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Intercomparison of Several Ocean Surface Wind Products over the Nordic Seas

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Surface winds are one of the key parameters that control the exchange of energy between the atmosphere and oceans. Being the major source of momentum for the upper ocean, winds mainly control ocean processes and air-sea interaction especially in synoptically active regions such as the Nordic Seas (Greenland, Norwegian, Iceland, and Barents Seas). Intense formation of water masses takes place in the Nordic Seas through cooling, brine rejection, and mixing of Arctic Ocean and North Atlantic waters. Deep water produced in this region by deep convection participates in the Atlantic Meridional Overturning Circulation. Water masses formed in the Nordic Seas are also important for the maintenance of thermohaline structure of the Arctic Ocean. The Nordic Seas has always been a challenging region for Arctic Ocean modeling due to complex ocean circulation, water mass transformation, intense air-sea interaction, deep vertical convection, etc. The lack of reliable high-resolution wind products over the Polar region is another factor that has been impacting modeling of the Arctic Ocean in general and the Nordic Seas in particular. Coarse resolution atmospheric fields are often used to force the Arctic Ocean models. The major drawback of the coarse resolution wind products is their inability to resolve small- and meso-scale cyclones frequently impacting the Nordic Seas. Several gridded surface wind products derived from scatterometer wind observations have reasonably high spatial resolution to represent most of the small scale cyclones in the region. In the present model study, Cross-Calibrated Multi-Platform surface wind data (CCMP) are compared against the wind fields from traditional the NCEP/NCAR Reanalysis 2 (NCEPR), from NCEP Climate Forecast System Reanalysis (CFSR), and from the interium version (30km) of the Arctic System Reanalysis (ASR). The NCEPR is a coarse resolution product (1.9°) and still is the primary source of forcing fields for the Arctic Ocean models. The CFSR has a much higher spatial (0.25° at the equator, extending to a global 0.5° beyond the tropics) and temporal (1 hour) resolutions. The ASR was produced by the Polar Meteorology Group, Ohio State University as a data source of major atmospheric parameters for the Arctic region. The ASR is based on the polar-optimized version of the WRF model that assimilates historical data along with measurements of the physical components of the Arctic Observing Network developed as part of the International Polar Year. Results from several model experiments driven by different wind forcing are presented. Numerical experiments are conducted with the fully coupled 1/12° resolution HYbrid Coordinate Ocean Model (HYCOM) and CICE sea ice model. The impact of discrepancies in the wind fields on ocean processes is discussed. Model results demonstrate high sensitivity of the ocean to different wind products especially during strong wind events due to differences in momentum and heat fluxes resulted from the wind data.