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Sea ice and atmospheric potential predictability in coupled GCMs

Daniela Flocco[1,2], Ed Hawkins[1], Leandro Ponsoni[3], François Massonnett[3], Daniel Feltham[2], and Thierry Fichefet[3]

[1]NCAS - Reading University, Department of Meteorology, Meteorology Department, Reading - UK (d.flocco@reading.ac.uk)
[2]CPOM - Reading University, Department of Meteorology, Meteorology Department, Reading - UK
[3]TECLIM - Earth and Life Institute Université Catholique de Louvain, Louvain-la-Neuve - Belgium

Assimilation of sea ice concentration satellite products has successfully been used to initialize sea ice models and coupled NWP systems. Sea-ice thickness observations, being much less mature, are typically not assimilated. However, many studies suggest that initialization of winter sea-ice thickness could lead to improved prediction of Arctic summer sea ice. We have examined the potential for sea ice thickness observations to improve forecast skill on timescales from days to a year ahead in two state-of-the-art coupled GCMs.

Here we examine the influence of Arctic sea-ice thickness observations on the potential predictability of the sea-ice and atmospheric circulation using idealised 'data denial' experiments. We perform paired sets of ensembles with the HadGEM3 and EC-Earth GCMs using different initial conditions retrieved from present-day control runs.

One set of ensembles start with complete information about the sea-ice conditions and is treated as "truth", and one set has degraded sea ice information. We investigate how the pairs of ensembles, all started in January, predict the subsequent evolution of the sea-ice state, sea level pressure and circulation within the Arctic with the aim of quantifying the value of sea-ice observations for improving predictions.

We show that accurate initialization of sea ice thickness improves the model prediction skill during the first month of simulation and that several sea ice state and atmospheric variables present a re-emergence of skill in September. Prediction skill of several oceanic variables is also observed. The two models present a good agreement in terms of the regions where they show either a skill gain or loss.