Floating with the Ice Across the Arctic

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A guard stands watch looking for polar bears in early January. Credits: Alfred Wegener Institute, Lucas Piotrowski. CC-BY-SA 4.0 (https://bit.ly/38OKcvg).

The largest polar expedition in history to study the melting polar ice sheet ended on October 12, 2020. It was called MOSAiC, standing for The Multidisciplinary drifting Observatory for the Study of Arctic Climate. It started in September 2019, when the German research icebreaker Polarstern sailed north from Tromsø in Norway into the Arctic to drift with the Arctic currents and ice for one year. This expedition started in September when the sea-ice cover is at a minimum and the ice is thin, so the ship could get the farthest north, before it was frozen into the ice for the winter. Instruments were set up a mile or so away from the ship to drift on an ice flow along with the ship, as they took measurements through the Arctic winter close to the North Pole and beyond. Observers had to watch all the time for curious and perhaps hungry polar bears, as they checked instruments and studied the ecosystems beneath the relatively thin ice.

The Arctic is changing rapidly as it warms twice as fast as the Earth as a whole. The Norwegian researcher and explorer Nansen set sail 127 years ago on the first ever drift expedition with his specially built wooden sailing ship Fram. His expedition lasted from 1893 to 1896. Last winter's Arctic temperature were 18 degrees warmer than what Nansen measured. The polar ice is much thinner now, heavily fractured and full of holes.

Why is the Arctic changing so fast? As you know the Earth is warming as the burning of the fossil fuels, leaking methane wells and other human sources pour greenhouse gases like CO2 into the atmosphere that slow the cooling of the Earth to space at night. More than 90% of this trapped heat is stored in the oceans. Think of this as the trigger that drives a series of amplifying effects. As the oceans warm, more water evaporates, and water vapor is a very powerful greenhouse gas that triples the warming by CO2 alone. This happens on a global scale. But in the Arctic, much more happens. The warming melts the polar ice that reflects most of the sunlight, and exposes the ocean which absorbs most of the sunlight. Sea-ice doesn't evaporate, but the ocean does, so water vapor in the air increases, and more clouds form. Both more water vapor and clouds trap more heat. Collectively all these processes -- the loss of ice reflecting sunlight, more heat stored in the oceans, more water vapor and clouds in the air -- double the warming of the Arctic over time. The ice cover is shrinking – this September the area covered was the second lowest on record – and the ice is getting thinner and thinner. Ice used to get thicker every winter and last for years. Now most of the Arctic ice is only one year old and only a few feet thick.

The Polarstern expedition measured all this in great detail, so we can better model the shrinking Arctic ice, as we lose a key region that helps keep the Earth cool. It was tough work for the scientists on-board, as resupply was difficult at times with the COVID pandemic and when the supply plane's ice landing-strip crumpled.

For us on land, our winters are warming twice as fast as summers for similar reasons. As winters warm, there is less snow cover to reflect sunlight, and if the ground is wet rather than frozen, more water vapor evaporates into the air, slowing the cooling to space. The big question for us is whether humanity could control the greenhouse gases and move away from burning 100 million years of fossil fuels in about a century. But driven by greed and the focus on current profits for the wealthy, we condemn our children and the Earth to the tragedies that lie ahead as the ice-sheets melt.

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