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Modeling and Prediction of Arctic Climate Using the Regional Arctic System Model

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The Regional Arctic System Model (RASM) has been developed and used to investigate critical processes controlling the evolution of the Arctic climate system under a diminishing sea ice cover. RASM is a fully coupled limited-domain ice-ocean-atmosphere-land hydrology model. Its domain is pan-Arctic, with the atmosphere and land components configured on a 50-km or 25-km grid. The ocean and sea ice components are configured on rotated sphere meshes with four configuration options: 1/12o (∼9.3km) or 1/48o (∼2.4km) in the horizontal space and with 45 or 60 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 Earth System models (ESMs) for climate projections. This allow comparison of RASM results with observations in place and time, which is a unique capability not available in global ESMs. Several examples of key physical processes and coupling between different model components will be presented, that improve the representation of the past and present Arctic climate system. The impact of such processes and feedbacks will be discussed with regard to improving model physics and reducing biases in the representation of its initial state for prediction of Arctic climate change at time scales from synoptic to decadal.

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