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The impact of denying sea ice information on the predictability of atmospheric processes over the Arctic and at mid-latitude regions

Leandro Ponsoni[1], Daniela Flocco[2], François Massonnet[1], Steve Delhaye[1], Ed Hawkins[2], and Thierry Fichefet[1]

[1]Université catholique de Louvain, Earth and Life Institute, Georges Lemaître Centre for Earth and Climate Research (TECLIM), Brussels, Belgium (leandro.ponsoni@uclouvain.be)

[2]Centre for Polar Observation and Modelling, Department of Meteorology, University of Reading, Reading, UK

In this work, we make use of an inter-model comparison and of a perfect model approach, in which model outputs are used as true reference states, to assess the impact that denying sea ice information has on the prediction of atmospheric processes, both over the Arctic and at mid-latitude regions. To do so, two long-term control runs (longer than 250 years) were generated with two state-of-the-art General Circulation Models (GCM), namely EC-Earth and HadGEM. From these two reference states, we have identified three different years in which the Arctic sea ice volume (SIV) was (i) maximum, (ii) minimum and (iii) a representative case for the mean state. By departing from each of these three dates (not necessarily the same for the two models), we generated a set of experiments in which the control runs are restarted both from original and climatological sea ice conditions. Here, climatological sea ice conditions are estimated as the time-average of sea ice parameters from the respective long-term control runs. The experiments are 1-year long and all of them start in January when ice is still thin, snow depth is small, air-ocean temperatures contrast the most and, therefore, the heat conductive flux in sea ice (at the surface) is nearly maximum. To robustly separate the response to degrading the initial sea ice state from background internal variability, each of the two counterfactual experiments (reference and climatological) consists of 50 ensembles members. Threstatedese ensembles are generated by adding small random perturbations to the sea surface temperature (EC-Earth) or to the air temperature (HadGEM) fields. Preliminary results reinforce the importance of having the right sea ice state for improving the (sub-)seasonal prediction of atmospheric parameters (e.g., 2m-temperature and geopotential) and circulation (e.g., Westerlies and Jet Stream) not only over the Arctic, but also at mid-latitude regions.

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