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Recent assimilation developments of FOAM the Met Office ocean forecast system

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FOAM is the Met Office's operational ocean forecasting system. This system comprises a range of models from a 1/4 degree resolution global to 1/12 degree resolution regional models and shelf seas models at 7 km resolution. The system is made up of the ocean model NEMO (Nucleus for European Modeling of the Ocean), the Los Alomos sea ice model CICE and the NEMOVAR assimilation run in 3D-VAR FGAT mode. Work is ongoing to transition to both a higher resolution global ocean model at 1/12 degrees and to run FOAM in coupled models.

The FOAM system generally performs well. One area of concern however is the performance in the tropics where spurious oscillations and excessive vertical velocity gradients are found after assimilation. NEMOVAR includes a balance operator which in the extra-tropics uses geostrophic balance to produce velocity increments which balance the density increments applied. In the tropics, however, the main balance is between the pressure gradients produced by the density gradient and the applied wind stress. A scheme is presented which aims to maintain this balance when increments are applied.

Another issue in FOAM is that there are sometimes persistent temperature and salinity errors which are not effectively corrected by the assimilation. The standard NEMOVAR has a single correlation length scale based on the local Rossby radius. This means that observations in the extra tropics have influence on the model only on short length-scales. In order to maximise the information extracted from the observations and to correct large scale model biases a multiple correlation length-scale scheme has been developed. This includes a larger length scale which spreads observation information further. Various refinements of the scheme are also explored including reducing the longer length scale component at the edge of the sea ice and in areas with high potential vorticity gradients. A related scheme which varies the correlation length scale in the shelf seas is also described.