

## ***Interactive comment on “Data Assimilation of Argos profiles in North-west Pacific Model” by Z. Wang et al.***

**Z. Wang et al.**

wang\_zhaoyi@163.com

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Thanks for reviewers' comments of the manuscript. We have paid more attention to the writing approaches of the revised context. Major comments: The specification of the background-error covariance matrix is one of the most important aspects affecting the performance of the assimilation system. The detailed description of B have been given in the revised manuscript. In the data assimilation system, the background-error covariance matrix is decomposed into horizontal correlations and vertical covariances. Horizontal correlations are modeled using four iterations of a first-order recursive. The Empirical Orthogonal Functions (EOFs) is used to represent the vertical component of the background-error covariance matrix. The EOFs were calculated from the daily means of a full-resolution model simulation covering 1995-2005, and contain covariances of sea level, temperature and salinity. Each monthly set consists of 20 EOFs

with 100 z-levels in the vertical. Fig. 3 shows the map of yearly mean background-error standard deviation reconstructed from the EOFs, where the Fig. 3(a) refers to sea level error, Fig. 3(b) to temperature at surface and Fig. 3(c) to salinity at surface. There are three main steps in the system as shown in Fig. 2: a) preparation of temperature and salinity observations from Argo profiles; b) integration of the NwPM model using the previous day analysis increments to correct the initial condition; c) running the data assimilation system using the daily observation innovations (or misfits) to produce the new analysis increments for the next model integration. In this assimilation scheme, the Argo observations are not assimilated in the model when the misfits are computed. Therefore, the observation misfits are independent from the assimilation and can be used to validate the performance of the system, if temporal correlations of the observation errors are neglected as usual. In the section of model validation, the independent in situ observations, such as profiles, satellite data and reprocessed datasets, are used to validate the performance of data assimilation system. I'm sorry for the figure caption confusion, which has been corrected in the new manuscript. Thanks for your detailed comments again. Minor comments: 1. We have used "Argo" instead of "Argos". 2. The assimilation window is daily. 3. We have used OISST instead of MGDSSST for comparison. 4. The new Fig. 7 is used instead of Fig. 3.1, and the caption has been confirmed. 5. In the Fig. 7, the depths below 200m has been masked out, because the Argo profiles mainly distributed in the region deeper than 2000 m. The Bohai Sea has been masked out in the new figure. In the experiment of 2010, the reductions of SST bias are similar in different seasons. 6. Fig. 10. monthly mean salinity bias at surface, is used instead of Fig. 3.2, where the SSS error calculated by BF and EN4.0.2, and by AF and EN4.0.4 has been shown. 7. The depth of Fig. 11 and 12, which are used instead of Fig. 3.3 and 3.4, has been limited to 1000 m. 8. Fig. 3.5 has been deleted in the manuscript, where has added the new Fig. 4 to show the vertical distribution of misfits for temperature and salinity. Fig. 6, which is used instead of Fig. 3.7-3.8, are related to whole column. That's all. Thanks very much for the reviewer's comments again.

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