Investigating the potential impact of assimilating total surface current velocity data in the Met Office's global ocean forecasting system

Accurate prediction of ocean surface currents is important for ship routing and offshore operations, marine safety, modelling advection of nutrients and pollutants, our understanding of large scale ocean circulation and coupled forecasting. However, observations of ocean surface currents are not presently available with global coverage. Several satellite missions with the capability to measure Total Surface Current Velocities (TSCVs) have been proposed. The ESA Assimilation of TSCV (A-TSCV) project investigates the potential impact of assimilating satellite TSCVs in global ocean forecasting systems. An Observing System Simulation Experiment (OSSE) framework is used to test the assimilation of TSCVs in coordinated experiments using two global ¼ degree ocean forecasting systems, the Met Office Forecasting Ocean Assimilation Model (FOAM) and the Mercator Ocean International system. Synthetic observations were generated for all standard observation types (sea surface temperature, sea-ice concentration, sea level anomaly and profiles of temperature and salinity) from a 1/12th degree free running nature run. In addition, TSCV observations expected from a Sea surface KInematics Multiscale monitoring (SKIM) like satellite were simulated. In this presentation we focus on the impacts of TSCV assimilation in the Met Office FOAM system. We will provide an overview of the OSSE experiment design, demonstrate the impact of assimilating TSCVs and outline some areas for improvements. We will show that TSCV assimilation has the potential to significantly improve ocean forecasts with improvements to global surface velocity Root Mean Square Error (RMSE) of 23% and a 4 day gain in forecast accuracy as well as improvements to global sea surface height RMSE of 14%. We will also show that away from the equator the majority of the benefit of TSCV assimilation comes from corrections to geostrophic velocities with corrections to ageostrophic velocities being poorly retained in the model. We suggest an approach to potentially improve the correction of ageostrophic velocities by initialising Near Inertial Oscillations.

Jennifer Waters (Met Office), Matthew Martin (Met Office), Robert R King (Met Office), Michael Bell (Met Office)