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Development of a Regional Arctic Climate System model: Performance of Polar WRF for regional pan-Arctic atmospheric simulations

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Efforts are currently underway to develop a regional Arctic climate system model (RACM), which will include atmosphere, ocean, sea ice, and land components. The atmospheric component of RACM is a version of Weather Research and Forecasting (WRF) model optimized for use in polar regions, known as Polar WRF. Extensive work has been completed to evaluate the performance of Polar WRF in the Arctic, with an emphasis on evaluating a variety of WRF's physical parameterizations and representation of ice covered surfaces. Using a pan-Arctic model domain, the sensitivity of atmospheric circulation, temperature, moisture, and precipitation is examined as a response to model physics options in boundary layer schemes, microphysics schemes, and longwave and shortwave radiation schemes. In addition, lower boundary land use properties (albedo, emissivity) for ice covered surfaces and fractional sea ice forcing options are examined. For each experiment, a three-member ensemble of January, April, July, and October one month simulations is used and compared with the NCEP/DOE Reanalysis II, with an emphasis on comparison with the broad features of the Arctic climate. Simulations with and without data assimilation will be presented. Significant biases in the circulation over the North Pacific are found for all model configurations that do not use data assimilation.