International workshop on seasonal to decadal prediction
Toulouse, France, 13-16 May, 2013

Assessing the decadal predictability of Arctic sea ice in CNRM-CM5.1 : A regional study

Agathe GERME

Centre national de Recherche Météorologique/Groupe d'Etude de l'Atmosphère Météorologique, Météo-France, Toulouse, France, agathe.germe@meteo.fr
Matthieu Chevallier, David Salas y Melia, and Emilia Sanchez-Gomez
Presenter : Agathe Germe

Based on the CMIP5 protocol for decadal experiments, the prognostic potential predictability (PPP) of Arctic sea ice on interannual timescales has been investigated in the CNRM-CM5.1 model. Sixteen 10-member ensembles of 10-year long hindcasts initialized on January 1st of years spanning the 1958-1996 period have been performed. The initial conditions are obtained from a coupled experiment performed with the same model, in which the ocean temperature and salinity under the mixed layer are nudged toward the ocean reanalysis NEMOVAR-COMBINE (Balmaseda et al., 2010). A surface restoring is also applied on sea surface temperature and salinity. We used standard CMIP5 historical twentieth to twenty-first century experiment performed with the same coupled model to investigate the added value of the ocean initialization for the interannual predictability and prediction of sea ice .

Our results showed that the CNRM-CM5.1 Arctic sea ice extent (volume) PPP is statistically significant for about 2 (5) years and 1 (4) years for the winter and summer respectively. It has been found that the predictability of the winter Arctic sea ice extent (SIE) mostly comes from the Atlantic sector, especially from the Greenland-Iceland-Norwegian (GIN) Seas. Concerning the sea ice volume (SIV), in addition to the Atlantic Sector, the Central Arctic plays also an substantial role. In accordance with this first PPP analysis, an added value of the initialization protocol has been found for the Labrador and GIN seas SIE predictions during the first two years. The Labrador and GIN Seas SIV exhibit the same added value of the initialization during 1-2 years. In contrast, central Arctic SIV predictions show an additional value of the initialization protocol during only a few months. This added value is only noticeable after detrending, showing that the predictability of the central Arctic SIV is dominated by climate external forcing rather than initial conditions. The time evolution of PPP has also been investigated, highlighting a decrease in PPP during the recent period. This decrease can be attributed to the thinning of the ice cover, as well as the disappearance of sea ice in areas characterized with strong ocean-sea ice interactions such as the convection zone in the Greenland Sea.