2. Multivariate reconstructions using DINEOF

DINEOF (Data Interpolating Empirical Orthogonal Functions, Alvera-Azcárate et al (2005)) is an EOF-based technique used in a multivariate approach to reconstruct missing data. We explore the benefits of using DINEOF to analyze Sea Surface Temperature (SST), chlorophyll-a concentration, and QuikSCAT winds. In particular, we studied the utility of combining SST + chlorophyll, SST + 1 day lagged SST + chlorophyll, and SST + 1 day lagged winds to construct cloud-free SST (and other) fields. To assess the quality of the reconstructions, we compared reconstructed fields to in situ data. We found that the combinations of SST + chlorophyll and SST + lagged SST + chlorophyll significantly improved the results obtained by reconstructions of SST alone. All the experiments correctly represent the SST, and as an example we discuss a downwelling event observed on the West Florida Shelf.

3. Surface Geostrophic Drifters

We simulate Lagrangian surface drifter trajectories by analyses of surface geostrophic currents. Sea level anomaly fields from the CLS Space Oceanography Division (Collecte Localisation Satellites, http://www.cls.fr) are added to a mean Sea Surface Height (SSH) field calculated from the HYCOM model to obtain absolute SSH, the gradient of which is used to calculate geostrophic currents. Simulated trajectories then follow from a Runge-Kutta second order integration, with a time step of 6 hours. In the following images for the Caribbean Sea and Gulf of Mexico the drifter trajectories are superimposed on our cloud-free OI-SST product. These trajectories are updated weekly.

4. OI Surface Wind Fields

We presently produce a 3-hourly wind field analysis by merging NCEP NAM winds with in situ data using Optimal Interpolation (OI). Since the NAM winds are coarse we combine the NAM analyses offshore of the 200m isobath with in situ winds inshore of the 200m isobath. The resulting OI wind fields were shown to improve upon the accuracy of coastal ocean circulation model simulations (Alvera-Azcárate et al, 2004) and these winds are used as forcing functions for our present WFS circulation models (e.g., Barth et al., 2006).

Here we present a similar analysis using QuikSCAT winds in place of NAM winds, and we study the potential for using this satellite data source as a part of the OI analysis. One disadvantage of QuikSCAT winds is their temporal resolution (two satellite passes daily compared to 3-hourly time step for NAM). An advantage, however, is that QuikSCAT data can be used near the coast.

Two OI analyses (QuikSCAT + in situ data and NAM + in situ data) are shown to the right in comparison with in situ buoy winds omitted from the analysis (buoy sgof1). The NAM OI analysis is too weak compared to the buoy data. The QuikSCAT OI winds are stronger and able to better represent the observations.

5. OCG ATLAS

As part of our COMPS and SEACOOS Coastal Ocean Analyses and Visualization Systems (OCG) project, new tools and products are available at the products mentioned in this poster, as well as oceanic and T/S climatologies, are available at the Ocean Circulation Group Atlas, at http://ocgatlas.marine.usf.edu/ATLAS/ocgatlas.htm

For a complete list of available variables, please take one of the handouts at the bottom of this poster.

6. Conclusions

Multivariate DINEOF

The use of multiple variables in the analysis of cloudy SST helps improve the accuracy of the reconstruction. The combinations SST + chlorophyll, SST + 1 day lagged SST + chlorophyll, and SST + 1 day lagged winds all improved the results obtained using only SST.

Surface geostrophic drifters

We have a Lagrangian surface drifter simulation tool for the Gulf of Mexico based on surface ocean circulation model. These drifters are used to track waters of Mississippi River origin after Hurricane Katrina. As an application example consider a series of downwelling and upwelling sequences observed on the West Florida Shelf (WFS). We use satellite SST along a transect situated at 28°N (see picture at right). Temperature variations are seen over the entire transect with large cloud gaps. The reconstructed SST shows variations more clearly, and inspection of the winds (not shown) accounts for the warming and cooling of the SST field. Such upwelling and downwelling occurrences are of great ecological importance. DINEOF is capable of accurately reproducing these in the presence of cloud contaminations.

Our first apportionment on one process was to trace one pan of Mississippi River waters after Hurricane Katrina. Due to the northern penetration of the Loop Current, waters of Mississippi River origin were rapidly transported towards the Florida Keys.

References


We would like to thank the Institute for Marine Remote Sensing (USF) for the SST satellite data.