

## Development of a global ocean data assimilation system based on a 4DVAR method

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A global ocean data assimilation system based on a 4-Dimensional Variational (4DVAR) method is currently being developed mainly for improving seasonal forecasts in Japan Meteorological Agency/ Meteorological Research Institute (MRI). The system is constituted of the analysis model with a coarse horizontal resolution to which temperature and salinity data are directly assimilated and the forecast model with a higher eddy-permitting resolution in which temperature and salinity fields are nudged to those in the analysis model. Both the models are based on MRI Community Ocean Model (MRI.COM), use tri-polar grids, and include sea ice models.

The analysis model has a zonal resolution of 1° and a meridional resolution of 0.5° with equatorial refinement to 0.3°. In the analysis model, temperature and salinity observation data are assimilated through a 4DVAR method with 10-day assimilation terms in which analysis increments for Incremental Analysis Updates (IAU) are optimized. The Sea Ice Concentration (SIC) fields are separately analyzed by a 3-Dimensional Variational (3DVAR) method and inserted into the model through IAU.

The forecast model has zonal and meridional resolutions of 0.25°. The temperature and salinity fields of the forecast model are using those fields in the analysis model through IAU with 5-day assimilation terms. The 3DVAR method of SIC with insertion of the result through IAU is also applied to the forecast model.

We are currently evaluating the accuracy of the oceanic fields reproduced by the global ocean data assimilation system. The analysis model with the 4DVAR scheme outperforms the same model with a 3DVAR scheme for the analysis accuracy of near-surface temperature fields. It also reproduces a fine structure of tropical instability waves which is physically consistent, and the forecast model represents the structure more clearly. They also improve the representation of SIC fields in polar regions over the current operational system to which sea ice data assimilation is not applied.

Keywords: Ocean Data Assimilation, 4DVAR, Sea Ice Data Assimilation