# Manmade Antarctic snowstorm 'could save coastal cities from rising seas'

**Blowing trillions of tonnes of snow on to ice sheet could halt its collapse, researchers say**

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The huge geoengineering project would need energy from at least 12,000 wind turbines to power water pumps and snow cannons. Photograph: Christian Vorhofer/Alamy

Spraying trillions of tons of snow over west Antarctica could halt the ice sheet's collapse and save coastal cities across the world from sea level rise, according to a new study.

The colossal geoengineering project would need energy from at least 12,000 wind turbines to power giant seawater pumps and snow cannons, and would destroy a unique natural reserve. The scientists are not advocating for such a project, but said its apparent "absurdity" reflects the extraordinary scale of threat from rising sea level.

Ending the burning of fossil fuels remains the key to tackling the climate crisis and sea level rise, the researchers said. But the carbon emissions pumped into the atmosphere so far may already have doomed the west Antarctic ice sheet.

A series of earlier studies concluded the accelerating loss of ice from the region could not be stopped by emissions cuts any more, meaning the oceans will rise by three metres in the coming centuries. This would leave major cities across the world, from New York to Kolkata to Shanghai, below sea level.

“As scientists we feel it is our duty to inform society about every potential option to counter the problems ahead,” said Prof Anders Levermann, at the Potsdam Institute for Climate Impact Research in Germany, who led the research. “As unbelievable as [the proposal] might seem, in order to prevent an unprecedented risk, humankind might have to make an unprecedented effort.”

“The effort needed would be huge, like an Antarctic moon landing,” he said, though the cost would be less than abandoning even one city like New York. “It is up to society to make this choice – it can’t shy away from making decisions.”

Scientists are not yet certain that the collapse of the west Antarctic ice sheet is inevitable, but Levermann said this had to be the working hypothesis. When the Earth has been 2C warmer in the past, sea level was much higher than today, he said.

“Even if we keep the Paris agreement [target of 2C above pre-industrial levels], we will get five metres of sea level rise,” he said. “I think people haven’t really entertained the real consequences of this. Either you abandon these coastal cities or millions of people live by a wall behind which is the world’s oceans, above your head, like the sword of Damocles.”

The loss of ice from west Antarctica is driven by warmer ocean water melting the underside of the ice sheet at the coast. Pumping snow on to the sheet would replace the lost ice, making it thicker again. This pushes the sheet back down on to the ground and stabilises it.

The research, published in the journal Science Advances, used computer models to calculate how much water would need to be pumped from the ocean on to the top of the ice sheet and then sprayed as snow to achieve this stabilisation.

The result was 7.4tn tons, or about 7 cubic km of seawater, over 10 years – though the scientists said the work was a proof of concept rather than a precise estimation. The area covered would be two-thirds the size of Scotland. Pumping the water alone would need 12,000 powerful wind turbines, but extra power would be needed for heating to stop the water freezing in the pipes and to desalinate it if required.

The research did not estimate the cost of the idea, as there are too many uncertainties. But Levermann said the largest pump in the world, in New Orleans, cost about $600m ($481m), and the Antarctic project would need about 90. However, he said less money would be needed to build expensive coastal defences if sea level rise was reduced.

Prof David Vaughan, director of science at the British Antarctic Survey (BAS) and not part of the research, said: “Scientists have an important role in testing, and challenging ‘climate fixes’. I think [Levermann and colleagues] tread the tightrope well, examining and challenging this idea without becoming advocates. Indeed, they are careful to point out the severe side effects.”

Robert Larter, also at BAS, said: “I think it is unlikely that cutting carbon emissions to zero will save the west Antarctic ice sheet, as even on that pathway warming is forecast to continue for some time. So, such a geoengineering scheme, even if it was practicable, would be just a very costly way of buying time.”

Geoengineering to stop ice loss in west Antarctica has been considered before. In 2018, scientists explored ideas including building a 300-metre-high artificial island to stop the ice sliding into the sea and constructing a 100-metre-high wall to keep warm water out.

The new study did not include future global heating of the ocean and atmosphere, and the scientists said bolstering the ice sheet with artificial snow would be in vain unless rising temperatures were checked. They concluded: “The ambitious reduction of greenhouse gas emissions is and will be the main lever to mitigate the impacts of sea level rise.”