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

Recent Changes in the Arctic

The Arctic is warming faster than any other region on Earth, and rapidly becoming a warmer, wetter, and more variable environment. Over the past 50 years, the Arctic's temperature has risen at a rate more than twice the global average. Increasing greenhouse gas emissions from human activities are the primary underlying cause. The changes underway affect the Arctic's role as a regulator of global temperature and its influence on Northern Hemisphere weather, its contribution to sea-level rise, the lifestyles and livelihoods of those who live and work in the Arctic, Arctic marine and terrestrial ecosystems, and the habitats of Arctic species.

Observed Changes

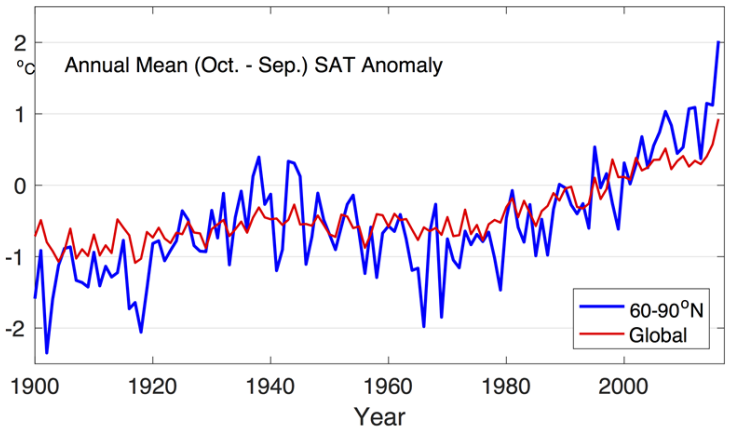
Since the first SWIPA report in 2011, the additional years of data show continued or accelerating warming trends in air temperatures, growing reductions in sea ice and snow cover, shrinking of glaciers and ice sheets, freshening and warming of the Arctic Ocean, thawing of permafrost, and widespread ecological changes.

Increasing Temperatures

The Arctic was warmer from 2011 to 2015 than at any time in the period of the instrumental record (beginning around 1900 for the Arctic). January 2016 in the Arctic was 5°C warmer than the 1981–2010 average for the region, a full 2°C higher than the previous record set in 2008. Monthly mean temperatures in October through December 2016 were 6°C higher than average for those months. Recent observations show a widespread decline in the incidence of extreme cold weather during both winter and summer, and increases in that of extreme warm periods in some areas, such as northern Alaska and northeastern Russia in autumn and spring. Ocean temperatures are also increasing, both near the surface and in deeper water (Chapter 2, Trends)

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.



Trends in average global (red line) and Arctic (blue line) temperature relative to the 1981-2010 mean, 1900-2016. Source: NOAA Arctic Report Card, 2016

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Sea Ice

Sea ice thickness in the central Arctic Ocean declined by 65% over the 1975–2012 period. Sea ice extent has varied widely in recent years, but continues a downward trend. A record low minimum sea ice extent occurred in 2012 and a record low maximum sea ice extent occurred in 2016. New observations from March 2017 show the lowest extent ever for this month since the start of the satellite record. More extensive areas of open water occur in all months of the year compared with observations reported in the first SWIPA report in 2011. Most sea ice in the Arctic is now seasonal ice that grows in the autumn and winter but melts during the spring and summer. Before 2007 more ice was perennial, lasting more than one year. (Chapter 5, Sea Ice)

Snow Cover and Permafrost

Snow cover has continued to decline in the Arctic, with its annual duration decreasing by 2–4 days per decade. In recent years, the area of snow cover in the North American and Eurasian Arctic during the month of June has been about half that observed before 2000. (Chapter 3, Snow)

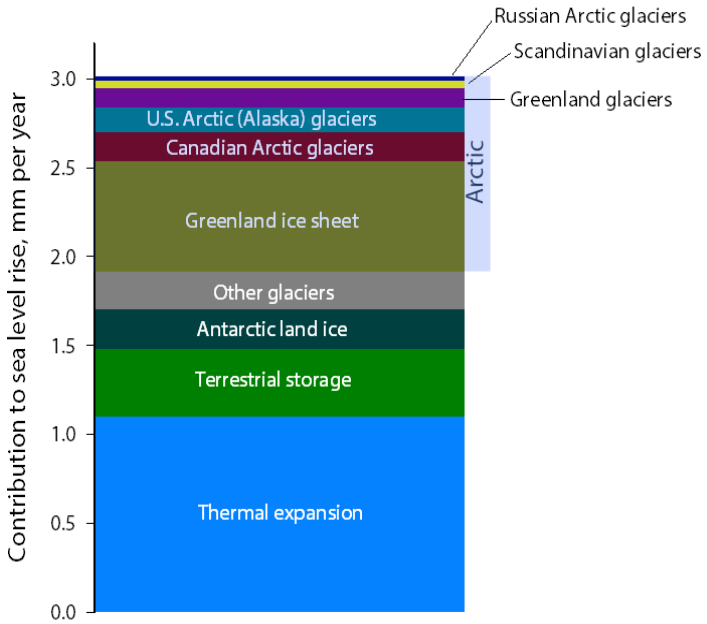
Near-surface permafrost in the High Arctic and other very cold areas has warmed by more than 0.5°C since 2007–2009, and the layer of ground that thaws in summer—the so-called active layer—has deepened in most areas where permafrost is monitored. (Chapter 4, Permafrost)

Land-Based Ice

Meltwater from Arctic glaciers, ice sheets, and ice caps accounts for more than a third of global sea level rise. Seventy percent of the Arctic's contribution to sea-level rise comes from Greenland, which on average lost 375 gigatons of ice per year—equivalent to a block of ice measuring 7.5 kilometers or 4.6 miles on all sides—from 2011 to 2014. This is close to twice the rate observed over the period 2003–2008. Between 2000 and the present, Greenland ice has released enough meltwater to raise global sea levels by more than 1 centimeter. (Chapter 6, Land Ice)

Freshwater in the Arctic Ocean

Compared with the 1980–2000 average, the volume of freshwater in the upper layer of the Arctic Ocean has increased by 8,000 cubic kilometers, or more than 11%. This volume equals the combined annual discharge of the Amazon and Ganges rivers, and could—if it escapes the confines of the Arctic Ocean—affect circulation in the Nordic Seas and the North Atlantic. (Chapter 7, Freshwater)



During the period 2004–2010, melting Arctic land ice accounted for more than 1/3 of global sea level rise, while thermal expansion caused by warming water contributed another 1/3. The sea level contributions from Antarctica, other glaciers, and changes in terrestrial storage accounted for less than 1/3. Greenland glaciers are those ice bodies not connected to the inland ice sheet.

Impacts on Ecosystems

The decline in sea ice thickness and extent, along with changes in the timing of ice melt, are affecting marine ecosystems and biodiversity; changing the ranges of Arctic species; increasing the occurrence of oceanic algal blooms; leading to changes in diet among marine mammals; and altering predator-prey relationships, habitat uses, and migration patterns. Terrestrial ecosystems are being affected by changes in precipitation, snow cover, and the frequency or severity of wildfires. The occurrence of rain-on-snow and winter thaw/refreezing events affects grazing animals such as caribou, reindeer, and muskox by creating an ice barrier over lichens and mosses. While many tundra regions have become greener over the past 30 years, reflecting an increase in plant growth and productivity, recent satellite data show shifts toward browning (indicating a decrease in plant cover and productivity) over large areas of the Arctic, particularly in Eurasia. (Chapter 9, Cross-Cutting Issues)