Geophysical Research Abstracts
Vol. 20, EGU2018-17436, 2018
EGU General Assembly 2018

Convective-scale atmospheric modelling in the Arctic: Model characteristics and sensitivity to the sea-ice representation

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There are many challenges for Arctic weather prediction, for example, the sparse observation network, atmospheric data assimilation, the representation of sea ice, and the high-latitude representation of many subgrid-scale parameterizations. We will present an evaluation of a high-resolution (2.5 km) Arctic weather forecasting system (AROME-Arctic), based on an operational hindcast data set and on sensitivity experiments with experimental sea-ice concentration and sea-ice lead products. In addition to the regional model, the model output of the ECMWF weather forecasting and reanalysis systems (deterministic, ensemble, ERA-Interim, and ERA5) is analysed for comparison.
First, a detailed evaluation of the regional forecast model system and the global ECMWF models against observations of radiosondes, land-surface stations, and over sea-ice is presented. For the evaluation over sea-ice the data set from the N-ICE 2015 expedition is utilized, which presents unique atmosphere, snow, sea-ice, and ocean measurements in ice-covered Arctic areas. The focus is on the atmosphere in the lower 200 meter and on air-sea fluxes. Second, we study the sensitivity of the atmosphere to the representation of sea-ice lead characteristics in the Marginal Ice Zone. For this study, the standard satellite sea-ice concentration product is merged with a novel sea-ice lead satellite product. The atmospheric response to the explicit representation of the sea-ice lead structure is analysed in terms of temperature, winds, and air-sea fluxes.