Snow, Water, Ice and Permafrost in the Arctic, 2017

Implications of Arctic Climate Change

The rapid changes underway in the Arctic have wide-ranging consequences for Arctic ecosystems and people living and working the Arctic. But what happens in the Arctic affects the rest of the world as well: the Arctic plays important roles in global climate and weather, sea level rise, and world commerce. A recent economic analysis of the global costs of Arctic change estimated the cumulative cost at USD $7–90 trillion over the period 2010–2100. (Chapter 10, Synthesis)

Impacts on the Arctic

Climate change has both positive and negative consequences for people and industries in the Arctic. For example, the Arctic Ocean's open water season has already increased by 1–3 months over much of the ocean since the late 1970s, creating more opportunities for marine shipping and tourism. In contrast, losses and decreases in the thickness of lake and river ice and changes in permafrost conditions affect or threaten ice roads, restricting access to remote communities. (Chapter 9, Cross-cutting Issues; Chapter 10, Synthesis)

Some impacts, such as coastal erosion; the increased mobility of sea ice; and higher risks of wildfires, avalanches, and floods, lead to risks of physical harm in the Arctic. Communities and infrastructure built on frozen soils are significantly affected by thawing permafrost, one of the most economically costly impacts of climate change in the Arctic. Ecosystems and wildlife in the Arctic—including migratory species that inhabit the Arctic only part of the year—are sensitive to many of the impacts of climate change. (Chapter 9, Cross-cutting Issues; Chapter 10, Synthesis)

About SWIPA 2017

The Arctic Monitoring and Assessment Programme's Snow, Water, Ice and Permafrost in the Arctic (SWIPA) assessment focuses on changes to the Arctic cryosphere (the portion of the Arctic land and water that is seasonally or perennially frozen), and the implications of those changes. The second SWIPA assessment, which covers the period 2011–2015, with some updates to include observations from 2016 and early 2017, was published in 2017. This fact sheet reports on 2017's findings related to recent observed changes in the Arctic. For more information, see the chapters referenced in the fact sheet.

Thawing permafrost damaged this section of Highway 4, east of Yellowknife in Canada's Northwest Territories. Photo credit: Natural Resources Canada.

AMAP Arctic Monitoring and Assessment Programme

ARCTIC COUNCIL

Impacts on Global Climate and Weather

The Arctic acts as the world's refrigerator, drawing warm ocean water from the south, cooling it, and ultimately sinking it toward the ocean bottom. The movement of warmer ocean waters to the north creates circulation patterns that have a major influence on climate as far south as the tropics. Meltwater from Arctic ice floods the upper layer of the ocean with freshwater, which could—if it escapes the confines of the Arctic Ocean—affect circulation in the Nordic Seas and the North Atlantic. Changes in ocean currents and circulation would in turn affect regional climate; evidence from the past suggests that a large release of freshwater from the Arctic Ocean could lead to substantial cooling of the Northern Hemisphere. (Chapter 7, Freshwater; Chapter 10, Synthesis)

Changes in the Arctic also affect weather patterns outside of the Arctic. Studies have found connections between Arctic changes and storm tracks, floods, and winter weather patterns in Northern Hemisphere mid-latitudes, and even to changes in the onset and rainfall of Southeast Asian monsoons. The warming Arctic atmosphere decreases air density and north-south horizontal pressure gradients, leading to shifts in wind patterns. While it is clear that Arctic changes can influence weather outside of the region, scientists are still working to characterize the nature, magnitude, and extent of these effects. (Chapter 10, Synthesis)

Arctic soils hold an estimated 50% of the world's soil carbon, and thawing permafrost is expected to increase emissions of methane, a powerful greenhouse gas. Climate change may also affect the amount of atmospheric carbon dioxide absorbed by the Arctic Ocean. (Chapter 8, Arctic Carbon Cycling)

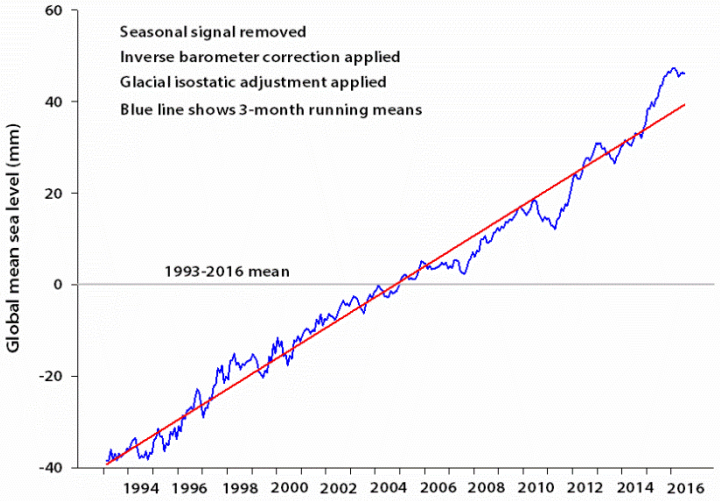
Implications for Sea Level Rise

The melting of Arctic glaciers, ice caps, and ice sheets is projected to increase the rate of global sea-level rise, potentially leading to coastal flooding, erosion, damage to buildings and infrastructure, changes in ecosystems, and contamination of drinking water sources in coastal communities and low-lying islands worldwide. The Arctic currently accounts for 35% of global sea-level rise. (Chapter 6, Land Ice)

Implications for World Commerce

Reductions in sea ice extent will open new shipping routes, and may facilitate access to oil, minerals, and other resources. As the Arctic becomes a warmer and wetter environment, it could become an increasingly important source of freshwater and hydropower for areas to the south.

Climate change is expected to have both positive and negative impacts on commercial fisheries as fish populations respond to changes in ocean temperature, phytoplankton growth, and the acidification of the ocean by carbon dioxide. Range shifts could create new markets as species normally found farther south become more common in the Arctic.



Satellite observations of global sea level, January 1993–August 2016. The melting of Arctic glaciers, ice caps, and ice sheets accounts for more than a third of global sea level rise. Credit: data from Commonwealth Scientific and Industrial Research Organization, Australia