Rain falls on peak of Greenland ice cap for first time on record

Temperatures on summit are normally well below freezing with rain a stark sign of climate crisis

Icebergs near Ilulissat, Greenland. The climate crisis is having a profound impact on glaciers. Photograph: Ulrik Pedersen/NurPhoto/Rex/Shutterstock

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Rain has fallen on the summit of Greenland's huge ice cap for the first time on record. Temperatures are normally well below freezing on the huge 3216-metre (10,551 ft) peak, making the precipitation a stark sign of the climate crisis.

Scientists at the US National Science Foundation's summit station saw rain falling throughout 14 August but had no gauges to measure the fall because the precipitation was so unexpected. Across Greenland, an estimated 7bn tonnes of water was released from the clouds.

The rain fell during an exceptionally hot three days in Greenland when temperatures were 18C higher than average in places. As a result, melting was seen in most of Greenland, across an area about four times the size of the UK.

The recent report from the Intergovernmental Panel on Climate Change concluded it was "unequivocal" that carbon emissions from human activities were heating the planet and causing impacts such as melting ice and rising sea level.

In May, researchers reported that a significant part of the Greenland ice sheet was nearing a tipping point, after which accelerated melting would become inevitable even if global heating was halted.

Ted Scambos, a scientist at the National Snow and Ice Data Center at the University of Colorado, which reported the summit rain, told CNN: "What is going on is not simply a warm decade or two in a wandering climate pattern. This is unprecedented. We are crossing thresholds not seen in millennia, and frankly this is not going to change until we adjust what we're doing to the air."

Greenland also had a large-scale melting episode in July, making 2021 one of just four years in the past century to experience such widespread melting. The other years were recent: 2019, 2012 and 1995. The rain and melt on 14-16 August came during the latest in the year a major event has been recorded.

The cause of the July and August melting was the same – warm air being pushed up over Greenland and held there. These "blocking" events are not uncommon but seem to be becoming more severe, according to scientists.

Global sea level would rise by about 6 metres if all of Greenland's ice melted, although this would take centuries or millennia to occur. But the trillions of tonnes lost from Greenland since 1994 is pushing up sea levels and endangering the world's many coastal cities.

Sea level has already risen by 20cm, and the IPCC said the likely range by the end of the century was a further 28-100cm, though it could be 200cm.

Greenland's ice is melting faster than any time in the past 12,000 years, scientists have estimated, with the ice loss running at a rate of about 1m tonnes a minute in 2019.

Greenland ice sheet on brink of major tipping point, says study

This article is more than 3 months old

Scientists say ice equivalent to 1-2 metres of sea level rise is probably already doomed to melt

If the Greenland ice sheet were to melt completely, sea levels would eventually rise by about 7 metres. Photograph: Jason Briner/University at Buffalo/PA

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A significant part of the Greenland ice sheet is on the brink of a tipping point, after which accelerated melting would become inevitable even if global heating was halted, according to new research.

Rising temperatures caused by the climate crisis have already seen trillions of tonnes of Greenland's ice pour into the ocean. Melting its ice sheet completely would eventually raise global sea level by 7 metres.

The new analysis detected the warning signals of a tipping point in a 140-year record of ice-sheet height and melting rates in the Jakobshavn basin, one of the five biggest basins in Greenland and the fastest-melting. The prime suspect for a surge in melting is a vicious circle in which melting reduces the height of the ice sheet, exposing it to the warmer air found at lower altitudes, which causes further melting.

The study shows destabilisation of this ice sheet is under way. Uncertainties in the research meant it might already be at the point of no return, or be about to cross it in the coming decades, the scientists said. However, even if the tipping point was crossed, it did not mean that the entire ice sheet was doomed, they said, because there might be a stable state for a smaller ice sheet.

“We’re at the brink, and every year with CO2 emissions continuing as usual exponentially increases the probability of crossing the tipping point,” said Niklas Boers at the Potsdam Institute for Climate Impact Research, Germany, who conducted the research with Martin Rypdal from the Arctic University of Norway. “It might have passed [the tipping point], but it’s not clear. However, our results suggest there will be substantially enhanced melting in the near future, which is worrying.”

Boers said ice equivalent to 1-2 metres of sea level rise was probably already doomed to melt, though this would take centuries and melting the whole ice sheet would take a millennium. “We would probably have to drive temperatures back below pre-industrial levels to get back to the original height of the Greenland ice sheet,” he said.

“The current and near-future ice loss will be largely irreversible,” he said. “That’s why it is high time we rapidly and substantially reduce emissions from burning fossil fuels and restabilise the ice sheet and our climate.”

The new research examined just one part of Greenland, but Boers said there was no reason in principle that it should be different from other parts of the giant ice sheet: “We might be seeing something that is happening in many parts of Greenland, but we just don’t know for sure, because we don’t have the high-quality data for other parts.”

Greenland's ice melting faster than at any time in past 12,000 years

Media reports in August 2020 suggested the Greenland ice sheet had already passed the point of no return, but scientists said this was a misinterpretation of research. In 2019, scientists warned that the world might already have crossed a series of climate tipping points.

The new study, published in the Proceedings of the National Academy of Sciences of the United States of America, used temperature records, ice cores, and modelling to reconstruct the ice sheet's elevation and melting rates since 1880. Careful examination of the size and duration of changes during this time series revealed the warning signals of an imminent tipping point, by showing that the ice sheet's ability to recover from melting is diminishing fast.

The feedback loop caused by falling ice-sheet height appears to be the largest factor, but other feedbacks may play a role in destabilising it. These include the thinning of coastal glaciers, allowing more ice to slip into the sea, and reduced falls of fresh white snow exposing the darker surface of the ice sheet, which then absorbs more heat from the sun. But warmer temperatures may also result in damper air and more snowfall, counteracting some ice losses.

Boers said the dynamics of the Greenland ice sheet were very complex, and that using today's incomplete knowledge to estimate a precise date when a tipping point is passed would give a false sense of certainty.

The scientists said better monitoring of the Greenland ice sheet is needed. "We urgently need to better understand the interplay of the different positive and negative feedback mechanisms that determine the current stability and the future evolution of the ice sheet," said Boers.

Large-scale melting of the Greenland ice sheet would have long-term global consequences, beyond rising sea levels. It could halt the Gulf Stream ocean current, with potential knock-on effects on the Amazon rainforest and tropical monsoons.

"It's great that we have satellites to track the pulse of our planet and models to perform a health check, but the diagnosis is shockingly clear: our climate is sick and needs urgent care," said Prof Andrew Shepherd, at the University of Leeds, UK, who was not involved in the new study.

"Although we see the effects of climate heating around the planet, often the changes of greatest concern are those that will alter landscapes forever," he said. "If Greenland has shifted into a new unstable state of heightened melting, then that's big news."

But uncertainties remained, Shepherd said, with some evidence that the heightened melting may have stabilised, which would be at odds with the idea that the ice sheet has entered an unstable state.

Rain fell at the normally snowy summit of Greenland for the first time on record

By Rachel Ramirez, CNN

Updated 1927 GMT (0327 HKT) August 19, 2021

An example of meltwater flowing across the Greenland ice sheet in 2007. As the ice melts, the meltwater pools into rivers of runoff that flow toward lower elevations and into the ocean, resulting in the ice sheet losing mass.

(CNN) For the first time on record, precipitation on Saturday at the summit of Greenland — roughly two miles above sea level — fell as rain and not snow.

Temperatures at the Greenland summit over the weekend rose above freezing for the third time in less than a decade. The warm air fueled an extreme rain event that dumped 7 billion tons of water on the ice sheet, enough to fill the Reflecting Pool at the National Mall in Washington, DC, nearly 250,000 times.

It was the heaviest rainfall on the ice sheet since record keeping began in 1950, according to the National Snow and Ice Data Center, and the amount of ice mass lost on Sunday was seven times higher than the daily average for this time of year.

Ted Scambos, a senior research scientist at the National Snow and Ice Data Center at the University of Colorado, said this is evidence Greenland is warming rapidly.

"What is going on is not simply a warm decade or two in a wandering climate pattern," Scambos told CNN. "This is unprecedented."

Interactive: Antarctica is changing. The impact could be catastrophic

The National Science Foundation's Summit Station is located at the highest point on the Greenland ice sheet, where scientists can observe Arctic weather and changes in the ice. The station has been staffed year-round to observe extreme changes since 1989. The majority of the weekend's rain fell from the southeast coast of Greenland up to the Summit Station.

Jennifer Mercer, program officer for the Office of Polar Programs at the National Science Foundation, said because of the significant rain event, operations at the Summit Station would need to change: "It means that

we need to consider weather events that we have not had to deal with before in the history of our operations there," she told CNN.
"Increasing weather events including melting, high winds, and now rain, over the last 10 years have occurred outside the range of what is considered normal," Mercer said. "And these seem to be occurring more and more."

A Greenland researcher holds a thin piece of ice that formed when rain fell on top of the snow at the Greenland summit on Saturday.

As human-caused climate change warms the planet, ice loss has rapidly increased. A major UN climate report released this month concluded that the burning of fossil fuels led to Greenland melting over the past two decades. A recent study published in the journal Cryosphere found Earth has lost a staggering 28 trillion tonnes of ice since the mid-1990s, a large portion of which was from the Arctic, including the Greenland ice sheet.
In July, the Greenland ice sheet experienced one of the most significant melting events in the past decade, losing more than 8.5 billion tons of

surface mass in a single day, which was enough to submerge Florida in two inches of water. It was the third instance of extreme melting in the past decade, during which time the melting has stretched farther inland than the entire satellite era, which began in the 1970s.

In 2019, Greenland shed roughly 532 billion tons of ice into the sea. During that year, an unexpectedly hot spring and a July heat wave caused almost the entire ice sheet's surface to begin melting. Global sea level rose permanently by 1.5 millimeters as a result.

A crucial ocean circulation is showing signs of instability. Its shutdown would have serious impacts on our weather.

"We are crossing thresholds not seen in millennia, and frankly this is not going to change until we adjust what we're doing to the air," said Scambos.

Other unusual events have become more frequent, too, Mercer said. Two years ago, a polar bear made it to the Summit Station, which was unusual since polar bears live in coastal regions where they can easily find food. The bear had trekked several hundred miles inland across the ice sheet. In the last five years, Mercer said three polar bears have been sighted high on Greenland's ice sheet.

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According to Mercer, the rain will have a lasting effect on the properties of the snow, leaving a crust of ice behind that will absorb more energy from the sun, until it gets buried by snow. Scambos said this crusty layer will also be a barrier that prevents the downward draining of melt water, which will then flood the surface of the ice sheet and initiate run off at higher elevations.

Because of the layer of ice it created, the weekend's rainfall event "will be visible in ice core records in the future," Mercer said.