

# Hectometric-scale Numerical Weather Prediction in Svalbard

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## Abstract

Numerous sectors in Svalbard, such as transportation, tourism, search and rescue operations and scientific fieldwork, are dependent on accurate and reliable weather predictions in high spatial and temporal resolution. The operational NWP systems in Svalbard, and in the Arctic in general, are challenged by the complex topography and unique small-scale phenomena present in the region. To adequately represent the local effects numerical forecasts are required to run with very high spatial resolution. Because of observation sparseness, sharing local observational data sets between Svalbard institutions and local expertise of meteorologists has become essential for validating numerical weather forecasts at higher resolutions.

We present results from a set of NWP forecasts with 0.5 km horizontal grid spacing for winter periods from 2018 to 2022. The forecasts were primarily produced for the University Centre in Svalbard and used for optimal and safe planning of scientific fieldwork and for educational purposes. In addition, the hectometric system was subjectively evaluated by an aviation weather forecaster in Svalbard. The forecasts were compared to the operational NWP model (2.5 km grid spacing) at the Norwegian Meteorological Institute, and local observational data sets from permanent weather stations and field campaigns including automatic weather stations, a tethered sonde and measurements on mobile platforms.

The results show large differences between the 0.5 km forecasts and the lower resolution operational system both for wind speed and temperature. Increased model resolution improves how the model captures terrain-induced flows, such as valley wind channelling, lee waves, gap winds, drainage flows and wake winds, which is reflected in the objective verification scores for wind speed. The impact on near-surface temperature is more complex and depends more on the weather situation.

The experience with the hectometric resolution system is beneficial for further model development and allows to proceed towards hectometric-scale resolution weather prediction in Svalbard that can enhance the modelling and predictive capacities for the benefit of activities in Svalbard.