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GLAD is part of the Consortium for Advanced Research on Transport of Hydrocarbon in the Environment (CARTHE) designed to understand the dispersion of surface materials under the action of ocean surface processes. As part of the experiment, ocean environment forecasts were used to aid in the initial deployment of 300 surface Lagrangian drifters in the northeastern coastal Gulf of Mexico during July 2012. The performance of the ocean predictions relative to the drifter observations indicates the present level of skill in predicting development of the physical processes controlling environmental conditions in such areas.

The predictions were based on numerical model forecasts, and in this case the Navy Coastal Ocean Model (NCOM) is used covering the Gulf of Mexico at both 3km and 1km resolutions nested into the global NCOM at 1/8 degree resolution. All publicly available satellite and in situ data were assimilated into the ocean model daily. Just prior to the experiment time period, the ocean community suffered loss of the satellite altimeter on ENVISAT, and the Jason-1 satellite was in the process of moving to a new orbit leaving only the Jason-2 data stream. Just prior to the experiment started on July 20 2012, the Jason-1 data stream was reestablished in its geodetic orbit, and the CryoSat2 data stream was added. These changes in the altimeter constellation presented an extreme challenge for the experiment, and did impact the forecast accuracies.

Post analysis indicated that the models were not generating the details in frontal positions of eddies that were observed in the satellite altimeter data and in gridded maps. The features were also observed in the drifter trajectories. A series of experiments were initiated in which variations in the correlation scales and background errors of the assimilation process were systematically changed. It was found that a key aspect is that a long time decorrelation is required for the altimeter data to properly affect the model forecast performance. Typical cycling assimilation systems use the most recently received observations through an analysis to correct the model initial condition or the model trajectory over one day's time. The implication is that the time decorrelation function is a delta function in the case of just resetting the initial condition or a 24 hour boxcar function if inserting the analysis over 1 day. The errors are much longer time scale just as the features of the ocean are, and increasing the temporal data influence reconstructed the features in the observations with much greater fidelity.

The submesoscale frontogenesis structure is predictable conditioned on accurate prediction of the mesoscale flow field that forces the ageostrophic secondary circulation. Experiments with the model results shows that surface divergence is much stronger than divergence at 40m depth, and this leads to different behavior in the dispersion of particles at each depth initially placed on an evenly spaced 1km grid. At 40m depth, the particle density remains relatively uniform even out to 40 days' time. At the surface after only 3 days, the particles aggregate along lines of surface convergence driven by the submesoscale frontogenesis.

This experiment is the first time ocean forecasts played such an integral part in the placement of such a grand Lagrangian data set. It provides a good reference point for the systems' performance. Assimilation of the drifter velocity observations has been examined to demonstrate the impact of this data source that is not presently used. The drifters are sampling the geostrophic velocity or surface height slope. The drifters provide information very similar to the altimeter satellites for an area of high interest with persistent coverage.
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