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Editorial

Some progress on ocean data assimilation in China: Introduction of the special section "Ocean Data Assimilation"

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This special section is the scientific legacy of the 13th National Ocean Data Assimilation and Numerical Simulation Conference of China, which was held in Changsha, China during December 3–4, 2020 with more than 160 participants from 35 units in China. It continued a series of National Ocean Data Assimilation conferences which began in 2003, which played an important role in the development of ocean data assimilation in China. In this 13th conference, there were 41 oral presentations and 15 posters, which focused on ocean data assimilation methods, ocean reanalysis data, developments and operational application of ocean data assimilation systems, assimilation of new type ocean observations, ocean targeted observation analysis, coupled data assimilation, ocean models and parameter estimation, etc. This conference was hosted by National University of Defense Technology, and co-hosted by the Institute of Atmospheric Physics of Chinese Academy of Sciences, the South China Sea Institute of Oceanology of Chinese Academy of Sciences, the Second Institute of Oceanography of the Ministry of Natural Resources, Ocean University of China, Tianjin University and Hohai University.

From this conference, we can see that ocean data assimilation has made great progress. In summary, there are six main aspects as follows: firstly, ocean data assimilation methods are improved continuously, especially new progress in hybrid data assimilation; secondly, there are continuous breakthroughs in data assimilation application of new type ocean observations, such as Glider data, ocean current data, acoustic information, etc; thirdly, the combination of ocean data assimilation and machine learning is showing more and more good prospects; fourthly, with the development of the Earth system model technology, the coupled data assimilation has become a hot spot; fifthly, ocean reanalysis and data fusion products are important for ocean study, some ocean reanalysis products, such as China's CORA 2.0 reanalysis, have been greatly improved on the spatial and temporal resolution, and other new data fusion products, including the fusion of multi-source altimeter products, sea ice reanalysis dateset have been developed; sixthly, some new ocean model parameter estimation have been proposed and show good results.

During the conference, the organizing committee announced *Acta Oceanologica Sinica* for publishing the research results on Ocean Data Assimilation. There are ten papers accepted for this special section, mainly from the first two aspects above, which are very important.

In this special section, Shen et al. (2022a) used the hybrid data assimilation method called Localized Weighted Ensemble Kalman Filter (LWEnKF) to assimilate along-track sea surface height (AT-SSH), swath sea surface temperature (S-SST) and *in-situ* temperature and salinity (T/S) profiles for checking the operational application potential of this filter; Zhao et al. (2022) presented an improved approach based on the equivalent-weights particle filter (EWPF) that uses the proposal density to effectively improve the traditional particle filter, which was tested with the Lorenz 96 model numerical experiments ; Song et al. (2022) proposed a new nudging scheme for the operational prediction system of the National Marine Environmental Forecasting Center (NMEFC) of China, which mainly aimed at improving El Niño–Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) predictions; Yang et al. (2022) designed a reconstruction method called the multi-scale high-order recursive filter (MHRF) to reproduce the refined structure of sea ice field, which is a combination of Van Vliet fourth-order recursive filter and the three-dimensional variational (3D-VAR) analysis; Chen et al. (2022) designed two comparative reconstruction schemes under the optimal interpolation framework to diagnose and evaluate the contribution from satellite measurements and Argo observations to the reconstructed analysis, allowing for better configuration of assimilation parameters; Zhang et al. (2022) applied the gradient-dependent optimal interpolation to reconstruct daily subsurface oceanic environmental information according to fishery dates and locations based on Argo temperature and salinity profiles; Liu et al. (2022) investigated the sensitive areas in targeted observation for predicting the Kuroshio large meander (LM) path using the conditional nonlinear optimal perturbation approach with the Regional Ocean Modeling System (ROMS); Shen et al. (2022b) developed a two-stage inflation method for parameter estimation, which can address the collapse of parameter ensemble due to the constant evolution of parameters and was applied in observation system simulation experiment with CESM; Wu et al. (2022) applied empirical orthogonal function (EOF) analysis to a 50-year long time series of monthly mean positions of the Kuroshio path south of Japan from a regional reanalysis to explore temporal-spatial oceanic variation in relation with the three typical Kuroshio paths; Han et al. (2022) developed two offline bias correction methods for sea surface temperature (SST) forecasts and validated the performances using bias correction experiments implemented in the South China Sea with six-year (2003–2008) datasets.

This special section systematically summarizes some, but not all, of the research results from the 13th National Ocean Data

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Assimilation and Numerical Simulation Conference of China. In the future, ocean models will develop to higher resolution, and ocean data assimilation will also face the problem of processing non-linear non-Gaussian information. With the development of earth system model, ocean model will also be coupled with atmosphere, land surface, ocean waves and sea ice models, the coupled data assimilation will be a hot topic; and the development of machine learning also prompt us to seek the combination of data assimilation and machine learning.

References

Chen Jian, Yan Hengqian, Bao Senliang, et al. 2022. Evaluating the contribution of satellite measurements to the reconstruction of three-dimensional ocean temperature fields in combination with Argo profiles. Acta Oceanologica Sinica, 41(2): 65–79, doi: 10.1007/s13131-021/1858-3

Han Guijun, Zhou Jianfeng, Shao Qi, et al. 2022. Bias correction of sea surface temperature retrospective forecasts in the South China Sea. Acta Oceanologica Sinica, 41(2): 41–50, doi: 10.1007/s13131-021-1880-5

Liu Xia, Wang Qiang, Mu Mu. 2022. Identifying the sensitive areas in targeted observation for predicting the Kuroshio large meander path in a regional ocean model. Acta Oceanologica Sinica, 41(2): 3–14, doi: 10.1007/s13131-021-1838-7

Shen Meng, Chen Yan, Wang Pinqiang, et al. 2022a. Assimilating satellite SST/SSH and *in-situ* T/S profiles with the Localized Weighted Ensemble Kalman Filter. Acta Oceanologica Sinica, 41(2): 26–40, doi: 10.1007/s13131-021-1903-2

Shen Zheqi, Tang Youmin. 2022b. A two-stage inflation method in parameter estimation to compensate for constant parameter evolution in CESM. Acta Oceanologica Sinica, 41(2): 91–102, doi: 10.1007/s13131-021-1856-5

Song Xunshu, Li Xiaojing, Zhang Shouwen, et al. 2022. A new nudging scheme for the current operational climate prediction system of the National Marine Environmental Forecasting Center of China. Acta Oceanologica Sinica, 41(2): 51–64, doi: 10.1007/s13131-021/1857-4

Wu Xiaobo, Zhao Yanling, Han Guijun, et al. 2022. Temporal-spatial oceanic variation in relation with the three typical Kuroshio paths south of Japan. Acta Oceanologica Sinica, 41(2): 15–25, doi: 10.1007/s13131-021-1941-9

Yang Lu, Li Dong, Zhang Xuefeng, et al. 2022. A multi-scale high-order recursive filter approach for the sea ice concentration analysis. Acta Oceanologica Sinica, 41(2): 103–115, doi: 10.1007/s13131-021-1940-x

Zhang Chunling, Wang Danyang, Wang Zhenfeng. 2022. Fishery analysis using gradient-dependent optimal interpolation. Acta Oceanologica Sinica, 41(2): 116–126, doi: 10.1007/s13131-021-1895-y

Zhao Yuxin, Yang Shuo, Jia Renfeng, et al. 2022. The statistical observation localized equivalent-weights particle filter in a simple nonlinear model. Acta Oceanologica Sinica, 41(2): 80–90, doi: 10.1007/s13131-021-1876-1