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## Assessment of the Regional Arctic System Model Intra-Annual Ensemble Predictions of Arctic Sea Ice

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The Regional Arctic System Model (RASM) has been developed and used to investigate the past to present evolution of the Arctic climate system and to address increasing demands for Arctic forecasts beyond synoptic time scales. RASM is a fully coupled ice-ocean-atmosphere-land hydrology model configured over the pan-Arctic domain with horizontal resolution of 50 km or 25 km for the atmosphere and land and 9.3 km or 2.4 km for the ocean and sea ice components. As a regional model, RASM requires boundary conditions along its lateral boundaries and in the upper atmosphere, which for simulations of the past to present are derived from global atmospheric reanalyses, such as the National Center for Environmental Predictions (NCEP) Coupled Forecast System version 2 and Reanalysis (CFSv2/CFSR). This dynamical downscaling approach allows comparison of RASM results with observations, in place and time, to diagnose and reduce model biases. This in turn allows a unique capability not available in global weather prediction and Earth system models to produce realistic and physically consistent initial conditions for prediction without data assimilation.

More recently, we have developed a new capability for an intra-annual (up to 6 months) ensemble prediction of the Arctic sea ice and climate using RASM forced with the routinely produced (every 6 hours) NCEP CFSv2 global 9-month forecasts. RASM intra-annual ensemble forecasts have been initialized on the 1<sup>st</sup> of each month starting in 2019 with forcing for each ensemble member derived from CFSv2 forecasts, 24-hr apart from the month preceding the initial forecast date. Several key processes and feedbacks will be discussed with regard to their impact on model physics, the representation of initial state and ensemble prediction skill of Arctic sea ice variability at time scales from synoptic to decadal. The skill of RASM ensemble forecasts will be assessed against available satellite observations with reference to reanalysis as well as hindcast data using several metrics, including the standard deviation, root mean square difference, Taylor diagrams and integrated ice-edge error.

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