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Establishing an automatic atmospheric measurement network across an Arctic fjord system in Svalbard

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During the last couple of decades the sea-ice cover on Isfjorden at the west coast of Spitsbergen in Svalbard has seen a dramatic reduction, which has been linked to, amongst others, regional and local changes in weather patterns. As Isfjorden is the most heavily trafficked fjord in Svalbard, these changes directly impact all kinds of operations at sea. Therefore, good information about the atmospheric state over the fjord system does not only enhance our scientific understanding of air-ice-sea interactions and the local processes leading to the formation of sea ice, but furthermore contribute to planning and conducting field activities in a safer manner.

With a horizontal resolution of 2.5 km, the current operational version of the AROME-Arctic weather forecasting model of the Norwegian Meteorological Institute can provide a good overall representation of the atmospheric state over the Isfjorden fjord system. However, the complex topography, as well as fine-scale variations in the surface cover and the sea surface temperature due to the oceanographic circulation within the fjord, lead to local variabilities of atmospheric variables, which are only poorly resolved by the model. Amongst others, high-wind events and associated phenomena like channeling effects are suspected to have a large effect on both the air-ice-sea interactions and the formation of sea ice within the fjord as well as the safety at sea.

Therefore, we aim at establishing an automatic meteorological measurement network across Isfjorden. The network will consist of several all-in-one weather stations deployed at lighthouse stations all around the fjord. Additionally, mobile stations will be installed onboard small tourist fjord cruise ships. In that way, small-scale local variations in near-surface atmospheric wind and temperature fields can be resolved and their changes can be monitored throughout the year. By making use of already existing infrastructure as platforms for the instrumentation, the high-resolution measurements can be performed in remote areas at low costs and with a minimal environmental impact. In the end, a real-time transfer of the measured data via the cellular network will additionally provide very valuable information for planning and execution of field activities performed by e.g. UNIS, tourist companies, private individuals or the Governor of Svalbard.

We will in detail present the measurement network, the status of its setup and first results. A special focus will be put on the comparison of the measurements with the AROME-Arctic model

data.