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The observed recent surface air temperature development across Svalbard and concurring footprints in local sea ice cover

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The Svalbard archipelago in the Arctic North Atlantic is experiencing rapid changes in the surface climate and sea ice distribution, with impacts for the coupled climate system and the local society. Using observational data of surface air temperature (SAT) from 1980–2016 across the whole Svalbard archipelago, and sea ice extent (SIE) from operational sea ice charts, a systematic assessment of climatologies, long-term changes and regional differences is conducted. The proximity to the warm water mass of the West Spitsbergen Current (WSC) drives a markedly warmer climate in the western coastal regions compared to northern and eastern Svalbard. This imprints on the SIE climatology in southern and western Svalbard, where the annual maxima of 50–60% area ice coverage are substantially less than 80–90% in the northern and eastern fjords. Owing to winter-amplified warming, the local climate is shifting towards more maritime conditions, and SIE reductions of between 5% to 20% per decade in particular regions are found, such that a number of fjords in the west have been virtually ice-free in recent winters. The strongest decline comes along with SAT forcing and occurs over the most recent 1–2 decades in all regions. In the 1980s and 1990s, enhanced northerly winds and sea ice drift can explain 30–50% of SIE variability around northern Svalbard, where they had correspondingly lead to a SIE increase. At the same time, interannual temperature fluctuations within the WSC waters can explain 20-37% of SIE variability in a number of fjords on the west coast. With an ongoing warming it is suggested that both the meteorological and cryospheric conditions in eastern Svalbard will become increasingly similar to what is already observed in the western fjords, namely suppressed typical Arctic climate conditions.