**Changing climate system in the marine Arctic**

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Recent changes in the marine Arctic climate system were summarized, including the atmospheric warming, rapid decreases in sea ice thickness and extent, increasing river discharge in Eurasia, as well as the ocean warming and decadal variations in salinity. During the latest 50 years, the Arctic has warmed 2-4 times faster than the Earth on average. This Arctic amplification is due to several positive feedback effects. Climate models include more uncertainty and inter-model spread in the Arctic than at lower latitudes. Much of the problems are due to (a) the complexity of physical processes, including mixed-phase clouds, stable boundary layers, and interaction of sea ice dynamics and thermodynamics, and (b) the sensitivity of the Arctic climate system, partly due to the role of sea ice, which is thin (small heat capacity) but an important insulator and reflector of solar radiation. Despite recent progress, some of these small-scale physical processes are still not sufficiently understood: these include wave-turbulence interactions in the atmosphere and ocean, the exchange of heat and salt at the ice-ocean interface, and the mechanical weakening of sea ice. Many processes are reasonably well understood as stand-alone processes but the major challenge is to understand their interactions as well as impacts and feedbacks on other processes.

Considering the effects of Arctic sea ice decline on mid-latitude weather, recent results scatter on the magnitude, timing, and spatial extent of these effects, as well as on the mechanisms behind them. According to several studies, Arctic sea ice decline favours circulation patterns that resemble the negative phase of AO and NAO in winter, but the sea ice decline is only one of the many factors affecting mid-latitude winter weather.