ScienceTalk

What happens in the Arctic does not stay in the Arctic

Warming of polar region will lead to climate changes that will impact the rest of the world

Benjamin Horton

Contrary to the famous line "What happens in Vegas, stays in Vegas", global warming is changing the Arctic in ways that will impact our climate and our world.

Its climate is changing at an accelerated pace compared with the rest of the world. Temperatures there, for instance, have risen 2.3 deg C since the 1970s, nearly twice the rate of the rest of the world. The Arctic region acts as a refrigerator for the rest of the world. It gives off more heat to space than it absorbs from outside, which helps cool the planet.

THE ARCTIC COUNCIL

The mounting evidence of climate change in the Arctic motivated international organisations to call for a study of its climate. The Arctic Council is the leading intergovernmental forum promoting cooperation, coordination and interaction among the Arctic states, indigenous communities and other inhabitants on common issues, in particular, sustainable development and environmental protection. Singapore has been an observer in the council since 2013.

I was fortunate to represent Singapore alongside our Government at Arctic Council meetings in Berlin and St Petersburg last year. There are more meetings in the next few years as the urgency for action on climate change intensifies.

GLOBAL IMPACT OF ARCTIC CLIMATE

The large-scale changes in the Arctic climate system exert a strong influence throughout the global climate system. For example, less sea ice leads to altered temperature and salinity in seawater, which in turn affect global ocean circulation patterns; these patterns play a major role in determining the climate in regions all over the world. Such alterations will also affect biodiversity far outside the Arctic.

The temperature difference between the cold Arctic and warmer regions in the south in autumn and winter drives the jet stream, which shapes and propels the weather systems of the Northern Hemisphere.

But the temperature difference has decreased, and this affects the speed of the jet stream. One apparent result is that weather systems spend more time over certain regions, leading to extreme snowfall, drought and heatwaves.

In addition, the warming of the Arctic allows the jet stream to meander more, bringing cold Arctic air farther south and allowing warm air to penetrate farther north, leading to new record high and low temperatures last year.

For example, a major winter storm hit the United States Atlantic coast in early January last year, battering coastal areas with heavy snow, blizzards and strong winds. Boston suffered coastal flooding after it saw the highest tide since 1921. In contrast, record high temperatures have been set across much of the world last summer.

Algeria experienced the hottest temperature reliably registered in Africa at a staggering 51.3 deg C.

The effect of thawing permafrost on the carbon cycle is another crucial aspect of how climate evolves worldwide. Permafrost in the Arctic will thaw as a consequence of increasing temperatures in the soil, oceans, rivers and lakes that overlie the frozen ground. Carbon stored in the permafrost may then be released as carbon dioxide and methane, increasing the levels of greenhouse gases in the atmosphere and hastening global warming.

The Arctic permafrost contains about 1.7 trillion tonnes of carbon – more than all that human activity has generated since the start of the Industrial Revolution. A study in Canada estimated that the thawing of its permafrost alone would release 75 million to 560 million tonnes of carbon into the atmosphere before 2100, and increase the earth's temperature by 0.5 deg C in addition to the warming that is already projected.

MELTING SEA ICE AND MARITIME TRADE

The changing Arctic climate can be illustrated clearly in the melting sea ice. Sea ice is simply frozen ocean water. Every year, the sea ice blanketing the Arctic Ocean and surrounding seas thickens and expands in autumn and winter, reaching its maximum yearly extent between late February and early April. The ice then thins and shrinks in spring and summer until it reaches its annual minimum extent in September.

The last four years saw nearly equally low extents in winter and continued the decades-long trend of diminishing sea ice in the Arctic. Last year's maximum extent was 1.16 million sq km – an area about 1,600 times larger than Singapore – and below the 1981 to 2010 average.

The decline of the Arctic sea ice has myriad effects, from changes in climate and weather patterns to impacts on the plants and animals dependent on the ice, and to the indigenous human communities that rely on them.

Sea ice (plus glaciers and the Greenland ice sheet) reflects a high proportion of the sun's energy into space. As the Arctic loses snow and ice, bare rock and water absorb more and more of this energy, making the earth ever warmer. This is called the albedo effect.

The disappearing ice is also altering shipping routes, creating opportunities for shorter trade links between South-east Asia, Europe and the Atlantic coast of North America via the Arctic. For example, voyages from South-east Asia to the United Kingdom could save 10 to 12 days by using transarctic routes instead of the Suez Canal route.

Professor Benjamin Horton speaking on sea-level rise at the "Arctic: Today and the Future" forum in St Petersburg.

IMPACT ON GLOBAL SEA-LEVEL RISE

At last year's Arctic Council meetings, I presented on the topic of sea-level rise. One of the ways a warming Arctic could directly impact the rest of the world is by raising global sea levels. Arctic regions store vast amounts of water on land as frozen ice sheets and glaciers.

The Greenland ice sheet holds enough frozen water to raise sea-level 6m! Run-off from this vast ice sheet – currently the biggest single source of meltwater adding to the volume of the world's oceans – is 50 per cent higher than in pre-industrial levels and increasing exponentially as a result of global warming.

About 625 million people live in low-elevation coastal zones. These zones, more than 70 per cent in South-east Asia, are vulnerable to sea-level rise. It also threatens Singapore's coastal population, economic activity, infrastructure and ecosystems because 30 per cent of its surface area is less than 5m above sea level.

Combating climate change is an urgent common challenge for the international community and requires immediate global action. I am proud to be part of Singapore's endeavours to generate commitments and take actions to maintain the sustainability of the Arctic.

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