A new gridding method for satellite altimeter data

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Satellite altimeter data have been very useful in the study of oceanic eddies. With a growing abundance of satellite data, characterization of the eddy field has greatly expanded. The TOPEX/Poseidon (T/P) altimeter has provided the most accurate sea level variation data to date (*Fu et al.*, 1994). However, the T/P ground track spacing is relatively large (314 km between parallel tracks at the equator) and eddies are only detected while they cross the satellite tracks but are missed when they are between tracks. An example of this problem can be observed in a Gulf of Mexico numerical simulation. In this example, two anticyclonic eddies' cores are between simulated T/P tracks (Fig. 1), so it is not possible to accurately estimate the magnitudes and positions of these eddies applying conventional interpolation methods to the T/P along track sea surface height (SSH) data. In order to identify more features of the eddy field, different processes have been developed to fill the gaps between the tracks (*Hendricks et al.*, 1996; *Jacobs et al.*, 2001).

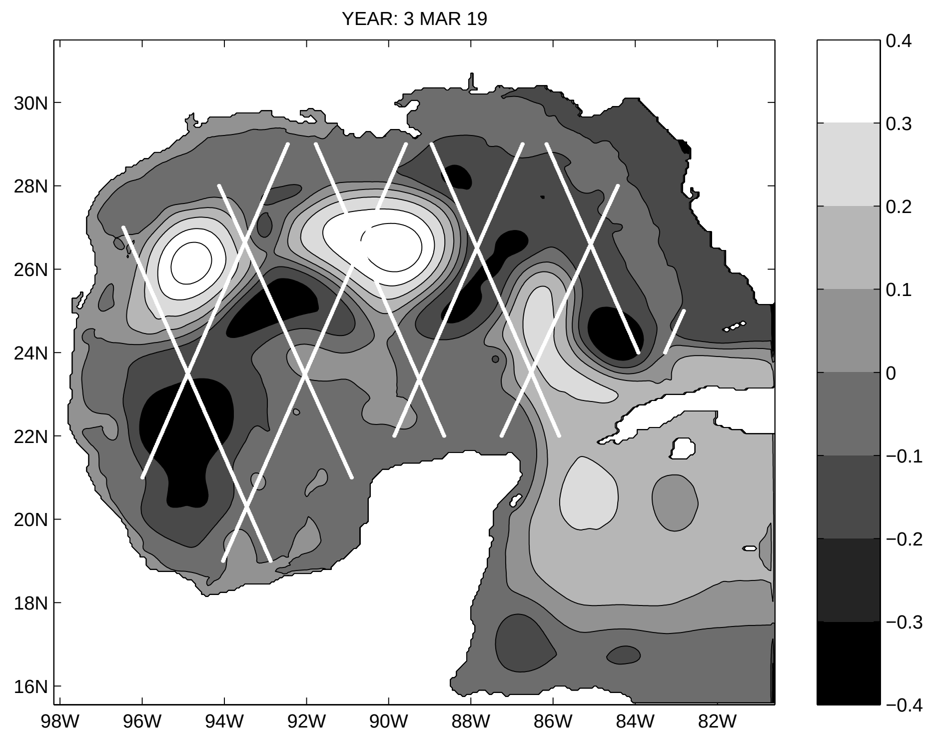

Figure 1. The sea surface height from the COAPS/FSU Gulf of Mexico numerical simulation using the Navy Coastal Ocean Model (NCOM). The white lines are simulated Topex/Poseidon tracks.

Here, a new satellite data processing method that combines propagating empirical orthogonal function (EOF) analysis and an interpolation algorithm based on eigen-modes is tested. The method uses the SSH anomaly data along the tracks, at different times and locations, in order to recognize moving features and recover their position, even at times when they are between tracks. For each EOF mode, space and time information is obtained and interpolated to a high resolution grid. Finally, the field is reconstructed onto the new grid by summing the significant modes.

This technique is applied to two idealized cases: In Experiment One a hypothetical eddy moves eastward. The SSH is sampled periodically along the simulated satellite tracks. Then the technique is applied to interpolate the data in

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space and/or time onto a high resolution grid, recovering the eddy when it is between tracks (Fig. 2). In Experiment Two a synthetic eddy moves in a circle around the center of the domain. The eddy is also well reproduced when it is between tracks (Fig. 2).

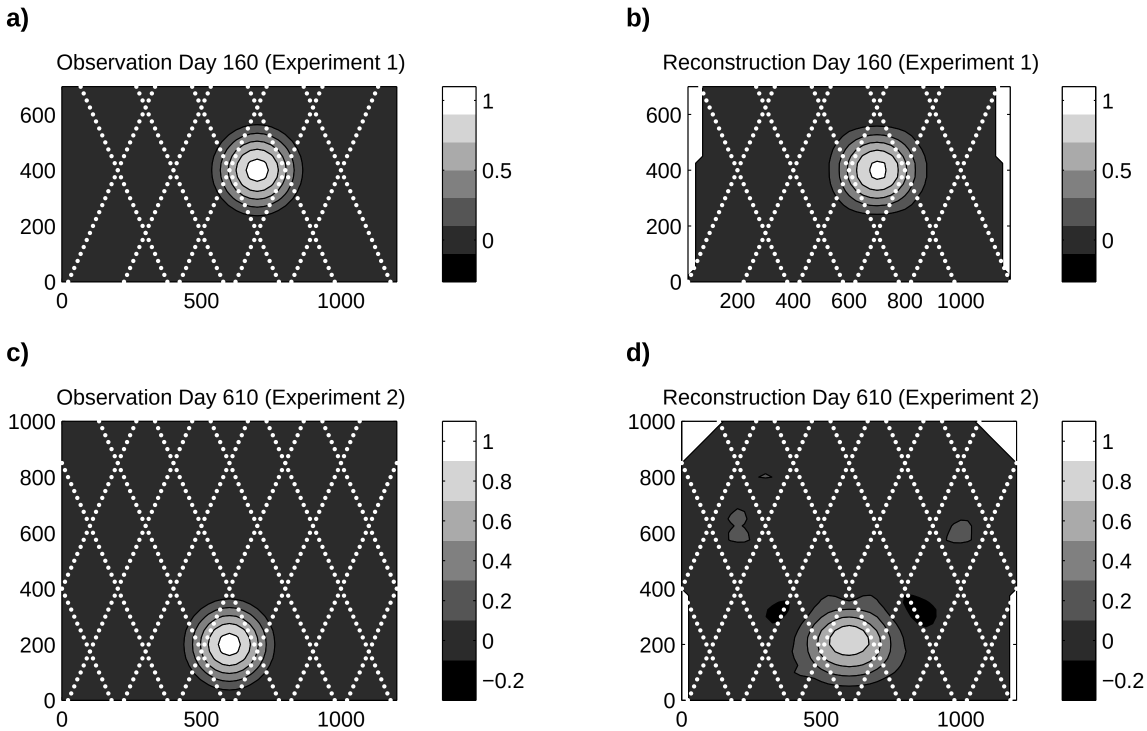

Figure 2. a) The synthetic SSH field for Experiment One with an eddy moving westward; b) The reconstructed field for Experiment One; c) The synthetic SSH field for Experiment Two with an eddy moving anticlockwise around the center of the domain; d) The reconstructed field for Experiment Two. The white dots are simulated satellite tracks.

The real ocean behaves quite differently from these two idealized cases. Usually there is more than one feature within a domain of interest; the data along satellite tracks are not simultaneous, so they have to be synchronized first; data may be missing or erroneous, etc. However, these experiments show that this technique is a promising way to more fully utilize information from the valuable satellite altimeter data. It is also a good candidate for creating SSH fields for numerical model initialization and data assimilation.

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