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Data assimilation for ocean and climate study

ISHIKAWA, Yoichi[1*] ; NISIKAWA, Shiro[1] ; MASUDA, Shuhei[1] ; TOYODA, Takahiro[2] ; SUGIURA, Nozomi[1] ; WAKAMATSU, Tsuyohi[1] ; NISIKAWA, Haruka[1] ; SASAKI, Yuji[1] ; IGARASHI, Hiromichi[1] ; TANAKA, Yusuke[1] ; AWAJI, Toshiyuki[3]

[1]JAPAN Agency for Marine-Earth Science and Technology, [2]Meteorological Research Institute, [3]Kyoto University

The data assimilation systems have been developed for the initialization of the numerical weather forecasting, and applied for other fields in recent studies. In the area of ocean and climate research, there are several interesting studies to utilize the advantage of the many aspects of the data assimilation, in addition to the ”ocean weather forecasting”.

The atmosphere-ocean coupled data assimilation system using variational adjoint method is one of the unique systems, which is developed in JAMSTEC. The target of this system is the variability of seasonal to inter-annual scale so that the integrated dataset of the observation both in atmosphere and ocean are derived using variational adjoint method. The remarkable feature of the system is that the bulk coefficients are estimated as well as the initial condition of the oceanic fields since the lower boundary condition of the atmospheric model are very important for seasonal to inter-annual time scale. Recently, the marine ecosystem model are embedded into this system and seasonal forecasting not only for physical fields but also for biogeochemical fields are carried out.

For oceanic long-term reanalysis dataset, the interesting data assimilation systems are developed using variational adjoint method (Masuda et al., 2010). In this data assimilation system, strong constraint conditions are applied for entire assimilation period over 50 years, so that the derived dataset are consistent with the dynamics in ocean general circulation model. This means that the derived dataset satisfies the conservation rules and suitable for the 4-dimensional analysis of the heat and water fluxes. This advantage is also suitable for the analysis of the oceanic tracers and useful for the biogeochemical studies.

The data assimilation system for the marine ecosystem model is also notable issues. Since it is difficult to identify the optimal parameters in the marine ecosystem model, the parameter estimation studies are widely used. The realistic fields of the biogeochemical variables are successfully obtained by parameter estimation (Toyoda et al., 2013).