Melting of West Antarctica's Ice Sheet

For Prelims: Antarctic Treaty, National Centre for Polar and Ocean Research, Indian Antarctic Act of 2022 , Maitri, Bharati, Dakshin Gangotri

For Mains: Processes Driving West Antarctic Ice Sheet Melting, Actions that India has Taken Related to Antarctica, Conservation.

Source: IE

Why in News?

A recent study reveals alarming predictions about the West Antarctic **ice sheet's inevitable melting** due to warming ocean waters.

- The implications of this melting are profound, with the **potential to significantly elevate** global mean sea levels **by 5.3 meters**, adversely affecting millions of individuals residing in vulnerable **coastal cities** worldwide, **including those in India.**

What do Ice Sheets Represent and How Do They Affect Sea Levels?

- **About:**
  - An ice sheet is essentially a mass of glacial ice that covers more than 50,000 square kilometers of land.
    - An ice sheet, such as the **West Antarctic ice sheet**, covers vast land areas, holding a substantial amount of **freshwater.**
    - The two major ice sheets in the world, **Greenland and Antarctica,** collectively possess around **two-thirds of the Earth's freshwater.**
  - When ice sheets gain or lose mass, they respectively **contribute to a fall or rise in global mean sea levels.**

Note

The present Antarctic ice sheet accounts for 90% of Earth's total ice volume.

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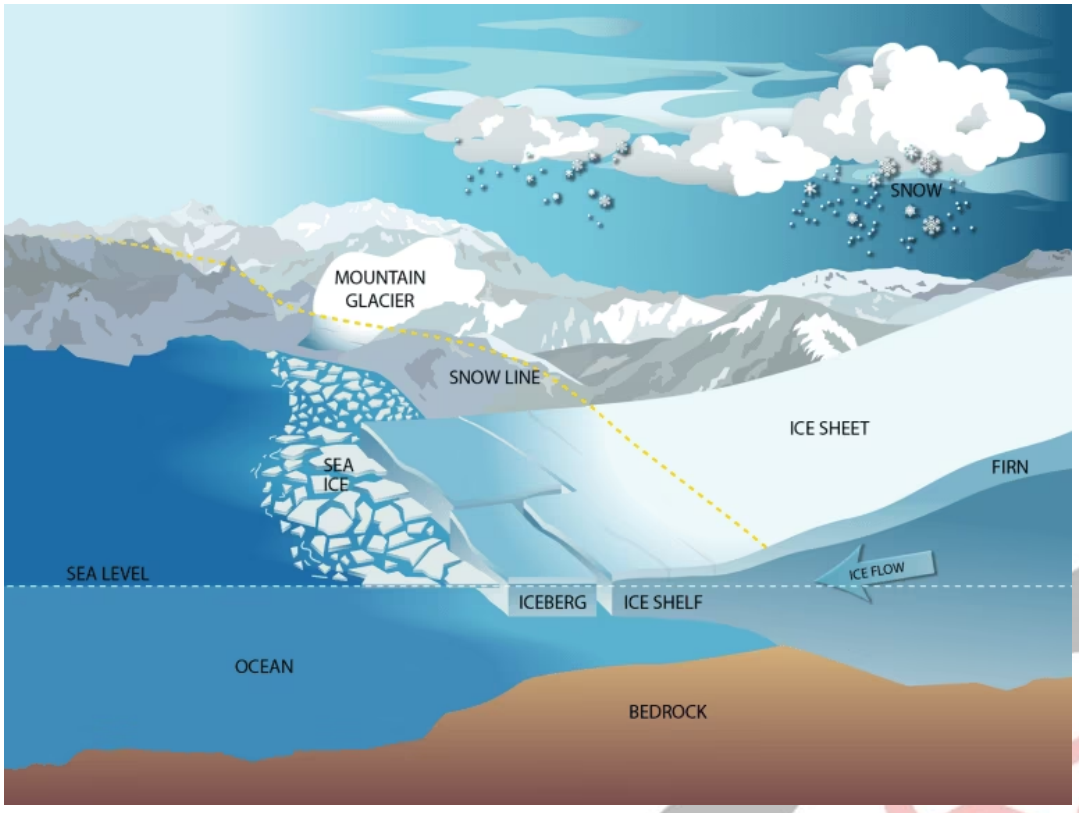

- **Processes Driving West Antarctic Ice Sheet Melting:**
    - Ice shelves stabilize the land-based glaciers just behind them. The melting of ice sheets occurs through various mechanisms. One key process involves **warm ocean waters eroding ice shelves,** which are the edges of an **ice sheet** floating on the ocean.
    - As these ice shelves thin or disintegrate, the glaciers **behind them accelerate,** releasing **more ice into the ocean** and consequently causing sea level rise.

Note

Ice shelves and ice sheets differ from **sea ice**, which constitutes the free-floating ice encircling the polar regions. Sea ice forms when seawater freezes.

- **Current Trends and Findings:**
    - The recent findings are distressing, indicating a significant, **widespread warming of the Amundsen Sea** and escalating ice shelf melting across all scenarios considered.
    - This projected melting will **inevitably lead to increased sea level rise,** profoundly impacting coastal communities worldwide.
- **Implications for India and Vulnerable Coastal Regions:**
    - India, with its extensive coastline and dense population, is particularly susceptible to sea level rise.
    - Coastal communities **might face displacement or become climate refugees** if unable to fortify against rising seas, highlighting the **urgency for adaptive strategies** such as building protective infrastructure.

What Actions has India Taken Related to Antarctica?

- India acceded to the Antarctic Treaty **in 1983,** received the consultative status on the **12th September, 1983.**
- **National Centre for Polar and Ocean Research** (erstwhile National Centre for Antarctic and Ocean Research) is India's premier R&D institution responsible for the country's research activities in the Polar and Southern Ocean realms.
- The **Indian Antarctic Act of 2022** regulates visits and activities in Antarctica, covering mineral protection, native plant conservation, and banning non-native bird introductions.
- Presently, India has **two operational research stations at Antarctica – Maitri and Bharati.**
    - **Dakshin Gangotri** was the first station to be built before **1985** but is **no longer operational.**

Way Forward

- **Environmental Protection and Conservation:** Strict adherence to the **Antarctic Treaty and associated agreements** for preserving the continent's unique environment and ecosystems.
    - This involves regulating human activities, waste management, and minimizing the environmental footprint.
- **Innovative Materials and Infrastructure:** Developing more **efficient materials and infrastructure for research stations** and vessels operating in harsh polar conditions, ensuring **minimal environmental impact.**
- **Geoengineering Techniques:** Researchers are exploring **solar radiation management to potentially slow ice melting.** In a scenario of moderated emissions, solar radiation management could be a **potent weapon against ice sheet degradation.**
    - However, these experimental methods require further investigation for efficacy and

environmental effects before implementation.

UPSC Civil Services Examination, Previous Year Question (PYQ) :

Q. With reference to the water on the planet Earth, consider the following statements:(2021)

1. The amount of water in the rivers and lakes is more than the amount of groundwater.
2. The amount of water in polar ice caps and glaciers is more than the amount of groundwater.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: (b)