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.

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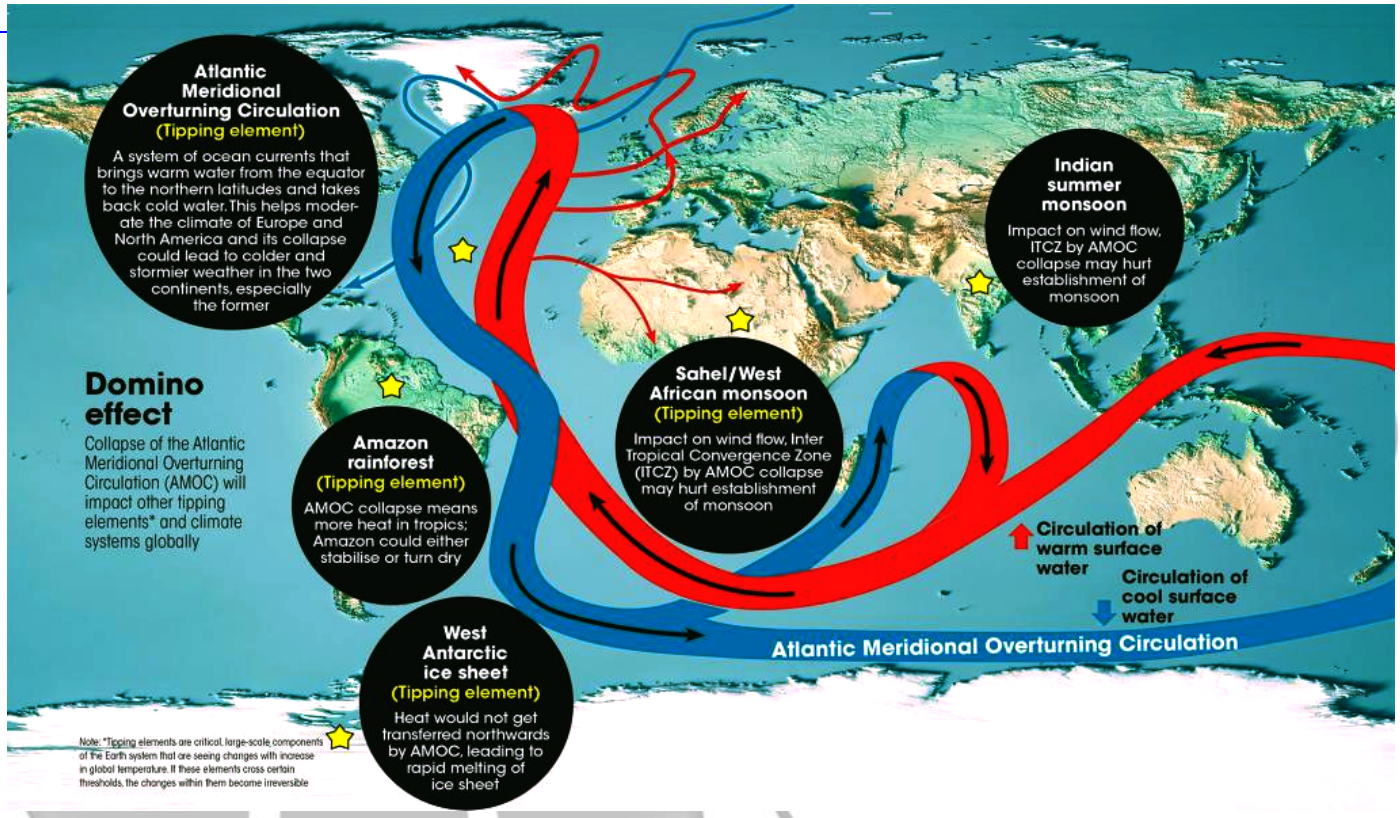

Read more: Ocean currents

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 Refernece URL: https://www.drishtiias.com/printpdf/gulf-stream-and-climate-sensitivity