

5 What caused the record amounts of ice loss?

6 How is ice normally built up on ice sheets?

10 Why might the Greenland ice sheet not be 'doomed'?

1 Why is the Greenland Ice Sheet significant in terms of sea level rise?

2 How much faster is are higher latitudes warming compared to equatorial regions?

3 How does the 2019 loss compare to previous years?

4 How much would sea levels rise by if the Greenland ice sheet melted? Why is this significant?

RECORD ICE LOSS IN GREENLAND

The ice sheet lost a record 1m tonnes of ice per minute in 2019

The Greenland ice sheet lost a record amount of ice in 2019, equivalent to a million tonnes per minute across the year, satellite data shows.

The climate crisis is heating the Arctic at double the rate in lower latitudes, and the ice cap is the biggest single contributor to sea level rise, which already imperils coasts around the world. The ice sheet shrank by 532bn tonnes last year as its surface melted and glaciers fell into the ocean and would have filled seven Olympic-sized swimming pools per second.

The satellite data has been collected since 2003. The 2019 loss was double the annual average since then of 255bn tonnes. Almost that amount was lost in July 2019 alone.

Scientists knew that ice loss from Greenland had been accelerating fast in recent decades and that there had been high rates of melting in 2019. But the satellite data accounts for new snowfall and allows the net loss to be calculated. The researchers said the scale of the 2019 loss was shocking and was likely to be the biggest in centuries or even millennia.

If the entire Greenland ice sheet melts, sea level would rise by six metres. But the researchers said it was not certain that the sheet had passed the point of no return and that cutting carbon emissions will slow the melting, which would take centuries to

complete.

The scientists attributed the extreme ice loss in 2019 to "blocking patterns" of weather that kept warm air over Greenland for longer periods. These are becoming increasingly frequent as the world heats up. Almost 96% of the ice sheet underwent melting at some point in 2019, compared with an average of 64% between 1981 and 2010.

Snowfall in Greenland was low in 2019, also due to the blocking pattern, meaning relatively little new ice was added. "The real message is that the ice sheet is strongly out of balance," Sasgen said.

Weather data and computer models allow for losses to be calculated back to 1948. "If we look at the record melt years, the top five occurred in the last 10 years, and that is a concern. But we know what to do about it: reduce CO2 emissions."

Sasgen said a further worry was feedback mechanisms that increase ice loss, including meltwater weakening the ice sheet and speeding its fall into the ocean. Hotter weather also melts the white snow on top of the sheet, revealing darker ice below, which absorbs more of the sun's heat.

"Since meltwater is freshwater, it dilutes the salt content of the surrounding ocean, which contributes to slowing the Gulf stream system," Rahmstorf said. "If we wanted to

make the 500bn tonnes of freshwater added in 2019 as salty as ocean water, about 200,000 Panamax-class cargo ships full of salt would need to dump their load into the Atlantic."

Despite the rapid melting, the Greenland ice sheet is not necessarily doomed to melt entirely. Firstly, as glaciers retreat they lose contact with warmer ocean waters and therefore melt less. Secondly, the melting of the sheet with warm air takes centuries, during which time the rise in global temperatures might be reversed.

"If we reduce CO2, we will reduce Arctic warming and we will therefore also reduce the sea level rise contribution from the Greenland ice sheet," Sasgen said. "So even though it might eventually disappear in large part, it happens much slower, which would be better as it would allow more time for the 600 million people living near coasts to move away."

11 What is the main (or indeed, only) way we can slow or stop ice melt?

12 List any terms here that you are unfamiliar with:

9 How does ice melt affect ocean currents? Why is this important in the context of climate change?

7 How many record melt years have there been this decade?

8 What might trigger a negative feedback loop?