

Assimilation of expendable bathythermograph, ARGO and Topex/Poseidon-Jason-1 altimeter data

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A variational scheme of assimilating temperature, salinity and altimetry data is developed and used in a tropical Pacific OGCM. The scheme is a bivariate one with three dimensional temperature and salinity fields as control variables. The altimetry observations are assimilated by minimizing a cost function that contains distance between sea surface dynamic height of analysis and the observed sea surface height from altimetry data. The cost function also contains a background term in which vertical correlations of background errors and the nonlinear T-S relationship are considered. After the altimetry data is assimilated we obtain a new set of temperature and salinity profile data. Then temperature and salinity profile data from expendable bathythermograph (XBT), ARGO and these estimated from altimetry are assimilated at each model level.

To examine the above scheme, an assimilation experiment is carried out in the tropical Pacific. As a comparison, we also performed a simulation run without assimilation with the same initial condition and atmospheric forcing. To obtain a quantitative evaluation of the assimilation results, we take out some temperature and salinity observations from TAO stations as independent data and calculated differences between the assimilation and independent data.

The assimilation of XBT, ARGO and T/P-J altimeter data produces significant improvement over the simulation. The improvement of temperature is very notable. Especially in the eastern Pacific, the accuracy reaches 0.3°C at most. For the salinity field, not only sea surface salinity but also the subsurface salinity has been analyzed successfully. The proposed method not only provides a new way to more effectively use T/P/J altimeter data, but also provides a new and feasible way to study salinity fields where the sparse salinity observation, even no salinity observation exist.

Keywords: T-S relationship; vertical correlations; variational scheme; altimeter data.