

News / Explained / Explained Climate / What the rapid ice melt in West Antarctica means

What the rapid ice melt in West Antarctica means

The rapid melting of ice sheet in West Antarctica is now unavoidable, according to a new study. What is an ice sheet? Why does its melting matter? Is all the hope lost?

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Calving front of an ice shelf in West Antarctica. (Photo: Wikimedia Commons)

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The rapid melting of West Antarctica's ice sheet due to warm waters around it is now unavoidable, no matter how much carbon emissions are cut, according to a new study. If lost completely, the ice sheet would raise the global mean sea level by 5.3 metres or 17.4 feet — a potentially devastating consequence for millions of people living in vulnerable coastal cities across the world, including in India.

Even under a best-case scenario of limiting global warming to 1.5 degree Celsius above pre-industrial levels, water in West Antarctica will continue to get warmer three times faster than in the 20th century, leading to an increased melting of the region's ice sheet, the analysis has found.

The study, 'Unavoidable future increase in West Antarctic ice-shelf melting over the twenty-first century', was published by the journal Nature last week. It was carried

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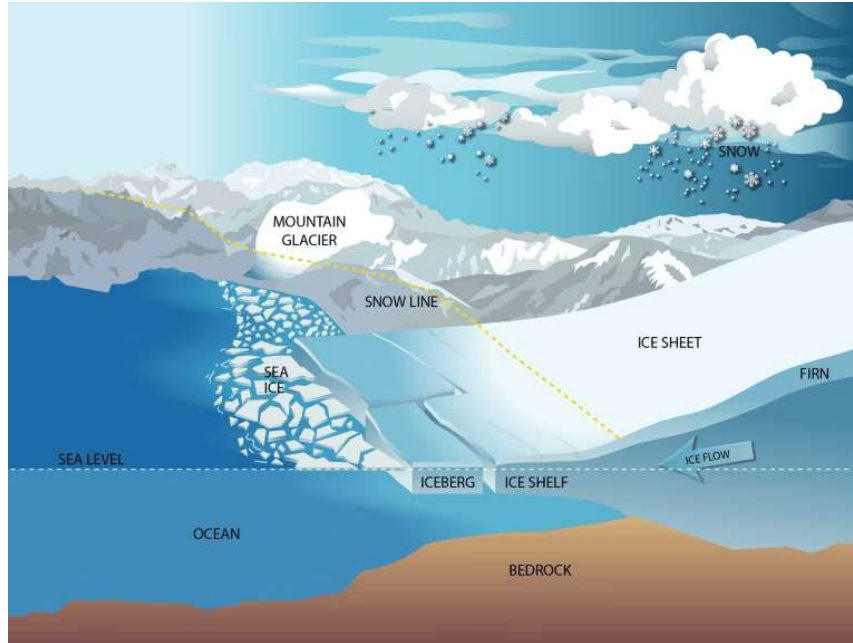
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out by Kaitlin Naughten and Paul R Holland, both of whom work at the British Antarctic Survey, and Jan De Rydt of the Northumbria University (UK).

But first, what is an ice sheet?

An ice sheet is essentially a mass of glacial ice that covers more than 50,000 square kilometres of land — roughly large enough to blanket Uttarakhand in ice. There are two major ice sheets in the world today: Greenland ice sheet and Antarctica ice sheet. Together, they contain about two-thirds of all the freshwater on Earth



An illustration of most of Earth's ice features, including the ice sheet. Credit: NASA

“This means that over time, when ice sheets gain mass, they contribute to a fall in global mean sea level, and when they lose mass, they contribute to a rise in global mean sea level,” according to a report by the National Aeronautics and Space Administration (NASA).

How is the West Antarctic ice sheet melting?

There are various processes through which ice sheets melt. One of them is when warm ocean waters melt ice shelves — the edges of an ice sheet which floats on the ocean.

Speaking to *The Indian Express*, Naughten, one of the authors of the new study, explains: “Ice shelves stabilise the land-based glaciers just behind them. If an ice shelf thins or disappears, these glaciers tend to speed up, discharging more ice into the ocean and causing sea level rise.” Note that both ice shelves and ice sheets are different from sea ice, which is the free-floating ice that surrounds the polar regions. Sea ice is created by sea water freezing.

The same process is taking place in West Antarctica, particularly the Amundsen Sea, which is the focus of Naughten's study. For decades, the region's ice shelves have been depleting, glaciers have been flowing faster towards the ocean and the ice sheet has been shrinking.

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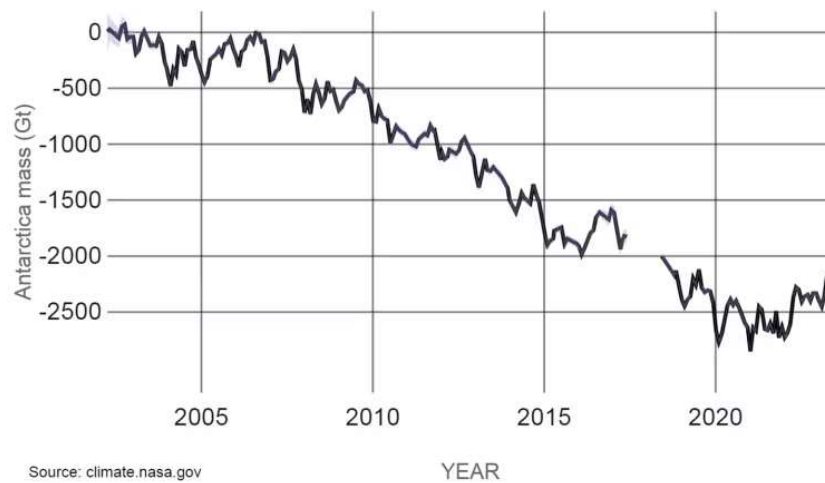
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Antarctica ice mass variation since 2002. Credit: NASA

What are the findings of the study?

To conduct the analysis, the scientists have used a high-resolution computer model of the Amundsen Sea to provide the most comprehensive assessment of warming in West Antarctica to date. They have used the model to run many different simulations of the 21st century, totalling over 4,000 years of ocean warming and ice-shelf melting in the Amundsen Sea.

“We considered different trajectories for fossil fuel burning, from the best-case scenario where global warming is limited to 1.5°C in line with the Paris Agreement, to the worst, in which coal, oil and gas use is uncontrolled. We also considered the influence of natural variations in the climate, such as the timing of events such as El Niño,” the researchers write in an article published in *The Conversation*.

The findings are grim. All scenarios show significant and widespread future warming of the Amundsen Sea and increased ice shelves melting. Moreover, there is little to no difference between the scenarios up to 2045.

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“Ocean warming and ice-shelf melting in the 1.5°C scenario is statistically the same as in a mid-range scenario, which is closer to what existing pledges to reduce fossil fuel use over the coming decades would produce,” the researchers add in their article.

This will most likely lead to an increased sea level rise, which will affect coastal communities across the world, including in India.

“India has a long coastline and a dense population and is therefore vulnerable to sea level rise. If coastal communities cannot afford to defend against the rising seas, for example by building walls, the people would have to move elsewhere or become refugees,” Naughten tells *The Indian Express*.

So, is all hope lost?

Although the findings are bleak, they shouldn't discourage the efforts to mitigate the impacts of climate change, the study highlights. According to the researchers,


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the melting West Antarctic ice sheet is just one contributor to sea level rise, which is just one impact of climate change.

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“We have reached the point where some impacts of climate change can no longer be avoided, and substantial ice loss in West Antarctica is probably one of them. But, climate change is not all or nothing, and there are many other impacts which we can still avoid or limit: like the loss of the East Antarctic Ice Sheet, or the severity of heatwaves, droughts, and extreme rainfall,” Naughten says.

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