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Quantifying drivers of internal sea-ice variability using feedback locking

Dirk Olonscheck (1), Thorsten Mauritsen (2), and Dirk Notz (1)

(1) Max Planck Institute for Meteorology, Ocean in the Earth System, Hamburg, Germany, (2) Max Planck Institute for Meteorology, Atmosphere in the Earth System, Hamburg, Germany

Current research highlights the importance of internal climate variability for the observed and modeled evolution of sea ice. However, the individual contribution of the various drivers of internal sea-ice variability are still largely unknown. We here investigate the individual role of atmospheric and oceanic drivers of sea-ice variability by in turn suppressing and imposing climate feedbacks and forcings in the Max Planck Institute Earth System Model MPI-ESM-LR. Specifically, we quantify the contribution of the water vapour feedback, the cloud feedback, the ice-albedo feedback, the surface wind forcing and the ocean heat forcing to the total sea-ice variability. Our results show an opposing response of Arctic and Antarctic sea-ice variability to the individual atmospheric feedbacks and oceanic forcings: while the variability in Arctic sea-ice area is reduced, the variability in Antarctic sea-ice area is enhanced by non-interactive feedbacks, except for the surface wind forcing that shows an opposite behaviour. We further present synergies and interactions among the locked feedbacks and discuss the physical mechanisms that explain the modelled results.