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Influence of the initial ocean state on the predictability of the Antarctic sea ice at the seasonal timescale: a study with NEMO$_3$.6-LIM3

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The Southern Hemisphere sea ice extent experienced an overall positive trend over the last 30 years. However, after a record high in 2014, the sea ice extent in 2017 fell down to its lowest value since the beginning of satellite measurements in 1979. The Antarctic sea ice extent is now heading for a new record summer minimum in 2019 due to the unprecedented melting rate in December 2018. Those rapid sea ice fluctuations exemplify the high seasonal and year-to-year variability of Antarctic sea ice.

The reasons of those recent changes are still the subject of active research. Predicting those anomalies several months in advance is of prime importance for multiple activities, including the organization of scientific field campaigns. Besides, exploring the sources of Antarctic sea ice predictability at sub-seasonal-to-interannual timescales certainly helps refining our understanding of the Southern Ocean variability and the way the Southern Ocean interacts with sea ice.

Although there is evidence that recent changes in Antarctic sea ice have been triggered by the atmospheric forcing, the Southern Ocean has been pointed out as a source of predictability of the sea ice cover. In this study, we explore the influence over one year of a biased initial ocean state on the sea ice predictability. In this respect, a control simulation covering the period 1980–2016 was performed using the ocean-sea ice model NEMO$_3$.6-LIM3. The model was driven by atmospheric fields derived from the JRA-55 reanalysis. For one specific control year, the perturbation of the initial ocean state was achieved by simply selecting the 36 other control ocean states simulated over the period 1980-2016 by the model at the same time. Repeating this procedure for the 37 years of the control simulation, i.e. for the 37 different atmospheric forcing years, led us to create 37 x 37 simulations. We demonstrate how unsatisfactory it could be to attempt to produce the best possible sea ice forecasts from an uncertain ocean state, even if the atmospheric conditions were perfectly known, which is never the case in reality.