

# Improved Arctic sea-ice reproductions and their impacts on atmospheric and oceanic fields in an initialized climate model

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Arctic sea-ice decline has substantially influenced the climate system not only in the Arctic but also in the mid-latitudes, therefore, requiring more accurate sea-ice forecasts. Initialized climate models can predict the Arctic sea-ice area up to several months ahead (e.g., Ono et al., 2018), but still have bias in regional reproduction. In the present study, we newly conducted three sea-ice initialization experiments with ten ensembles for each and then evaluated the reproduction of sea-ice area, concentration, and velocity in 1979–2014 based on some metrics such as anomaly correlation coefficient and root mean square error. Comparisons of sea-ice reproducibility among experiments show that the sea-ice momentum constraint with wind stress provides further realistic sea-ice fields (e.g., see blue and cyan lines in Fig. 1). Moreover, the Arctic upper ocean states under sea ice, for which data were not assimilated, are also influenced, leading to the improved upper halocline layer in the Pacific sector. The sea-ice momentum constraint with wind stress is therefore likely an effective method for sea-ice initialization.

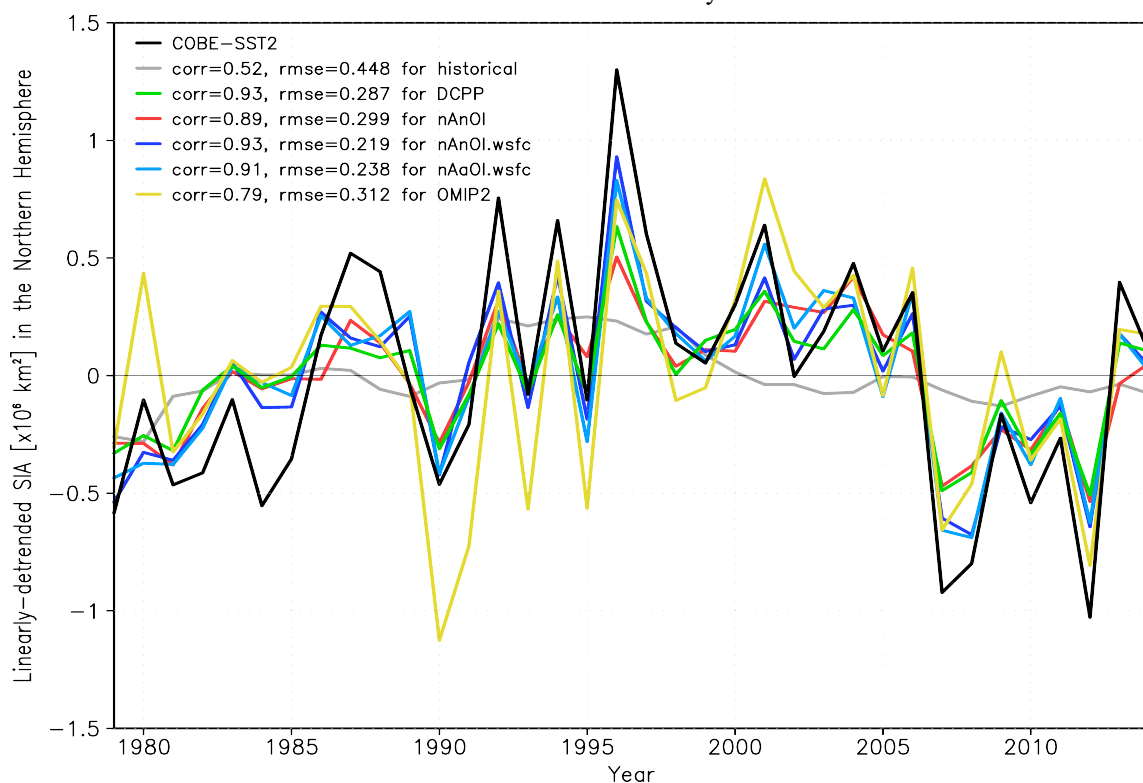


Figure 1. Time series of the linearly-detrended September sea-ice area in 1979–2014, from COBE-SST2 reanalysis data (black), historical (gray, Tatebe et al. (2019)), DCP (green; initialization with ocean temperature and salinity anomalies and sea-ice concentration, Kataoka et al. (2020)), nAnOI (red; initialization with only sea-ice concentration), nAnOI.wsfc (blue; as in nAnOI but for sea-ice motion constrained by diagnostic wind stress in the OMIP-2 simulation), nAaOI.wsfc (cyan; as in nAnOI.wsfc but for initialization with ocean temperature and salinity anomalies), and OMIP-2 (yellow; a global ocean–sea-ice model simulation with COCO4.9 based on phase 2 of the Ocean Model Intercomparison Project (OMIP-2), Tsujino et al. (2020)). The correlation coefficient (corr) and RMSE (rmse) between the model experiments and the reanalysis are presented at the top left corner.

## References

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