EGU21-15116, updated on 30 Jul 2021
https://doi.org/10.5194/egusphere-egu21-15116
EGU General Assembly 2021

Impact of initialization techniques on the predictive skill of Arctic-Atlantic region in the Norwegian Climate Prediction Model (NorCPM)

Leilane Passos[1,2,3], Helene R. Langehaug[2,3], Marius Årthun[1,3], Tor Eldevik[1,3], Ingo Bethke[1,3], and Madlen Kimmriz[4]

[1]University of Bergen, Geophysical Institute, Bergen, Norway (leilanepassos@gmail.com)
[2]Nansen Environmental and Remote Sensing Center, Bergen, Norway
[3]Bjerknes Centre for Climate Research, Bergen, Norway
[4]Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany

Society's need for operational climate forecast on seasonal to decadal time scales means an increased effort to improve climate prediction models. One way to address this issue is to investigate how initialization techniques affect the predictive skill in these systems.

Considering this, three implementations and two versions of the Norwegian Climate Prediction Model (NorCPM) are analyzed concerning the effects of different initialization methods on the predictive skill in the Arctic-Atlantic region from interannual to decadal time scales. We consider aspects as data assimilation (DA) in the surface vs subsurface, DA update of sea-ice, CMIP5 vs CMIP6 NorCPM versions, ensemble size, and initialization frequency. Besides that, a comparison between the predictive skill in the Norwegian Sea (NS) and the Subpolar North Atlantic Ocean (SPNA) is performed to identify characteristics that can help to improve predictions in these areas.

The additional assimilation of subsurface data increases the predictive skill in the SPNA at all lead times (1-10 years). In contrast, in the NS the skill is increased just at medium lead times (4-7 years). The strongly coupled DA, updating both ocean and sea ice, increases the predictive skill in the SPNA at all lead times, whereas the weakly coupled DA method, only updating ocean, results in higher skill in the NS at shorter (1-3 years) and medium (4-7 years) lead times. With respect to the NorCPM versions, the CMIP5 versions show higher predictive skill in both areas than the CMIP6 ones. In this comparison, besides the differences in the climate forcings, the new NorCPM version contributing to CMIP6 has minor code modifications, addition of interactive aerosol-cloud schemes, and an ocean component with biogeochemistry. Because of that, it is not possible to isolate just the effect of the climate forcings on the skill. Regarding the ensemble size and initialization frequency, NorCPM had a non-linear response; the skill varies with the area, variable, and lead times.

Considering the results, no single version was superior to the others with respect to the skill. In the SPNA, the CMIP5 version, assimilating both surface and subsurface observations, and using

strongly coupled DA, shows the highest skill. In the NS, we find the similar except that the highest skill is shown for the weakly coupled DA. Further investigation about technical aspects and the representation of dynamical process are necessary to better understand why the sea ice updating in the strongly coupled method is not beneficial to the NS.