Seas, Oceans & Public Health in Europe
Linking oceans and health research

The Ocean regulates the Earth's temperature

WILDSEA EUROPE

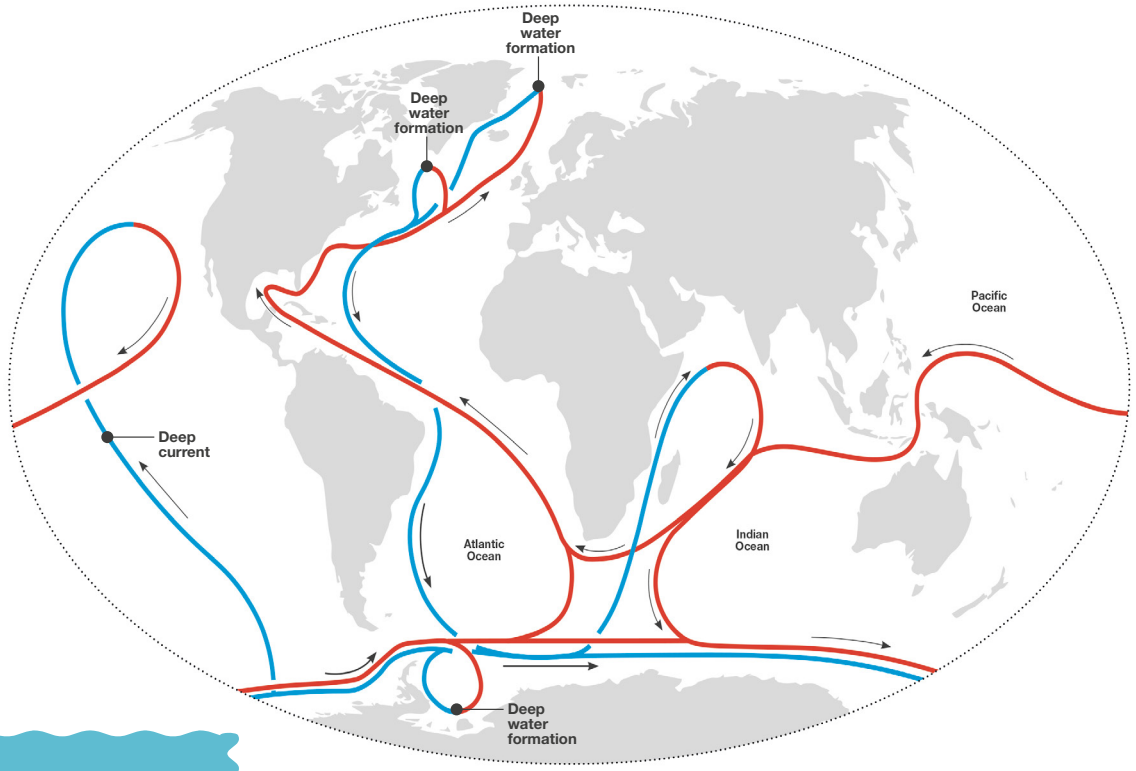
Heat in the ocean

Water has great *heat capacity*: it has a high ability to store heat. Since **the Ocean** is a massive body of water, it acts as **a crucial heat reservoir, absorbing 1,000 times more heat than the atmosphere.** This absorbed heat is later distributed throughout the planet, making the ocean **the main governor over the planet's climate.**

The heat in the Ocean is distributed around the Earth through *thermohaline circulation*: the movement of huge masses of water driven by temperature and salinity differences. Simply explained, warmer and lighter water moves on the surface, while colder and denser water (full of nutrients and salinity) moves through the depths. When warm surface water reaches the poles, it emits heat, cools down and becomes deep, cold water.

To understand the effect of ocean circulation on our climate, compare the weather of two cities located on the same latitude and by the sea: New York, USA (chilly winters with plenty of snow) and A Coruña, Spain (mild winters with no snow). This weather variation is a direct effect of the presence of cold or warm water (deep or surface water), due to the ocean's thermohaline circulation.

But the Ocean's heat capacity makes it **very vulnerable to climate change,** increasing its temperature year after year; global sea surface temperature has increased an average of approximately 1°C over the last 100 years. And this is even worse in European seas: they warm faster than the global sea average.



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IN THE LAST 25 YEARS, SEA SURFACE TEMPERATURES IN THE NORTH AND BALTIC SEAS HAVE RISEN 5-6 TIMES FASTER THAN THE GLOBAL AVERAGE; IN THE BLACK AND MEDITERRANEAN SEAS, 3 TIMES FASTER.

Learn more at **www.teamupwithsophie.eu** and **sophie2020.eu**

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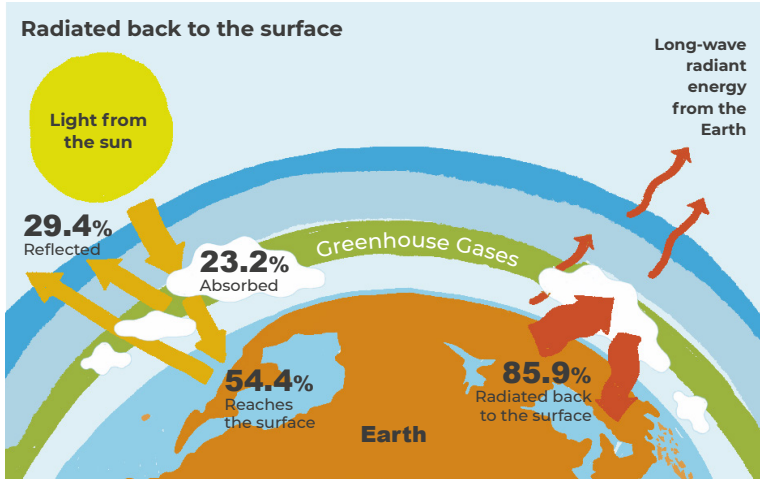
Greenhouse gases

The role of greenhouse gases is to retain part of the heat that the Earth radiates back into the space. **This is a natural process that keeps the planet warmer and inhabitable** (without them, the Earth's average temperature would be around -18°C!).

However, **since the industrial revolution** (in the early 1800s), **the amount of gases emitted to the atmosphere has swiftly increased,** accumulating and **trapping extra heat,** making our planet warmer and warmer. Before the industrial revolution, the concentration of CO_2 (the main greenhouse gas) in the atmosphere was 280 parts per million (ppm). **In 1960, CO_2 concentration was increasing at a rate of 0.7ppm/year; it now increases at 2 ppm/year!**



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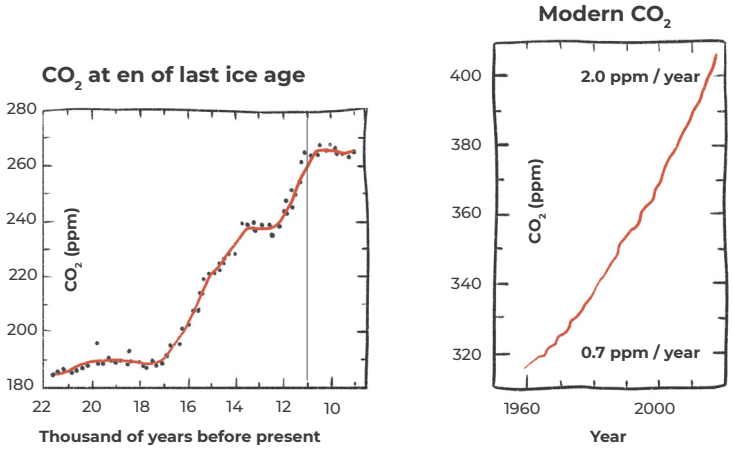

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The Ocean suffers from CO_2 accumulation and the resulting increase in temperature in two different ways:

- Its great heat capacity: **more than 90% of the heat from global warming ends up in the ocean, bringing up the temperature.** This warming:
  - **Triggers changes in ocean circulation** (altering the world's climate).
  - **Raises the sea level.**
  - **Affects marine biodiversity,** as it affects crucial marine habitats, such as coral reefs. Some species also migrate in search of colder waters, which has a profound effect on fisheries, for example.
- **The Ocean absorbs approximately 25-30% of the CO_2 that is emitted to the atmosphere,** slowing climate change. However, the absorption of great amounts of CO_2 is responsible for one of the greatest issues the ocean must now face: **acidification.**

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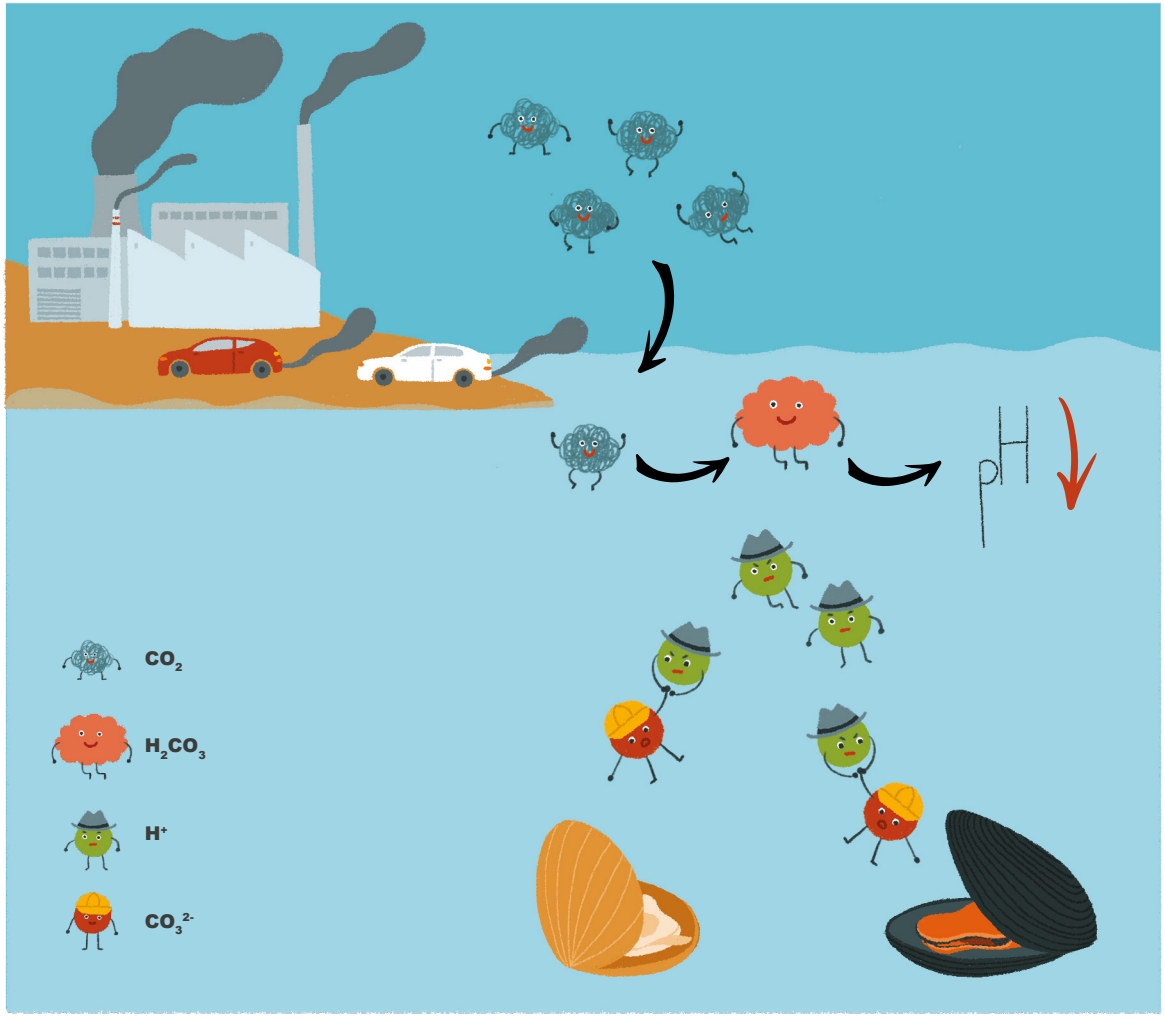

Ocean acidification

Ocean acidification is caused by the CO_2 that is absorbed by the Ocean. It dissolves and forms carbonic acid (H_2CO_3), leading to higher acidity. But this carbonic acid also releases free hydrogen ions (H^+), which have great chemical affinity with the free carbonate (CO_3^{2-}) available in the sea. Marine calcifying creatures like corals, oysters, clams and calcareous plankton need this carbonate to produce their shells and must compete with the hydrogen ions for it. They have more difficulties finding the carbonate, spending much energy in this quest. This means it is harder for them to grow and reproduce, and many will die off. The fish eating them will also have greater difficulties surviving, and eventually, this process will affect the entire ecosystem and fisheries.

Since the industrial revolution, **the Ocean has grown 30% more acidic.** The effects of acidification in the future are uncertain, but if the trend continues, predictions say that the Ocean will reach a pH of 7.78 by 2100. This would have **fatal consequences for many marine species** (not being able to produce their own shells/skeletons, or they may even dissolve), and **critical economic consequences for many countries** that depend on fisheries and shellfish production. These economic losses have been estimated at **approximately 900 million euros per year in Europe alone.**

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