3rd International Conference on Earth System Modelling
Vol. , 3ICESM-249, 2012
3rd International Conference on Earth System Modelling

Potential decadal predictability and its sensitivity to sea ice albedo parameterization in a global coupled model

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This study analyses the potential climate predictability on decadal time scales and its dependency on sea ice albedo parameterization by performing two perfect ensemble experiments with the global coupled climate model EC-Earth. In the first experiment, the standard albedo formulation of EC-Earth is used, in the second experiment sea ice albedo is reduced. Under the assumption that the model realistically simulates real climate conditions, the potential predictability can be seen as upper limit of predictability. Knowing this upper limit is important to realistically estimate the outcome from decadal predictions and it helps diagnosing regions where decadal predictions are not skilful although the potential is there, thus indicating if it is meaningful to use different initialization or perturbation techniques for decadal predictions.

We analyse the potential prognostic predictability for a set of oceanic and atmospheric parameters. The decadal predictability of the atmospheric circulation is small. The highest potential predictability was found in air temperature at 2 m height over the northern North Atlantic and the southern South Atlantic. Over land, only a few areas are significantly predictable. The predictability for continental size averages of air temperature is relatively good in all northern hemisphere regions. Sea ice thickness is highly predictable along the ice edges in the North Atlantic Arctic Sector. The meridional overturning circulation is highly predictable in both experiments and governs most of the decadal climate predictability in the northern hemisphere.

The experiments using reduced sea ice albedo show some important differences like a generally higher predictability of atmospheric variables in the Arctic or higher predictability of air temperature in Europe. Furthermore, decadal variations are substantially smaller in the simulations with reduced ice albedo, which can be explained by reduced sea ice thickness in these simulations.