2020

Sensitivity of Arctic sea ice to variable model parameter space in Regional Arctic System Model simulations

Osinski, Robert; Maslowski, Wieslaw; Lee, Younjoo; Craig, Anthony; Clement-Kinney, Jaclyn; Niciejewski, Jan

EGU

Osinski, R., Maslowski, W., Lee, Y., Craig, A., Clement-Kinney, J., and Niciejewski, J.: Sensitivity of Arctic sea ice to variable model parameter space in Regional Arctic System Model simulations., EGU General Assembly 2020, Online, 48 May 2020, EGU2020-13039, https://doi.org/10.5194/egusphere-egu2020-13039, 2020

http://hdl.handle.net/10945/66160

EGU2020-13039
https://doi.org/10.5194/egusphere-egu2020-13039
EGU General Assembly 2020

Sensitivity of Arctic sea ice to variable model parameter space in Regional Arctic System Model simulations.

Robert Osinski[1], Wieslaw Maslowski[2], Younjoo Lee[2], Anthony Craig[3], Jaclyn Clement-Kinney[2], and Jan Niciejewski[1]
[1]Institute of Oceanology PAS, Sopot, Poland (roberto@iopan.gda.pl)
[2]Naval Postgraduate School, Monterey, USA
[3]Contractor

The Arctic climate system is very sensitive to the state of sea ice due to its role in controlling heat and momentum exchanges between the atmosphere and the ocean. However, the representation of sea ice state, its past variability and future projections in modern Earth system models (ESMs) vary widely. One of the reasons for that is strong sensitivity of ESMs to sea ice related varying parameter space. Based on limited observations, those parameters typically have a range of possible values and / or are not constant in space and time, which is a source of model uncertainties.

The Regional Arctic System Model (RASM) is a limited-domain fully coupled climate model used in this study to investigate sensitivity of sea ice states to limited set of parameters. It includes the atmospheric (Weather Research and Forecasting; WRF) and land hydrology (Variable Infiltration Capacity; VIC) components sharing a 50-km pan-Arctic grid. The sea ice (the version 6.0 of Los Alamos sea ice model, CICE) and ocean (Parallel Ocean Program, POP) components share a 1/12° pan-Arctic grid. In addition, a river routing scheme (RVIC) is used to represent the freshwater flux from land to ocean. All components are coupled at high frequency via the Community Earth System Model (CESM) coupler version CPL7.

We have selected four parameters out of the set evaluated by Urrego-Blanco et al. (2016) and subject to their potential impact on sea ice and coupling across the atmosphere-sea ice-ocean interface. The total of 96 sensitivity simulations have been completed with fully coupled and forced RASM configurations, varying each parameter within its respective acceptable range. Using sea ice volume as a measure of sensitivity, the thermal conductivity of snow (ksno) parameter has produced the most sensitivity, in qualitative agreement with Urrego-Blanco et al. (2016). However, using dynamics related metrics, such as sea ice drift or deformation, other parameters, i.e. controlling the sea ice roughness and frictional energy dissipation, have been shown more important. Finally, different quantitative sensitivities to the same parameter have been diagnosed between fully-coupled and forced RASM simulations, as well as compared to the stand alone sea ice results.

How to cite: Osinski, R., Maslowski, W., Lee, Y., Craig, A., Clement-Kinney, J., and Niciejewski, J.: Sensitivity of Arctic sea ice to variable model parameter space in Regional Arctic System Model simulations., EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-13039, https://doi.org/10.5194/egusphere-egu2020-13039, 2020