



Gulf Stream and Climate Sensitivity

[Source: SD](#)

Why in News?

A recent study, published in Nature, has revealed that the [Gulf Stream](#) was significantly stronger during the last **ice age (about 20,000 years ago)** due to more powerful winds across the **subtropical North Atlantic**.

- This finding suggests that the **Gulf Stream's** strength is sensitive to changes in wind patterns, which could impact future climate if these winds weaken due to [climate change](#).

Note:

- The Gulf Stream is a **powerful ocean current that brings warm water from the Gulf of Mexico up the eastern coast of North America**.
- It then crosses the Atlantic Ocean, influencing the climate of Western Europe by making it warmer than it would otherwise be.

What are the Key Highlights of the Study?

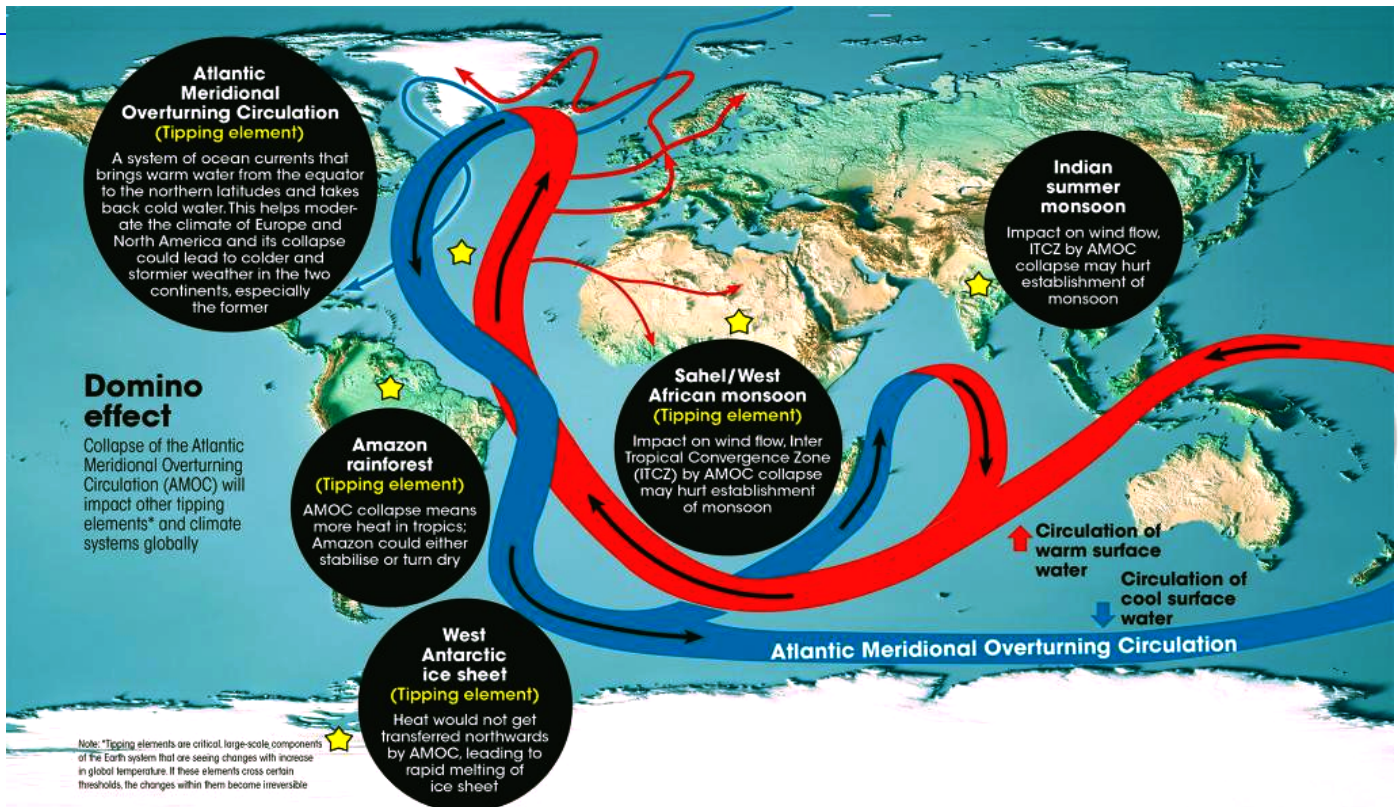
- **Research Methodology:** Analysis of **fossil foraminifera** from sediment cores off **North Carolina and Florida** was used to gauge the prehistoric Gulf Stream's strength.
 - Findings showed the **Gulf Stream** was twice as deep and fast during the last ice age.
- **Impact on Climate:** Despite the strength of the Gulf Stream, the global climate was much colder than at present.
 - A weakened Gulf Stream in the future could limit tropical heat reaching Europe, potentially cooling the continent and raising sea levels in North America.
- **Role of Atlantic Meridional Overturning Circulation (AMOC):** The Gulf Stream is part of the [AMOC](#), which involves both deep water formation and wind patterns.
 - Climate change-induced disruptions, such as melting glacial water from [Greenland](#), could weaken the AMOC.
 - A weakened AMOC could significantly cool Europe by 10 to 15 degrees Celsius, disrupt agriculture, and alter weather patterns.
 - **AMOC Loops and Climate Impact:**
 - The **AMOC** should be viewed as **interconnected loops** (subtropical and subpolar) rather than a simple [conveyor belt](#).
 - Different parts of the AMOC may respond uniquely to climate change, affecting climate impacts.

Atlantic Meridional Overturning Circulation (AMOC)

- **About:** AMOC is a major system of ocean currents that forms part of the global ocean conveyor belt or **ThermoHaline Circulation (THC)**, distributing heat and nutrients across the world's

oceans.

- **Working of AMOC:** AMOC transports warm surface waters from the tropics to the Northern Hemisphere, where the water cools and sinks. It then returns as a bottom current through the South Atlantic, eventually being spread to all ocean basins by the **Antarctic Circumpolar Current (ACC)**, the only current circulating the globe.
- **Implications of Decline of AMOC:** A weakened AMOC, including the Gulf Stream, could cause Europe to become very cold, reduce rainfall, and potentially influence **El Nino** and shift monsoons in South America and Africa.
- **Causes of Decline:** Predictions suggest **global warming** may weaken major ocean systems. Melting Greenland ice and the "Last Ice Area" contribute freshwater that lowers water salinity and density, impeding the AMOC flow. Increased precipitation and river runoff in the Indian Ocean may also impact AMOC.
- **Importance:** AMOC is crucial for redistributing heat and regulating global weather patterns.



Read more: [Ocean currents](#)

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q. What could be the main reason/reasons for the formation of African and Eurasian desert belt? (2011)

1. It is located in the sub-tropical high pressure cells.
2. It is under the influence of warm ocean currents.

Which of the statements given above is/are correct in this context?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

Ans: (a)

Q. Consider the following factors: (2012)

1. Rotation of the Earth
2. Air pressure and wind
3. Density of ocean water
4. Revolution of Earth

Which of the above factors influence the ocean currents?

(a) 1 and 2 only

(b) 1, 2 and 3 only

(c) 1 and 4 only

(d) 2, 3 and 4

Ans: (b)

PDF Reference URL: <https://www.drishtiias.com/printpdf/gulf-stream-and-climate-sensitivity>