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Seasonal prediction of the austral summer Southern Annular Mode, and investigation of its connection to the Southern Ocean

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The Southern Annular Mode (SAM) modulates the eddy-driven-westerly jet in the southern mid- to high-latitudes. This modulation has major impacts on the seasonal climate in the southern hemisphere. Thus, a seasonal prediction of the SAM is desirable. Still, only few studies show a significant prediction skill on this timescale. In this contribution the prediction skill of the SAM is improved by using its physical links to the Southern Ocean.

We use the seasonal prediction system based on the Max-Planck-Institute Earth-System-Model (MPI-ESM) in mixed resolution (MR). In ensemble reforecasts for 1982 to 2016 we find large regions of the surface ocean in the southern mid- to high-latitudes to be significantly predictable on seasonal timescales. In contrast, the atmospheric variables in the same regions show only very little skill. In the austral summer season (December-January-February (DJF)) different ensemble members evolve considerably different in the ocean and the atmosphere. With physical links between the Southern Ocean and the SAM, identified in ERA-Interim, we only select ensemble members that also show these links. This process is repeated every year and leads to a new time series with a reduced number of ensemble members. To evaluate the prediction skill of the new ensemble mean SAM we use the correlation coefficient and the Heidke Skill Score (HSS). The reduced ensemble has a correlation with ERA of 0.50, while the full ensemble shows a correlation of 0.31. Similarly the reduced ensemble has a HSS of 0.35 compared to the HSS of the full ensemble of 0.17.

We additionally show that choosing the same ensemble members we selected for the SAM also increases the prediction skill for other atmospheric variables. The reduced ensemble has an increased prediction skill for pressure, wind, and temperature in the southern mid- to high-latitudes, to which the selection is targeted.