Seamless sea ice prediction with AWI Climate Model

Seamless sea ice prediction with coupled model

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In Short

- Adapting the first version of the seamless sea ice prediction system in AWI-CM v1.1 to the newly developed AWI-CM v3.0.
- Improve the initial ocean state and sea ice forecasts by further assimilating more observations.

With Arctic sea ice continuously declining in recent decade, reliable sea ice prediction is urgently needed by stakeholders. The climate model that evolves the model to a long time is expected to satisfy the sea ice predictions from daily scale to decadal scale.

Based on the AWI climate model (AWI-CM v1.1), we developed the first version of the seamless prediction system. The sea ice concentration, sea ice thickness, sea ice drift, and sea surface temperature is assimilated into the system. A comprehensive evaluation was summarized in a recently published paper on the Journal of Advances in Modeling Earth Systems [1]. The assimilation has dramatically improved the ocean, sea ice, and atmosphere states. As an example, the impact of sea ice drift assimilation is shown in Figure 1.

With the newly developed AWI-CM 3.0, the ocean component has shifted from a finite element sea-ice ocean model (FESOM 1) to a finite volume sea-ice ocean model (FESOM 2); and the previous atmosphere component, ECHAM, has been replaced by OpenIFS from the European Centre for Medium-Range Weather Forecasts. The sea ice model is still not changed. AWI-CM v3.0 has shown a speed of 5 times faster than its ancestor AWI-CM v1.1, which a larger ensemble under the same computation costs is expected to better represent the cross-covariances matrix during multivariate data assimilation.

The assimilation system on AWI-CM v1.1 will be reconstructed to the new AWI-CM v3.0. More observations such as sea surface height, sea surface salinity, and temperature and salinity profiles will be assimilated in the new system apart from previous observations. Analysis over one decade will be conducted and evaluated after the accomplishment of the developing.

Using the initialization field over one decade, we will evaluate the prediction performance by sea ice re-forecasts. The forecast calibration will be applied to reduce model bias and improve the forecast skill. To further improve seasonal sea ice prediction, important parameters in the sea ice model such as sea ice/snow albedo, sea ice strength, eccentricity of the deformation curve will be optimized using the assimilation system. The optimized parameter together with the newly developed seamless sea ice prediction system will tackle the real short-term forecast and also the seasonal forecasts within the discipline of the Sea Ice Prediction Network Phase 2 (SIPN2).

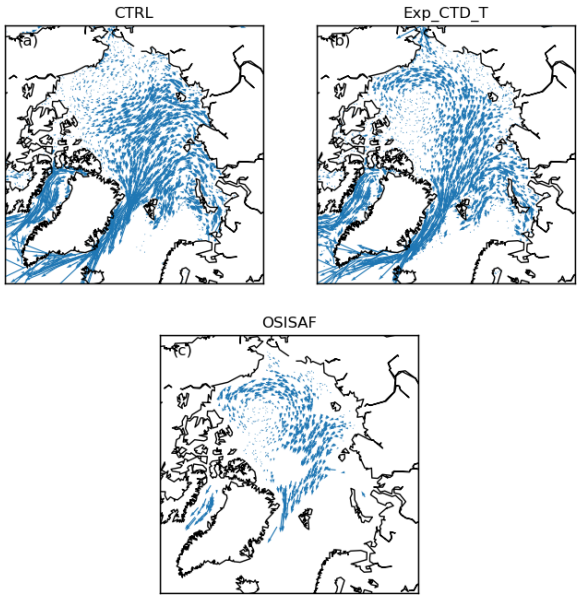

***Figure 1:** Sea ice drift assimilation in the Arctic. CTRL represents the results without data assimilation; Exp_CTD_T assimilates the sea ice drift; OSISAF is the observations with high quality.*

WWW

https://www.awi.de/en/science/junior-groups/seamless-sea-ice-prediction.html

More Information

[1] Mu, L., Nerger, L., Tang, Q., Losa, S.N., Sidorenko, D., Wang, Q., Semmler, T., Zampieri, L., Losch, M. and Goessling, H.F., Toward a data assimilation system for seamless sea ice prediction based on the AWI Climate Model. *Journal of Advances in Modeling Earth Systems*, 2020, doi:10.1029/2019MS001937

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