current?
2 – What are the 2 types of existing sea currents?
3 – What are the origins of these different marine currents?

#10: Let's the students have the following read on the importance of the Gulf stream: *"The Gulf Stream is a sea current that is part of the global thermohaline circulation, the famous conveyor belt, which carries heat from the tropics to the poles. In the North Atlantic, this current is the hot leg of the conveyor belt. It transfers its heat, accumulated in the tropics, to air masses above Europe, helping to warm the regional climate. Cooled and enriched by colder and more salty, therefore heavier, arctic waters, this current plunges to the bottom of the ocean and heads back to Antarctica. The engine of this thermohaline circulation is the difference in density, and therefore in temperature and salinity, of water masses. It has therefore been proposed that an increased melting stions of glaciers, following global warming, could slow the Gulf Stream by reducing the salinity of polar waters. "The warm, fresh waters are more light and dive less quickly than cold and salty waters," recalls Josh Willis, oceanographer of the NASA. Such a slow down would have consequences for the European climate, which would cool down."*

#11: Let's the student answer to the following questions:
1 – What is the Gulf Stream?
1 – Why does the Gulf Stream sink to the bottom of the ocean when it arrives in the Arctic and then returns to the Antarctic?

#12:The teacher asks to the students what have they learned during the activity about sea currents and concludes talking about climate change impact on the ocean circulation.

Type of activity	Experimental activity
Target audience	From 12 years old
Place	Lab room, classroom
Material needed	Green and blue water dyes / hotplate / thermometer / 2 beakers / 2 micropipette / coarse salt / 1 ice cube tray
Duration of activity	Implementation : 2 hours
Authorship	CPIE Bastia U Marinu No authorization required
Links	https://phys.org/news/2010-03-nasa-atlantic-conveyor-belt.html http://www.ecoles.cfwb.be/arvise/SECONDAIRE/pedagogie/G%C3%A9ographie/Mr%20Fallais/courants%20marins.pdf https://www.futura-sciences.com/planete/actualites/oceanographie-fonte-arctique-affecte-courants-oceaniques-plus-encore-44867/
Notes by author	None