Arctic sea ice sensitivity to atmospheric forcings in a sea ice model

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Atmospheric thermodynamic/dynamic forcings play an important role for sea ice variability and contribute to sea ice melting as much as contribution from underlying oceanic forcings. In this study, we examine the sensitivity of a standalone sea ice model (CICE5) to different atmospheric forcing data. Downward shortwave radiation, downward longwave radiation, air temperature, wind, precipitation and specific humidity fields from the NCEP-NCAR reanalysis version 2 (NCEP-NCAR R2), ECMWF Interim Re-Analysis (ERA-Interim) and Japanese 55-year Reanalysis Project (JRA-55) are used to force the CICE5. Annual cycle of the Arctic sea ice extent in each experiment reproduces the observed sea ice extent retrieved by satellite reasonably well and resembles each other, while sea ice thickness exhibits different characteristics in each simulation. Simulation results forced by ERA-Interim show the largest melting at the top during summer. We find that this is due to the relatively large downward longwave radiation forcing. Furthermore, ERA-Interim data gives the largest incoming total energy fluxes among other products. During winter, the volume differences among reanalysis products are largely determined by the ice export. The largest amount of ice export is attained in NCEP NCAR R2 due to its strong wind speed. However, the largest uncertainties in the estimation of annual mean sea ice volume arise from the differences in the radiative forcings in the three reanalysis.