An assessment of equatorial variability and surface currents in FOAM-NEMO against observations, including the TAO Array

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The Met Office run daily analyses and 5 day forecasts using several operational configurations of the Forecast Ocean Assimilation Model (FOAM) system, using the NEMO ocean and LIM2 sea ice models. These configurations include the ¼ degree global (ORCA025) and the 1/12th degree regional North Atlantic, Indian Ocean and Mediterranean domains. Hindcast analyses of all these operational configurations have been run for the period 2007 to 2008, both with and without data assimilation.

Qualitative assessment of simulated equatorial sea surface height between the AVISO observations and the assimilative global model indicated good agreement. In the free running global model there was a drift in sea surface height associated with a global freshwater imbalance. However, when this drift was removed the simulated sea surface height agreed reasonably well both with the observations and with the assimilative model. Qualitative assessment of simulated equatorial SST against the OSTIA observational analysis also indicated good agreement.

Surface currents were assessed quantitatively against observations at ~45 TAO Array moorings for the Global and Indian Ocean models through visual inspection, correlation, several cost functions, RMS, mean errors, Taylor diagrams etc. Visual inspection suggested that zonal currents are less challenging to model accurately than the meridional flows due to their lower variability and consistent direction. The overall global equatorial quantitative assessment suggest that the assimilative global model had good skill (r=0.77) for zonal currents but poor skill (r=0.46) for meridional currents. By comparison, the non assimilative global model had average skill (r=0.67) for zonal flows but poor skill (r=0.36) for meridional flows. In both runs, a band of negative mean bias of the order of 20cm/s was evident along the equator in all ocean.

The regional 1/12th degree Indian Ocean model had similar skill to the global ¼ degree ocean model at simulating equatorial currents in the Indian Ocean, i.e. no additional skill was evident for the higher resolution model.