IEAGHG Information Paper: 2017-IP7; What happens after all the ice goes?

A new paper in Nature takes an interesting meander around the issue of melting artic ice and what could be done to bring the sea ice back. The article is: Nature 542, 152–154 (09 February 2017) doi:10.1038/542152a and can be found at: http://www.nature.com/news/arctic-2-0-what-happens-after-all-the-ice-goes-1.21431?WT.ec_id=NEWS-20170209&spMailingID=53386858&spUserID=MTc2NjU3OTUxNwS2&spJobID=1101563319&spReportId=MTEwMTU2MzMxOQS2

The article suggests that as early as 2030 the Arctic Ocean could lose essentially all of its ice during the warmest months of the year. A radical transformation that would upend Arctic ecosystems and disrupt many northern communities.

The published research looks beyond the Arctic sea ices current decline and starts thinking about what it would take to restore sea ice.

In theory, there's still a chance that the world could prevent the total loss of summer sea ice. Global climate models suggest that about 3 million square kilometres — roughly half of the minimum summer coverage in recent decades — could survive if countries fulfil their commitments to the newly ratified Paris climate agreement, which limits global warming to 2 °C above pre-industrial temperatures.

But, it seems that sea-ice researchers feel that the models have consistently underestimated ice losses in the past, causing them to worry that the declines in the next few decades will outpace projections. If we do as many suspect and overshoot the 2°C target, this will, they say, guarantee essentially ice-free summers (winter ice is projected to persist for much longer) in the Artic.

In the best-case scenario, the Arctic is in for a 4–5 °C average temperature rise according to US National Oceanic and Atmospheric Administration. The consequences of such warming include:

- The Arctic's 4 million residents — including 400,000 indigenous people — will feel the most direct effects of ice loss.
- Entire coastal communities, such as many in Alaska, will be forced to relocate as permafrost melts and shorelines crumble without sea ice to buffer them from violent storms.
- Residents in Greenland will find it hard to travel on sea ice.
- Reindeer herders in Siberia could struggle to feed their animals.

Of course at the same time, new economic opportunities will beckon as open water allows greater access to fishing grounds, oil and gas deposits, and other sources of revenue.

People living at mid-latitudes may not be immune, either. Emerging research, referenced in this article, suggests that open water in the Arctic might have helped to amplify weather events, such as cold snaps in the United States, Europe and Asia in recent winters.

Also, sea ice helps to cool the planet by reflecting sunlight and preventing the Arctic Ocean from absorbing heat. Keeping local air and water temperatures low, in turn, limits melting of the Greenland ice sheet and permafrost. With summer ice gone, Greenland's glaciers could contribute more to sea-level rise, and permafrost could release its stores of greenhouse gases such as methane. Such is the vast influence of Arctic ice on the global climate the researchers state.

If the future of the Arctic seems dire, the researchers suggest there is one source of optimism: summer sea ice will return whenever the planet cools down again.

In the article one of the researchers is quoted as saying "*It's not this irreversible process," "You could bring it back even if you lose it all."*

The researchers explain that unlike land-based ice sheets, which wax and wane over millennia and lag behind climate changes by similar spans, sea ice will regrow as soon as summer temperatures get cold enough. Greenhouse-gas concentrations in the atmosphere are one of the factors that affects ice regrowth but it also depends on how long the region has been ice-free in summer, which determines how much heat can build up in the Arctic Ocean. In theory, if the Arctic experiences ice-free summers for a relatively short time before greenhouse gases drop, then models suggest ice would regrow much sooner.

The paper suggests that one way you bring back the sea ice is global-scale geoengineering to cool the planet and, by extension, preserve or restore ice. Another line of thought is by artificially whitening the Arctic Ocean with light-coloured floating particles to reflect sunlight which might just chill the north. Apparently, another study referenced in the article has suggested installing wind-powered pumps to bring water to the surface in winter, where it would freeze, forming thicker ice. However, the researchers in the paper argue that managing greenhouse gases — and local pollutants such as black carbon from shipping — is the only long-term solution.

The researchers conclude that the idea of re-growing sea ice is wishful thinking, because it would require efforts well beyond what nations must do to meet the Paris agreement. Limiting warming to 2°C will probably entail converting huge swathes of land into forest and using still-nascent technologies to suck billions of tonnes of CO_2 out of the air. Lowering greenhouse-gas concentrations enough to regrow ice would demand even more.

Summary

The article presents a stark warning of the impacts of the total loss of artic sea ice and explores the theoretical possibility of how it might return. Like the researchers, I think that geo-engineering options are pre nascent and that greenhouse gas mitigation is what is needed to control global temperatures. The researchers do not suggest which technologies are in their mind still nascent – but the reference to sucking CO_2 out of the atmosphere must refer to CCS in part at least. We, of course, would argue strongly that CCS is a technology that is deployable now if Governments back the technology. The key point of this article of course, is that we need strong government commitment to mitigate greenhouse gas emissions and the time for prevaricating is over; we need action now.

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