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Modification of ocean currents

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Ice melting

Source : https://www.futura-sciences.com

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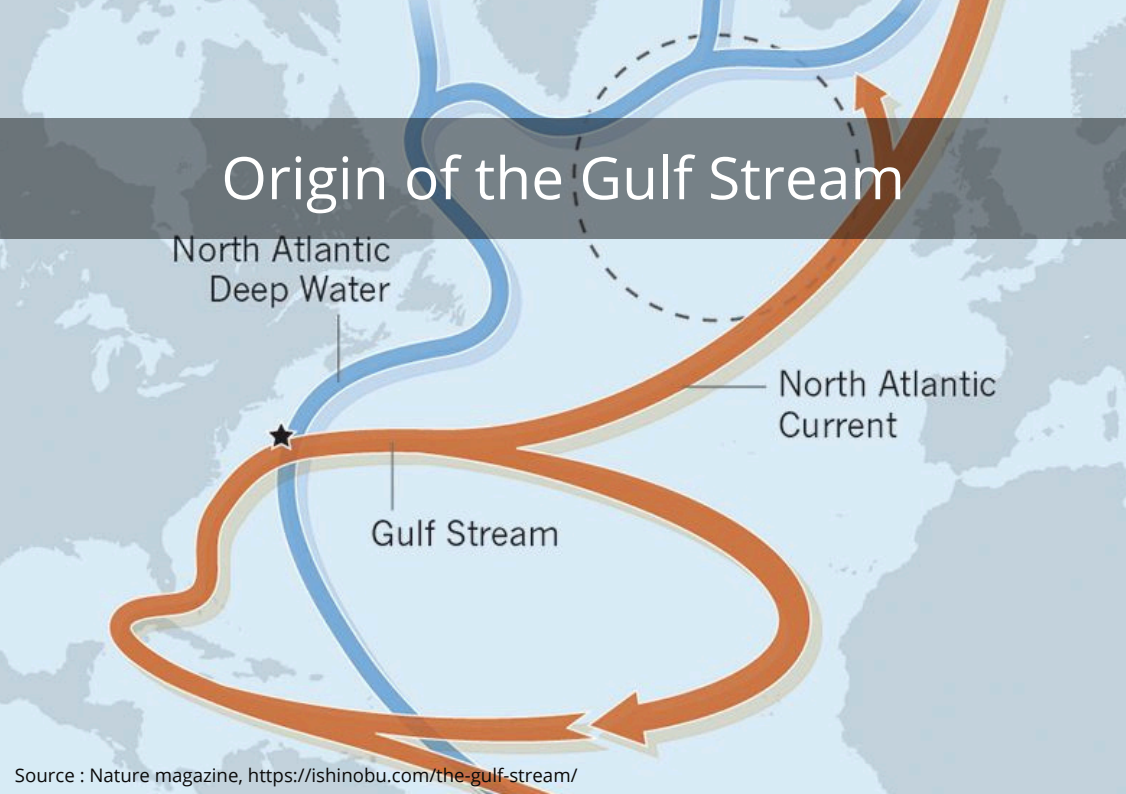
Climate change is causing ice melting at the poles, mainly because temperatures are rising. This melting ice adds more cold freshwater to polar regions, and disrupts the water temperature and salinity in these areas.

Origin of the Gulf Stream



Source : Nature magazine, https://ishinobu.com/the-gulf-stream/

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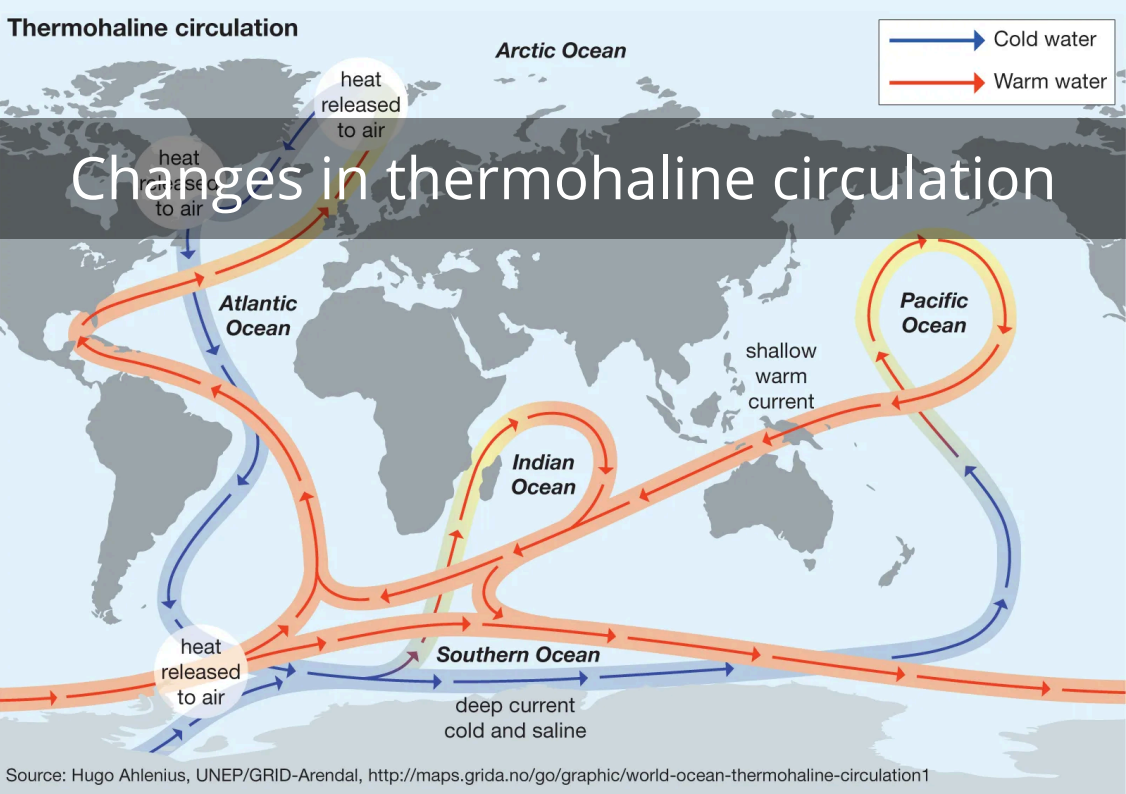
Negative wind stress curls in the Atlantic Ocean trigger seawater downwelling, leading to water column adjustments and convergence in subtropical regions. This results in an equatorward flow across the basin. To maintain mass conservation, a strong poleward flow forms along the western boundary, giving rise to the Gulf Stream. Following this, the North Atlantic Current emerge, driven by the Gulf Stream and thermohaline circulation. **This system constitutes the AMOC***.

*Atlantic Meridional Overturning Circulation



Changes in thermohaline circulation

Source: Hugo Ahlenius, UNEP/GRID-Arendal, http://maps.grida.no/go/graphic/world-ocean-thermohaline-circulation1

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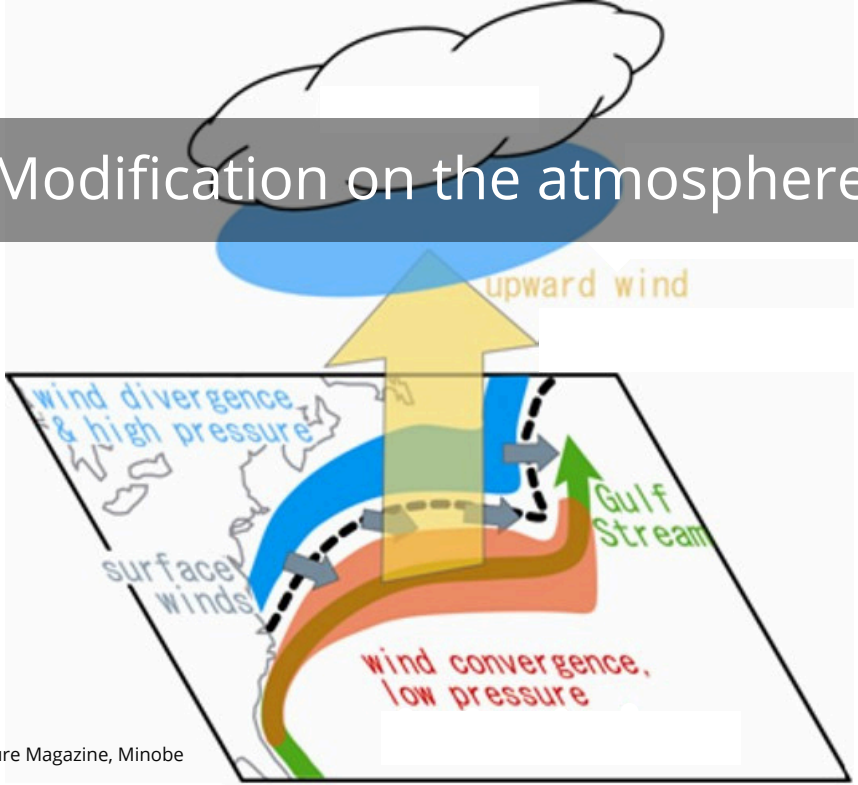
Changes in salinity and temperatures cause **changes in water density.** These changes **affect ocean currents**, especially the AMOC*, due to their impact on the thermohaline circulation. This process is driven by differences in temperature and salinity. Indeed, warm less dense water rises in the tropics and cold denser water sinks in polar regions, as a “conveyor belt”. Yet, the AMOC is decreasing in intensity : forecasts show an average slowdown of 30% by 2100.

*Atlantic Meridional Overturning Circulation

Modification on the atmosphere



Source : Nature Magazine, Minobe et al (2008)

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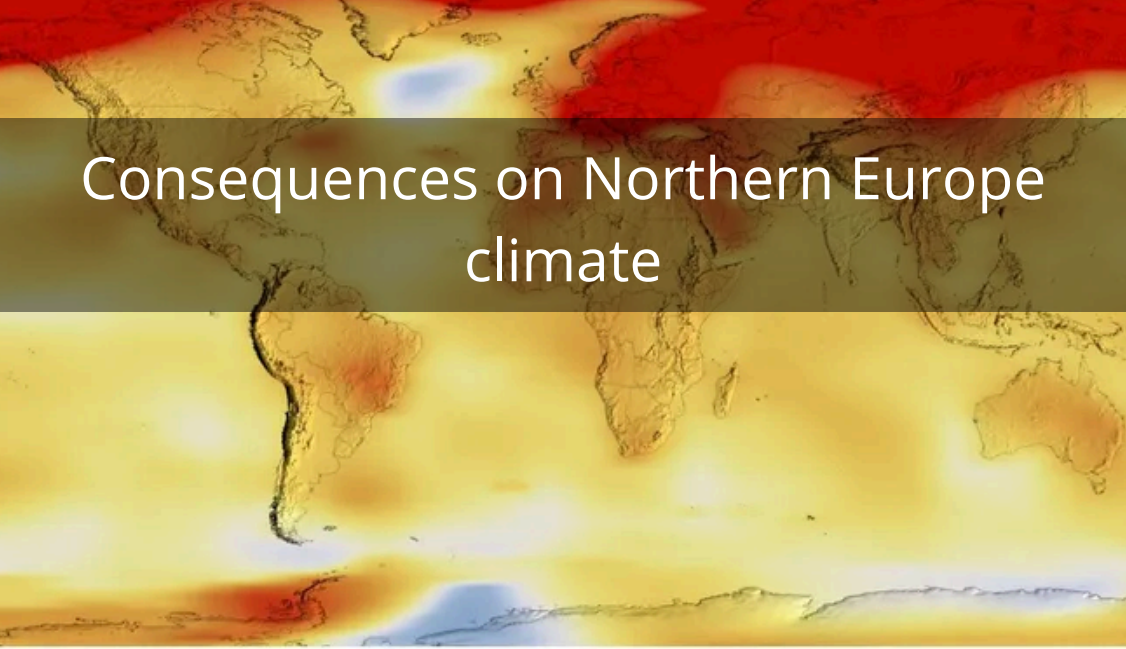
Recent results show that **the AMOC affects the atmosphere locally**. In the marine boundary layer, atmospheric pressure adjustments to sharp sea surface temperature gradients lead to surface wind convergence, which creates upward wind by mass conservation. This upward motion, extending into the upper troposphere, creates cloud formation, resulting in a narrow band of precipitation along the AMOC. This can affect regions such as Western Europe, which has a wet climate in winter.

Consequences on Northern Europe climate



Source : https://services.meteored.com/img/article/presente-y-futuro-de-la-corriente-del-golfo-318421-3_768.jpg

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The AMOC acts as a heater that distributes heat from the equator towards the poles, contributing to the mild climate of Western Europe. The disappearance of the AMOC could lead to a **rapid cooling of temperatures in Northern Europe** by about 2 to 3 degrees. Therefore, climatic extremes could become more pronounced with harsher winters and drier, hotter summers. These consequences could be multiple for people living on both sides of the Atlantic.