Argo impact studies with the Mercator 1/4° global ocean data assimilation system

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Description of impact study carried out: 1-year Observing System Experiment (OSE) have been performed to evaluate the impact of Argo observations on the 1/4 degree global ocean data assimilation system. SST, SLA and In situ observations are assimilated in the reference experiment, as they are for the real time ocean analysis and forecast production. In two additional experiments, all of the Argo floats and 50% of Argo data are withheld from the analysis. Observing System Simulation Experiments, where observations are simulated from a fully known ocean simulation, were also carried out to simulate extension of the future deep ARGO network and its impact on the global ocean analysis.

Results: In the OSEs, a significant impact of Argo data assimilation is identified on temperature and salinity estimates up to 2000 m, linked with an Observation – Model forecast error reduction both in term of variability and bias. The performance of the operational forecasting system is highlighted by comparing analysed fields to observations. The temperature estimation is improved by around 40% when Argo is assimilated (figure 1). A comparable result is obtained for salinity. The performance of the system is degraded if only half of the array is assimilated. Time series of the anomaly of heat and salt content for different depth ranges show a strong sensitivity to the density of the Argo array.
The analysis quality at depth greatly benefits from assimilation of simulated observations deeper than 2000 m, even with a sparser spatial coverage than the surface layers.

Conclusion: Argo data assimilation is greatly improving the skills of the operational 1/4 degree global ocean system. This improvement is very significant in the mix layer and in region with high variability. At depth, the improvement is more localized in some specific dynamical regions. From an integrated point of view, the assimilation of Argo profiles is absolutely crucial to correctly evaluate heat and salt content variability. Deep ocean bias could be potentially controlled if deep observations are assimilated (figure 2).

Figures:

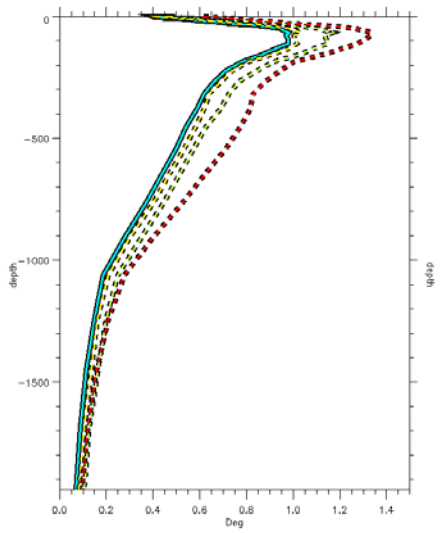

Figure 1: RMS of temperature innovations from 0-2000m for Run-Ref(blue), Run-Argo1/2(yellow), Run-NoArgo (green) and Free Run (red).

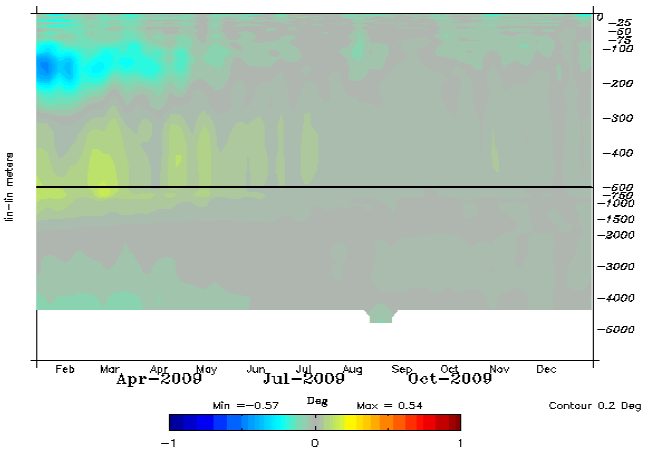

Figure 2 : Global mean innovation in temperature when 1/9 of simulated Argo floats dive up to 4000 meter depth.