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High-Resolution Modeling of Arctic Climate Using the Regional Arctic System Model for Dynamical Downscaling of Global Climate Model Reanalyses and Projections

Maslowski, Wieslaw; Osinski, Robert; Lee, Younjoo; Kinney, Jaclyn L. Clement; Craig, Anthony; Seefeldt, Mark W.; Cassano, John J.; Nijssen, Bart

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PC42A-03 - High-Resolution Modeling of Arctic Climate Using the Regional Arctic System Model for Dynamical Downscaling of Global Climate Model Reanalyses and Projections

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- *SDCC - 1A, UL*

Abstract

The Arctic is one of the most challenging regions to model climate change due to its complexity, including the cryosphere, small scale processes and feedbacks controlling its amplified response to global climate change. The combination of these factors defines the need for high spatial and temporal model resolution, which is commonly not practical for most state-of-the-art global Earth system models (ESMs), including those participating in the Coupled Model Intercomparison Project Phase 6.

We offer an alternative approach to improve model physics and reduce uncertainties in modeling Arctic climate using a high resolution regional climate system model for dynamical downscaling of output from ESMs. The Regional Arctic System Model (RASM) has been developed to better understand the past and present operation of the Arctic climate system and to predict its change at time scales up to decades. RASM is a coupled model, consisting of the atmosphere, ocean, sea ice, land hydrology and river routing scheme components. Its domain is pan-Arctic, with 50-km or 25-km grids for the atmosphere and land components. The ocean and sea ice components are configured at ~9.3-km or ~2.4-km grids horizontally and with 45 or 60 vertical layers. For hindcast simulations, RASM derives boundary conditions from global atmospheric reanalyses, allowing comparison with observations in place and time, which is a unique capability not available with ESMs.

We will discuss improvements to RASM model physics offered by high resolution and in generation of internally consistent realistic initial conditions for Arctic climate prediction. We will also discuss the need for fine-tuning of scale aware parameterizations of sub-grid physical processes in varying model configurations. Finally, selected results will be presented to demonstrate gains of dynamical downscaling in comparison with observations and with the global reanalysis and predictions.

Authors

- **Wieslaw Maslowski**
  - Naval Postgraduate School
- Robert Osinski
  - Institute of Oceanology Polish Academy of Sciences
- Younjoo Lee
  - Naval Postgraduate School
- Jaclyn L Clement Kinney
  - Naval Postgraduate School
- Anthony Craig
  - Naval Postgraduate School
- Mark W Seefeldt
  - Cooperative Institute for Research in Environmental Sciences
- John J Cassano
  - Univ Colorado
- Bart Nijssen
  - University of Washington Seattle Campus