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Impact of observations in a mesoscale NWP model in the Arctic

Roger Randriamampianina (1), Mile Máté (2), Stephanie Guedj (3), and Harald Schyberg (1)

(1) Norwegian Meteorological Institute, Oslo, Norway (rogerr@met.no), (2) Hungarian Meteorological Service, Budapest, Hungary (Mile.m@met.hu), (3) NCEP, Washington, USA (stephanie.guedj@hotmail.fr)

In the frame of the EU-funded project ACCESS (Arctic Climate Change, Economy and Society), MET Norway aimed 1) to describe the present monitoring and forecasting capabilities in the Arctic; and 2) to identify the key factors limiting the forecasting capabilities and to give recommendations on key areas to improve the forecasting capabilities in the Arctic. The first task was assessed using observing system experiments (OSE), while second one was evaluated applying observing system simulation experiments (OSSE).
We have observed that the NWP forecast quality is lower in the Arctic than in the regions further south. An earlier research indicated that one of factors behind this is the composition of the observing system in the Arctic, in particular the scarceness of conventional observations. To further assess possible strategies for alleviating the situation and propose scenarios for a future Arctic observing system, we have performed a set of experiments to gain a more detailed insight in the contribution of the components of the present observing system in a regional state-of-the-art non-hydrostatic NWP model. These observing system experiments have been evaluated 1) in terms of a measure of the information content of observations with respect to analysis quality and 2) with respect to the impact on forecasts assessed (a) through case studies, (b) through a norm measuring the impact on forecasts and (c) through the quality of forecasts verified with available reference observations.
The OSE studies show that conventional observations (Synop, Buoys) can play an important role in correcting the surface state of the model, but prove that the present upper-air conventional (Radiosondes, Arcraft) observations in the area are too scarce to have a significant effect on forecasts. We demonstrate that satellite sounding data play important role in improving forecasts quality at present. This is the case with the satellite temperature sounding data (AMSU-A, IASI), as well as with the satellite moisture sounding data (AMSU-B/MHS, IASI).
This clearly highlights that satellite information will be important also in the future evolution of the Arctic observing system, and that enhancing the extraction of information from satellites is a key area. To quantify further the impacts of different observing strategies, we have implemented and performed necessary tuning of an Observing System Simulation framework with the same limited-area NWP system. The OSSE studies show that scenarios able to enhance the conventional observing system beyond the limited impact we find today can be found. Options which could be logistically and economically feasible could be to increase the launch frequency (at least twice per day or four times a day) at the few radiosonde stations in the region, and also to increase the number of drifting surface buoys (two, three or four times) measuring the air pressure in the area. The proposed scenarios to be evaluated in more detail include both enhanced exploitation of satellite data and more frequent radiosonde launches as well as higher density of drifting pressure buoys.