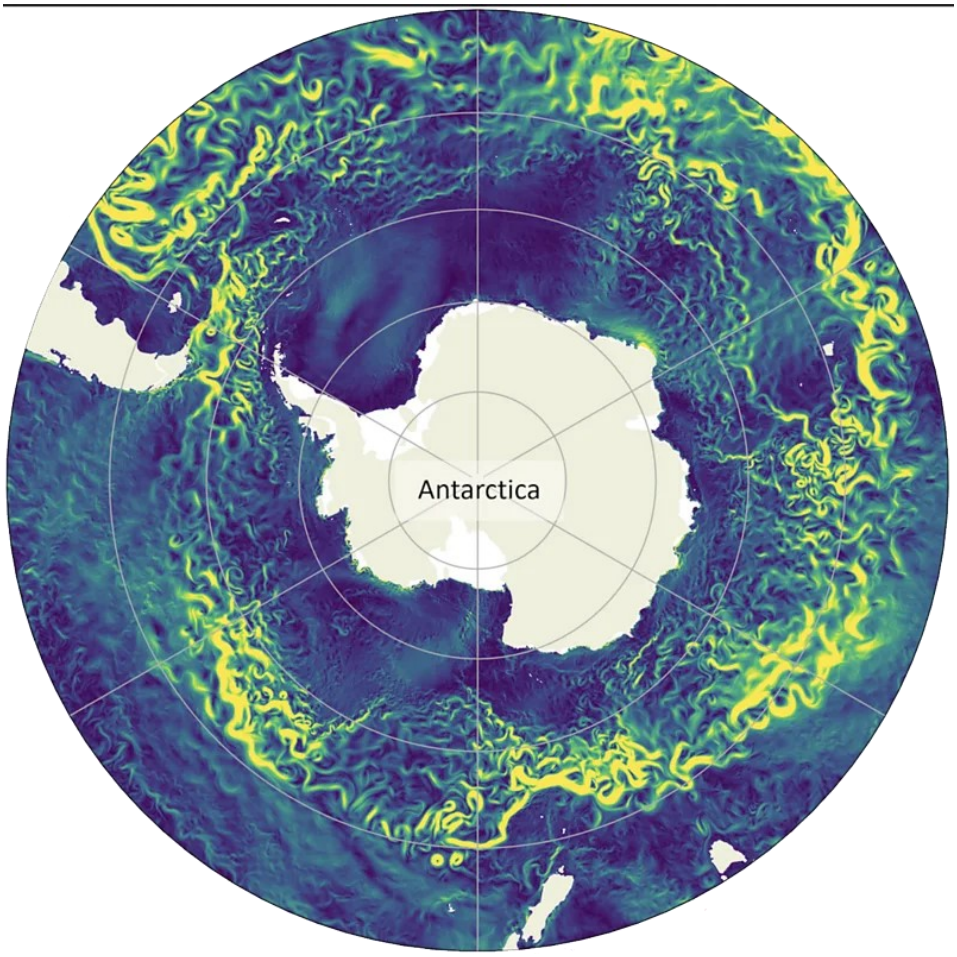
ANTARCTIC CIRCUMPOLAR CURRENT - GEOGRAPHY

NEWS: *Scientists warn that the **Antarctic Circumpolar Current (ACC)** could slow by about **20% by 2050** under a high carbon emissions scenario.*

WHAT'S IN THE NEWS?

About

- **ACC** is the **world's strongest ocean current.**
    - It's **five times stronger than the Gulf Stream** and **more than 100 times stronger than the Amazon River.**
    - It forms **part of the global ocean "conveyor belt"** connecting the Pacific, Atlantic and Indian oceans.



- **ACC's Role:** ACC moves **clockwise** around **Antarctica** and **regulates global climate** by influencing the ocean's ability to **absorb heat and CO2 and preventing warm waters from reaching Antarctica.**
    - The system **regulates Earth's climate** and pumps water, heat and nutrients around the globe.

Impacts of Slowing Down of the Antarctic Circumpolar Current (ACC)

The **Antarctic Circumpolar Current (ACC)** is a major ocean current that encircles Antarctica, playing a critical role in regulating global climate, ocean circulation, and the Antarctic ecosystem. A slowdown in the ACC could have far-reaching consequences.

1. Impact on Climate and Carbon Absorption

- The **ACC helps regulate global temperatures** by redistributing heat between the Southern Hemisphere and other parts of the world.
- A weakening ACC could **lead to greater climate variability**, causing more extreme weather conditions in certain regions.
- The ocean acts as a **carbon sink**, absorbing large amounts of carbon dioxide (CO_2) from the atmosphere.
- If the ACC slows down, **the ocean's ability to absorb CO_2 will decrease**, leading to **higher atmospheric carbon levels and accelerated global warming**.

2. Threat to the Antarctic Ecosystem

- The ACC **acts as a barrier** that prevents non-native species from reaching Antarctica.
- A slowdown could **allow invasive species**, such as **southern bull kelp, shrimp, and mollusks**, to migrate to Antarctic waters.
- These invasive species could **disrupt the Antarctic food web**, outcompeting native species and impacting populations of **penguins, krill, and other marine organisms**.
- Changes in ocean temperatures and salinity could further **alter the distribution of marine species**, affecting biodiversity in the region.

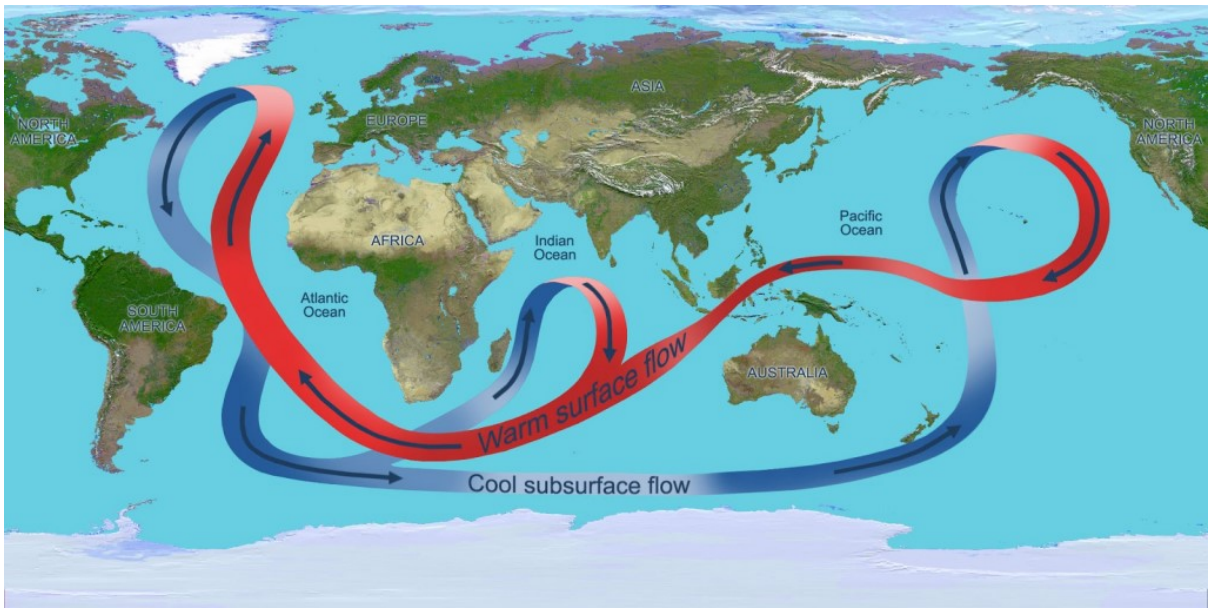
3. Impact of Melting Ice Sheets

- Melting ice shelves around Antarctica are adding **large volumes of freshwater** to the ocean.
- This influx of freshwater **lowers ocean salinity**, weakening the formation of **Antarctic Bottom Water (AABW)**, a critical component of global ocean circulation.
- AABW helps **drive the deep ocean currents** that regulate Earth's climate. Its weakening could slow down the global ocean circulation system.
- The weakening of the ACC could also **reduce the strength of the ocean jet surrounding Antarctica**, further disrupting climate patterns and marine ecosystems.

Understanding Ocean Currents

Ocean currents are the **continuous, predictable, directional movement of seawater**, driven by **gravity, wind (Coriolis Effect), and water density differences**. These currents play a crucial role in global climate regulation and marine biodiversity.

- **Horizontal movements** of seawater are called **currents**, while **vertical movements** are referred to as **upwellings (rising of deep water) or downwellings (sinking of surface water)**.
- These currents influence **heat distribution, ocean biodiversity, and climate systems** across the globe.



The Ocean Conveyor Belt (Global Thermohaline Circulation - THC)

- The **global thermohaline circulation (THC)**, also called the **ocean conveyor belt**, is a massive ocean current system that moves water between different ocean basins.
- It begins in the **North Atlantic**, where **cold, dense water sinks** and moves **southward** through the Atlantic.
- This deep-water flow then travels **through the Southern Ocean**, before moving into the **Indian and Pacific Oceans**.
- Eventually, the water **upwells in the Pacific and Indian Oceans**, bringing nutrients to the surface, and **returns toward the equator** as surface currents.
- This system plays a **vital role in regulating Earth's climate**, as it **redistributes heat, nutrients, and dissolved gases like carbon dioxide** across the oceans.

Key Roles of Ocean Currents

1. **Climate Regulation**
    - Ocean currents **transport heat from the equator to the poles** and vice versa, helping to **moderate global temperatures**.
    - Without this heat exchange, certain regions would experience **more extreme temperature variations**.
2. **Supporting Marine Life**
    - Currents help **distribute essential nutrients**, supporting the growth of **phytoplankton**, which form the base of the ocean's food chain.
    - Upwelling zones bring **deep, nutrient-rich water to the surface**, creating **rich fishing grounds**.
3. **Influencing Weather Patterns**
    - Ocean currents interact with the atmosphere, influencing **weather phenomena such as El Niño and La Niña**.

- These events **alter global rainfall patterns, storm intensity, and drought occurrences** in different regions.

4. **Carbon Sequestration**
    - The ocean acts as a **carbon sink**, absorbing CO_2 from the atmosphere and helping mitigate **climate change**.
    - If ocean currents slow down, this ability to store carbon could be **weakened**, contributing to **higher global temperatures**.
5. **Fisheries and Global Economy**
    - Ocean currents determine **fish migration patterns**, affecting **global fisheries and seafood supply chains**.
    - Efficient ocean currents also provide **cost-effective shipping routes**, influencing **global trade and commerce**.
6. **Ocean Mixing and Salinity Balance**
    - Currents help in **mixing surface and deep ocean waters**, ensuring a balance of **temperature, salinity, and oxygen levels**.
    - A slowdown could lead to **stagnation in deep ocean waters**, disrupting marine ecosystems.
7. **Sea Level and Coastal Erosion**
    - Changes in ocean currents can **affect regional sea levels**, leading to **coastal flooding** and increased **erosion of shorelines**.
    - Areas that rely on **stable ocean currents** for **storm protection and tidal balance** may face **higher risks of coastal damage**.

Conclusion

- While the slowdown of the **Antarctic Circumpolar Current (ACC)** presents serious risks, **the future is not predetermined**.
- **Reducing greenhouse gas emissions** can help slow down melting around Antarctica and mitigate the worst effects of climate change.
- **Long-term scientific monitoring in the Southern Ocean** is crucial to understanding and addressing these ongoing changes.
- International cooperation is essential to implement **climate policies** that safeguard **global ocean circulation and marine ecosystems**.

Source: https://economictimes.indiatimes.com/news/new-updates/worlds-strongest-ocean-current-is-slowing-down-rapidly-scientists-warn-it-could-have-a-scary-effect-on-earth/articleshow/118705369.cms?from=mdr