Development of Four-Dimensional Variational Global Ocean Data Assimilation System for Coupled Predictions in Japan Meteorological Agency and Evaluation of the effects of Argo Data Quality Control in the System

Authors: Yosuke Fujii (JMA/MRI, yfujii@mri-jma.go.jp), Ichiro Ishikawa (JMA/MRI, iishikaw@mri-jma.go.jp), Takuma Yoshida (JMA, t.yoshida@met.kishou.go.jp), Masashi Sumitomo (JMA, sumitomo@met.kishou.go.jp)

Abstract

JMA updated the coupled atmosphere-ocean prediction system in February, 2022. In this update, the Three-Dimensional Variational (3DVAR) global ocean data assimilation system used for oceanic initialization of the coupled model is replaced by a Four-Dimensional Variational (4DVAR) global ocean data assimilation system, named MOVE/MRI.COM-G3. MOVE/MRI.COM-G3 is composed of the lower-resolution (0.5°×1°) model, G3A, and the higher-resolution (0.25°×0.25°) model, G3F. Temperature, salinity, and sea surface height observations are assimilated into G3A through a 4DVAR method, and the data-assimilated temperature and salinity fields are downscaled into G3F through Incremental Analysis Updates (IAU). The resulting G3F fields are used as oceanic initial conditions for the coupled predictions.

A series of observing system experiments (OSEs) were conducted in order to evaluate the effects of Argo data quality control in the global ocean 4DVAR system. Between 2015 and 2020, about 15% of Argo floats develop the Abrupt Salinity Drift, which caused spurious increasing trend of the global salt content in a regular reanalysis result using the 4DVAR system. The spurious trend is mitigated by applying the gray list provided by the Argo Global Data Center (GDAC), and further reduced by assimilating the delayed-mode Argo data of the Argo GDAC instead of the real-time Argo data.

JMA is currently developing a new data assimilation system in which the global ocean model with 1/4 resolution is directly optimized by the 4DVAR methods. The new system improves representation of meso-scale eddies around the Kuroshio Extension over the current operational system. In the presentation, we further demonstrate the improvement of the new system.