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An Assessment of Arctic Sea Ice Intra-Annual Probabilistic Prediction Skill Using the Regional Arctic System Model

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The Regional Arctic System Model (RASM) has been developed and used for modeling of past to present and predicting future Arctic climate change at time scales from weeks to decades. RASM is a fully coupled ice-ocean-atmosphere-land hydrology model. Its domain covers the pan-Arctic region, with the default atmosphere and land components configured on a 50-km horizontal grid. The ocean and sea ice components are configured on a rotated sphere mesh with the default configuration of 1/12^{o} (~9.3km) in the horizontal space and with 45 ocean vertical layers. As a regional climate model, RASM requires boundary conditions along its lateral boundaries and in the upper atmosphere, which are derived either from global atmospheric reanalyses for simulations of the past to present or from global forecasts or from Earth System models (ESMs) for climate projections. The former simulations allow comparison of RASM results with observations in place and time, and their tuning, which is a unique capability not available in global ESMs.

Within this framework, RASM has been used every month for the past 3+ years (from January 2019 to present) to dynamically downscale the global intra-annual (i.e., 7-month) operational forecasts from the National Center for Environmental Predictions (NCEP) Climate Forecast System version 2 (CFSv2). Here we present summary results from analysis of RASM predictive skill from these forecasts using the common metrics to quantify model skill in predicting sea ice conditions at time scales from weeks up to 6 months. Examples of possible improvements of RASM predictive skill are discussed, related to optimized parameter space, improved initial conditions and higher spatial resolution. An outlook for up to decadal probabilistic predictions using dynamical downscaling is also discussed.