

Scientists explore drastic solution to sea-level rise

Camille von Kaenel, Environment & Energy Publishing, 3-10-16

Scientists have a new idea to slow the effects of climate change: pumping water far onto inland Antarctica to freeze for millennia.

The proposal, outlined in a new paper published in the journal *Earth System Dynamics* today, could help fight rising sea levels.

It is undoubtedly drastic. The pumps would require at least 7 percent of the global energy supply. Researchers did not even attempt to estimate costs because the scope of the project was so "unprecedented." And even in a best-case scenario with no extra global warming, it would only delay the rise in sea levels threatening coastal communities.

Instead, the modeling exercise showed to what point sea-level rise is unavoidable, researchers said.

"It's an illustration of what kind of sea-level rise we have already caused that we can no longer avoid, and what it actually means if we really want to avoid it," said Katja Frieler of the Potsdam Institute for Climate Impact Research, the lead author of the paper. "It would really be an enormous effort."

Scientists have proposed using technology to counter some of the effects of climate change before. Tiny particles spread into the stratosphere could reflect the sun's rays back into space, for example. The geoengineering fixes are controversial for being costly or for relieving policymakers from the immediate burden of cutting fossil fuel consumption.

No one has studied the possibility of pumping water directly out of the oceans onto land before.

Ideal conditions for a water dump?

The Intergovernmental Panel on Climate Change estimates that global sea levels will rise by between 11 and 38 inches by 2100, flooding many low-lying island nations. Most scientists think sea levels could rise even higher if countries do not significantly reduce their carbon emissions. Recent studies in the *Proceedings of the National Academy of Sciences* found that sea levels could rise more than 4 feet by the end of the century (*ClimateWire*, Feb. 23).

Frieler, who studies the impacts of climate change, first thought of the potential fix with her colleague Anders Levermann, a sea-level rise expert who is the head of global adaptation strategies at the Potsdam Institute.

Because of the human-caused carbon emissions already in the atmosphere will likely warm the planet for centuries to come, some sea-level rise is unavoidable, according to scientists. The current rate of sea-level rise is around 3 millimeters per year. That left the researchers with around 40 centimeters, or 15.7 inches, of unavoidable sea-level rise by the end of the century to store somewhere else.

Antarctica emerged as a possible dumping ground because it is uninhabited and will likely remain cold under climate change. The researchers ran several scenarios through ice sheet simulations developed at the institute.

Levermann, Frieler and a third author, Matthias Mengel, an ice sheet researcher at the Potsdam Institute, ran simulations on several scenarios.

Because of the natural movement of ice sheets, the durability of the transfer would depend on its location. Almost 15 percent of the added ice would already return to the ocean after 100 years if placed within 200 kilometers (124 miles) from the coastline. Ensuring that at least 80 percent of the ice would stay put after a millennium would require placing it at least 700 kilometers (435 miles) from the coastline.

Critics: First reduce GHGs

The continent rises up to 4,000 meters high, so the endeavor would require massive amounts of energy. The pumps would require around 1,275 gigawatts of constant power -- equivalent to around 7 percent of the global energy supply in 2012, according to the International Energy Agency.

Around 850,000 wind farms on the continent, each producing 1.5 MW, could provide that power, according to the study.

Such an operation could also have significant impacts on coastal environments. The scientists acknowledged that it was far-fetched but said they wanted to see how the math played out.

"Even if this was feasible, it would only buy time -- when we stop the pumping one day, additional discharge from Antarctica will increase the rate of sea-level rise even beyond the warming-induced rate," said Levermann in a statement. "This would mean putting another sea-level debt onto future generations."

The limitations of the proposed fix highlight the need to reduce emissions first, said Michael MacCracken, chief scientist for climate change programs at the Climate Institute.

"Proposals such as suggested in this paper can only potentially play a helpful, albeit likely expensive, role if greenhouse gas emissions are sharply reduced and use of fossil fuels (i.e., coal, oil, and natural gas) is essentially phased out over the coming few decades," MacCracken wrote in an email.

Putting the brakes on the slide of glaciers

Glaciologist Slawek Tulaczyk of the University of California, Santa Cruz, has seen a growing interest in geoengineering solutions, which he calls climate interventions, in recent years. He praised the authors of the paper for testing out an idea.

He offered a few ideas of his own to put the brakes on sea-level rise. He has given talks and is working on publishing a paper on the topic.

The glaciers he studies in West Antarctica have sparked concerns over runaway melting, as warm water eats away at the ice from underneath. But one glacier, the Kamb Ice Stream, has stopped flowing toward the sea.

"Now that we know that can happen, we can try to reproduce that in some fashion," he said. "There are pressure points where relatively limited action could result in a larger impact."

The water the glacier slides on toward the ocean could be pumped out, for example. Or liquid nitrogen could freeze that meltwater in place.

"This is not to be taken lightly, as we're talking about efforts comparable in expense and scope to [the] largest earth-moving and building efforts that humanity has ever done, and I can't claim that I even know that they should be done," he said. "But we should consider them. ... Time is getting short."