Salinity and Temperature in the Upper Ocean Model-Float Comparisons

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Introduction

There are presently over 500 active Argo floats (Fig. 1) deployed by 14 different national programs. A global array of 3000 floats at average spacing of 5 degrees in latitude and longitude is planned by late 2005. All data are available in near real-time via the GTS or internet (http://www.nemo.iroce.obs-mip.fr/argo.html).

The ECCO ocean estimation activity is a synthesis of the WOC Eklidav, obtained by constraining the MIT model by these data over the period 1992-2001. The model has a 1 degree grid with 21 levels. For our comparisons we use monthly means of temperature, salinity, velocities and surface fluxes.

Sea surface height variability due to salinity

Sea surface height signals due to anomalous salinity (SSH-S, 0.0001 dbh) are commonly 2 cm or less, relative to WOD91 climatology. However, as shown in Fig 5 there are many profiles having SSH-S of 4 cm or more, and some exceeding 8 cm. Profiles with large SSH-S are clustered in space and time, with clusters in the central equatorial Pacific and the southeastern tropics and subtropics. In the highly evaporation region of the southern Pacific, where the subsurface salinity maximum is formed, large SSH-S is produced. Argo float data due to a very salty surface layer extending down to 300 m. Model-Float comparisons in this region (Fig. 3, 4), reveal that the model has a salinity anomaly relative to its own mean, but the structural details are different in the float than in the model. Capturing the location and magnitude of such anomalies is an area where the inclusion of salinity in comparison with float data is essential for understanding the strength and depth changes of the model.

Methods of Comparison: Sums and Profiles

The model output used is in the form of monthly mean temperature and salinity fields on a 1-degree global grid. Argo profiles are snapshots of a different time and place every 10-14 days. In order to compare these data, a model data was interpolated both spatially and temporally onto the float track. This means model fields were interpolated spatially to the float track and subtracted from both the model field and the float field. Qualitative comparisons can be made between the profiles of temperature and salinity (Fig. 3). For more quantitative analysis, it is necessary to establish a correlation between the model fields and the float data. This requires the use of statistical methods to determine the relationship between the model fields and the float data.

Preliminary Results/Future Work

Balancing the heat and salinity budgets, by incorporating estimated upward and downward fluxes from the WOD91 model into the float data, is one of the primary objectives of this project. An initial study towards this goal, we define a 24x24 degree box and examine the balance of heat in the model. Both model and float data were used to calculate the heat flux at the sea surface. The results show that the model heat budget is in balance, and that the model is able to reproduce the observed surface heat fluxes. This suggests that the model is able to accurately represent the heat exchange at the sea surface.

This diagram shows the difference between the observed and model heat fluxes. The model heat flux is represented by the black line, while the observed heat flux is represented by the blue line. The difference between the two lines is shown in the red line. The results show that the model is able to accurately reproduce the observed heat fluxes.

The model heat budget is shown in the left panel, while the observed heat fluxes are shown in the right panel. The results show that the model is able to accurately reproduce the observed heat fluxes.

Floats track in the south Pacific in the west of the high salinity north equatorial current (Fig. 6). This emphasizes the role which the floats can play in understanding the ocean.