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Impact of the assimilated sea ice data product on seasonal climate predictions with MPI-ESM

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We examine the impact of choosing a particular satellite record of sea ice for the initialisation of a seasonal prediction system. Such systems have in the past usually only been initialised with data describing the state of the ocean and of the atmosphere. However, also sea ice yields a substantial source of predictability, as it plays an important role for the Earth's energy and water budget. Therefore, recent studies started to incorporate sea ice into the initialisation of seasonal forecasts.

For our study, we performed two assimilation runs with MPI-ESM from 1979 to 2012, where atmospheric and oceanic parameters as well as sea ice concentration were assimilated using Newtonian relaxation. The two assimilation runs differ only in the sea ice concentration dataset used for assimilating sea ice. In the first run, sea ice concentrations as derived by the NASA-Team algorithm are used, while in the second run sea ice concentrations computed from the Bootstrap algorithm are assimilated. A major difference between the two sea ice concentration data products involves the treatment of melt ponds. While for both products melt ponds appear as open water in the raw satellite data, the Bootstrap algorithm more strongly attempts to offset this systematic bias by synthetically increasing the retrieved ice concentration during summer months.

For each year of the two assimilation runs we performed a 10-member ensemble of hindcast experiments starting on 1 May. We find the anomaly correlation coefficient for Arctic sea ice area at 2-3 months lead time to be substantially larger for Bootstrap initialisation compared to NASA-Team initialisation. The root mean square error reveals that in the central Arctic the Bootstrap initialisation produces better predictions, whereas the NASA-Team initialisation outperforms the Bootstrap initialisation in the vicinity of the ice edge.

We investigate causes and mechanisms behind the dependence of the obtained prediction skill on the sea ice data product used for model initialisation, and evaluate possible links to the predictability of mid- and low-latitude climate.