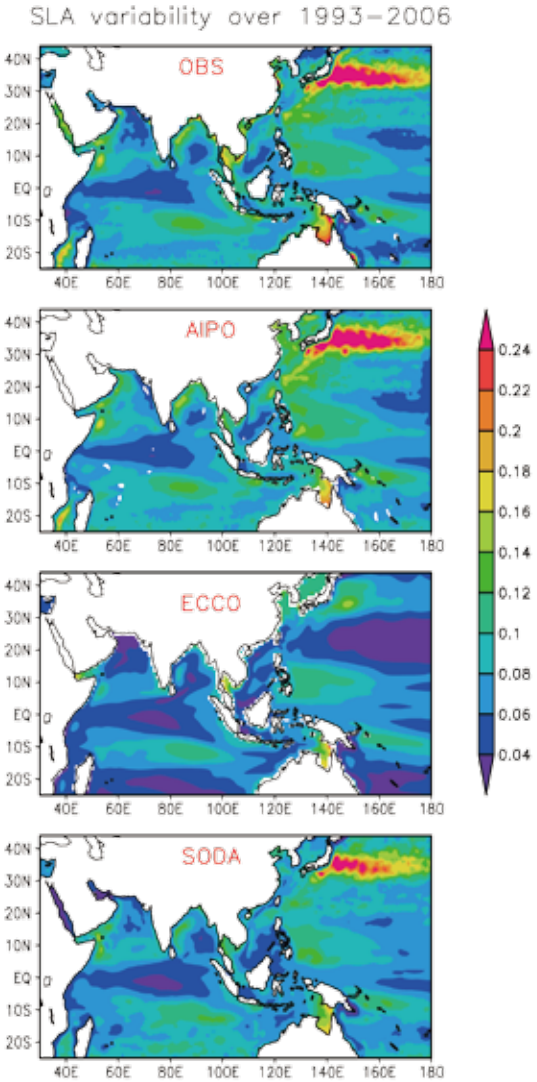
An Ocean Multi-variate Data Assimilation System in the Indo-West-Pacific Oceans

The joining area of Asia and Indian-Pacific Ocean (AIPO) refers to the ocean area that surrounds the East Asian and South Asian continents and connects the Western Pacific and the Indian oceans. The air-sea interaction in the area is one of the key factors that affect large-scale climate variation in China. Therefore, it is important to develop an ocean data assimilation system and deliver high-resolution ocean state estimation for the area via reanalysis data.

The existing global ocean reanalysis datasets such as Estimating the Circulation and Climate of the Ocean (ECCO) and Simple Ocean Data Assimilation (SODA) can cover the region but the horizontal resolutions are relatively low. With such resolutions, it's difficult to resolve the complicated coastal lines, like the one in the Indonesian

The joining area of Asia and Indian-Pacific Ocean (AIPO), showed enclosed by red dots. (Diagram by IAP)



Interannual variablities of sea level anomalies: (a) observations (b) assimilation experiment, (c) ECCO and (d) SODA. (Figure by IAP)

Through Flow (ITF) region that connects the Indian Ocean and the Pacific Ocean. Strong activities of meso-scale eddies occur in the region, with cases visible in the Korushio extension region and the South China Sea. An eddy-permitting resolution is necessary to represent those meso-scale induced variabilities.

A group of scientists headed by Dr. YAN Changxiang from the Institute of Atmospheric Physics developed an ocean data assimilation system based on the ensemble optimal interpolation (EnOI) method. They presented the thinning of observations (super-observing) and domain partitioning for lower computational cost. They adopted a different temperature-salinity assimilation scheme corresponding to the layer model (HYCOM) that assimilates layer thickness observations calculated from observed temperature and salinity profiles to adjust the model layer thickness and current fields. They then assimilated temperature or salinity observations to adjust the model temperature or salinity, followed by diagnosing the model salinity or temperature.

A 14-year reanalysis product (1993–2006) is generated by assimilating various types of observations such as in-situ profiles from ARGO, XBT, CTD, TAO *etc*., remotely-sensed sea surface temperature and altimetry data into the HYCOM model. A series of quantitative and qualitative evaluations of this assimilation system were carried out by comparing its results with independent *in-situ* profiles, sea surface currents, drifters, and tide gauges. It's found that the resultant reanalysis from the assimilation system reconstructs the basin-scale ocean circulation and meso-scale eddies, captures seasonal or interannual variabilities with strong correlations with observations and reduced RMSEs, and shows good agreement with tide gauges as well as observed ITF transports. Moreover, It outperforms SODA and ECCO products in these aspects.

For more information please refer to:

Yan C.X., Zhu J., and Xie J. P. (2015) An Ocean Data Assimilation System in the Indian Ocean and West Pacific Ocean. *Adv. Atmos. Sci.*, 32(11), 1460–1472, doi: 10.1007/s00376-015-4121-z. (in press)