

# Pumped up: will a Dutch startup's plan to restore Arctic sea-ice work?

As the Arctic warms, devastating the climate and ecosystems, an old idea used to create skating rinks could be deployed to restore melting ice caps, despite scepticism from some experts

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A polar bear on the sea ice in Naujaat, or Repulse Bay, Nunavut, Canada. Arctic ice is shrinking at a rate of almost 13% a decade, and climate scientists are warning that ice-free summers in the Arctic are inevitable by 2050. Photograph: Paul Souders/Getty Images

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very winter when the temperatures drop, the *IJsmeester* (ice master) in villages around the Netherlands carefully starts to flood a field with water to form enough thin layers of ice to create a perfect outdoor skating rink.

Now a Dutch startup wants to use the same technique to help solve a major ecological problem: melting Arctic ice and its devastating effect on the climate.

“In cold weather, the IJsmeesters start a frantic race to be the first village that can organise an ice-skating marathon,” says Fonger Ypma, chief executive of Arctic Reflections. “They flood a meadow with a thin layer that becomes ice, and every night they apply more thin layers on top of it. And then, once it’s thick enough, they start skating. It’s our cultural heritage.”

*The ice is about a metre thick. By refreezing the top layer, where there is snow, we will add 10-20cm*

Andrea Ceccolini

Arctic ice is shrinking by almost 13% a decade, according to WWF, prompting warnings from climate scientists that ice-free summers in the Arctic are inevitable by 2050. This, coupled with the very visible evidence of polar bears’ habitat melting, and the threat to the Indigenous people who rely on the Arctic ecosystems for survival, gave Ypma a wild thought.

“The Arctic acts as a sort of mirror or heat shield for the Earth and a substantial part of global warming comes from the Earth’s surface becoming darker,” he says.

“And so I thought: isn’t there some way to maintain that ice sheet for a bit longer until CO2 levels come down and the ice becomes regenerative? I had this naive idea: why not pump water on top of it?”



Real Ice's experiment in flooding part of Iqaluktuuttiaq in the Canadian Arctic. Photograph: Arctic Reflections

Ypma was not the only person to be considering this, he realised, after checking with experts. "I took the fact that it had been researched already as a positive sign, because then you're not the only crazy person!" he says.

Arctic reflections is just one company looking to use a technique that is already being employed in several places for other purposes, such as creating ice roads in Canada and Finland and for oil exploration in the Arctic (typically using diesel pumps). In 2016, the physicist Steven Desch and colleagues from Arizona State University proposed building 10m wind-powered pumps over the Arctic ice cap to bring water to the surface in winter, potentially adding a metre of ice.

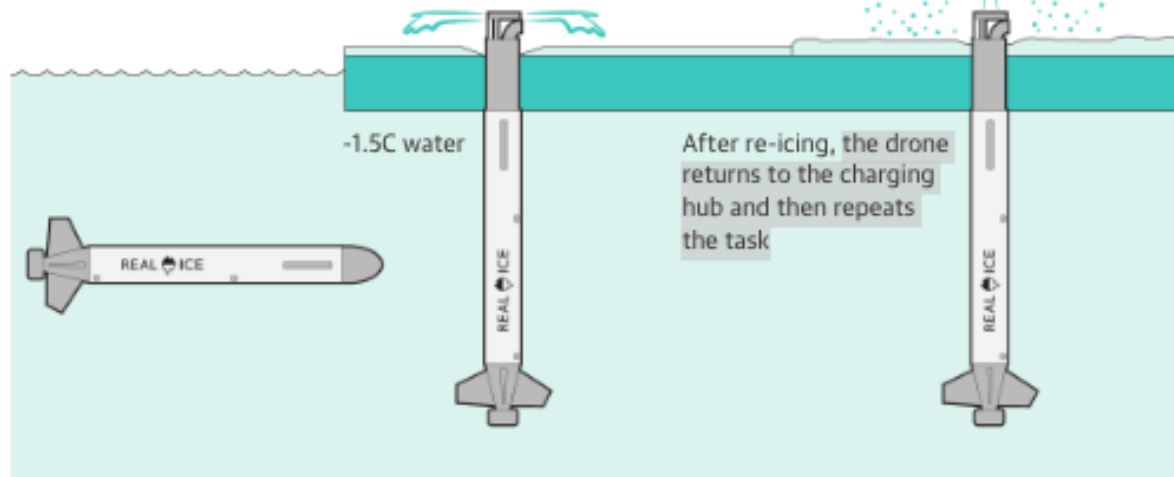
Ypma recently joined a separate Bangor University spinoff, Real Ice, which has a similar idea, for a series of field tests in Iqaluktuuttiaq (the Inuit name for Cambridge Bay), Nunavut, Canada, with a 600-watt, hydrogen fuel-cell-powered water pump. This not-for-profit company has drilled through the ice, pumped up seawater and let temperatures approaching  $-50\text{C}$  ( $-58\text{F}$ ) refreeze it at the surface.

## How the drone could restore sea ice

1 An underwater drone sails under ice floes in Arctic waters

2 Drone detects thin ice above and rotates to punch a hole through the ice. Water is pumped to the surface

3 When the water hits the cold air it spreads over the ice sheet and freezes to create an extra thick layer of ice.



Guardian graphic. Source: Arctic Sea Ice Restoration

“At the moment the ice is about a metre thick,” says Real Ice’s co-chief executive, Andrea Ceccolini. “By refreezing the top layer, where there is snow, we will add 10-20cm. After that, the ice will grow thicker because we are removing the snow insulation, which is constraining further growth.”

Ceccolini hopes to develop an underwater drone that could navigate the -1.5C water, detect the thickness of the ice, pump up water as necessary, refuel and move on to the next spot. “If we demonstrate [this over] 100 sq km a day with 50 drones, then we can show that this can actually scale [up] to a much larger area,” says Ceccolini.

*The only real solution is to either pull carbon out of the air or cut our emissions in half*  
Prof Julienne Stroeve

The goal is also local, to restore sea ice at a site whose Inuit name means a place of good fishing. “A large part of our success will be determined by how well we engage with the local community,” says the co-chief executive, Cian Sherwin, who envisages giving the technology to Indigenous landowners with some form of philanthropic part-funding.

“Local people have started to notice differences when it comes to wildlife patterns, migration routes, and we hear locals have to travel almost 300km to hunt their ‘country food’: caribou, elk, moose,” he says.

“We’ve also heard accounts of how elders, the resident experts, now can’t actually predict when the ice will be safe, which is shocking to members of the community.”



One of the Arctic Reflections team measures a layer of new ice laid on top of older, darker ice in Iqaluktuuttiaq, or Cambridge Bay. Photograph: Arctic Reflections

For Arctic Reflections, however, the key aim is to boost the “albedo” – the whiteness of the ice – and its ability to reflect the sun’s rays back to the atmosphere. The Dutch startup’s other idea is to explore whether Arctic currents could spread ice thickened at strategic locations. So instead of needing as many pumps, they could potentially save 100,000 sq km of ice from melting in the summer with just 100 to 1,000 installations.

Another Dutch project, the Sand Motor, illustrates this perfectly, says Ypma. Known as “beach nourishment”, it uses sea currents to spread sand naturally to bolster the Netherlands’ coastal defences.

“I live in Delft and I go with my kids and my wife quite often to the *Zandmotor* project: it’s a really good analogy,” he says. “If you’re



positioning your ice-making sites in the right locations, then you can really leverage those flows.”

But there are still unanswered questions, such as how ice thinner than three metres will react to flooding and whether thicker ice will last, says Hayo Hendrikse, assistant professor at Delft University of Technology, who has worked on lab and real-life trials with Arctic Reflections.

*We have to resort to these kinds of crazy measures to buy time*  
Maurits Groen

“We know we can just pump water on top of ice, flood it and then it will freeze,” he says. “But can we also do it with a positive gain in the end?”

“I see a potential for this on a smaller scale, for example, if you want to strengthen natural habitats for polar bears and seals, where the sea ice in summer could survive a bit longer if we target specific fjords or bays.

But Hendrikse adds: “It’s not a solution – it’s a sticking plaster.”

Julienne Stroeve, professor of polar observation and modelling at University College London, says it would probably be impossible to act on a large-enough scale to have a real impact on the climate.



An *Ijsmeester* on the rink of the Winterswijk Ice Club in the eastern Netherlands. Layering ice for skating is a cherished Dutch tradition. Photograph: ANP/Alamy

“I agree that the sea ice is worth protecting, since it helps to keep our planet cool, but the entire Arctic Ocean is about 14m sq km,” she says. “The only real solution is to either pull carbon out of the air or cut our emissions to half of what they currently are.”



### Greenland losing 30m tonnes of ice an hour, study reveals

Maurits Groen, a jury member of the Dutch Wubbo Ockels innovation prize, which recently gave an award to Arctic Reflections, agrees that tackling the causes of the climate crisis is preferable.

“But the speed at which things are going wrong is such that we have to resort to these kinds of crazy measures to at least buy some time,” he says.

“It’s a proven technology and cost-effective compared with alternatives – we have to start somewhere.”