A NEW MAPPING METHOD FOR PROPAGATING DATA

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ABSTRACT

Satellite altimetry data have been very useful in the study of oceanic eddies. However, eddies are only detected while they cross the satellite tracks but are missed when they are between tracks. A natural question is: should we use information of both time and space to do the mapping? A new satellite data processing method combines propagating empirical orthogonal functions (EOF) analysis and an interpolation algorithm based on variance decomposition and maps the data into new time and/or space grids objectively. Here, as an example, the method is applied to the T/P along-track sea surface height (SSH) anomaly data. For each EOF mode, space and time information is obtained, and then mapped into a finer grid. Finally, the field is reconstructed into the new grid by summing the significant modes. The method was tested by performing several simple experiments and another experiment using synthetic SSH from a realistic high resolution model. Finally a reconstruction of SSH from satellite data was applied to the Gulf of Mexico.

INTRODUCTION

Data gaps or holes are a problem fundamental to many geophysical data records. The gaps are frequently the consequence of uneven or irregular sampling (in time and/or space). For example, in the study of eddies in the Gulf of Mexico with TOPEX/Poseidon data, major difficulties arise when the eddies locate between tracks (Fig. 1), *i.e.*, how these eddies could be detected. This problem can be solved by using the information from both time and space. One way to do this is to use the propagating EOF analysis.

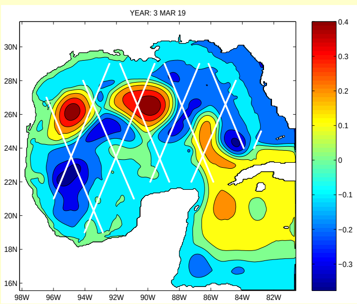

Figure 1. The sea surface height (SSH) from the COAPS/FSU Gulf of Mexico numerical simulation using the Navy Coastal Ocean Model (NCOM). The white lines are simulated TOPEX/Poseidon tracks.

METHODOLOGY

Propagating EOF analysis decomposes data into orthogonal modes and identify the propagating information within each mode. After the application of it, the spatial and temporal information are gotten. Among all the eigenmodes, the top several most significant modes were picked. After the manipulation of the complex temporal function (TF) and spatial function (SF) associated with each mode, the information is mapped into a regular finer grid in time and/or space. With this information, the new TFs and SFs are rebuilt and the reconstruction of data was finished by summing the product of each TF and SF.

RESULTS

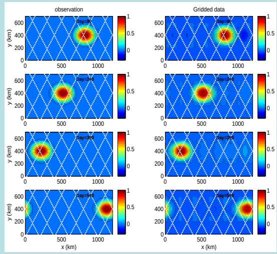

Figure 2. The left panel is the synthetic data with an eddy moving to the west. The white dots are the simulated satellite tracks, i.e., the positions where observations are be obtained. The right panel shows the reconstructed data based on the simulated satellite observations.

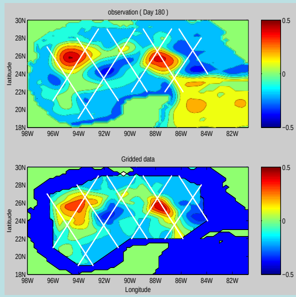

Figure 3. The upper panel is the SSH from the NCOM Gulf of Mexico simulation; the lower panel shows the reconstructed data. The white dots are the simulated satellite tracks.

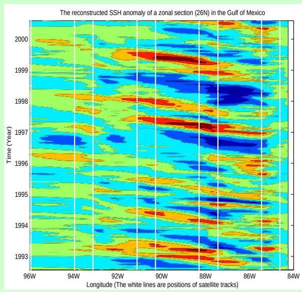

Figure 4. Reconstructed T/P SSH anomaly of a zonal section(26N) in the Gulf of Mexico.

SUMMARY

- The basic idea behind this method is map the reconstructed propagating EOFs into a finer space/time grid combining information from both time and space at the same time
- This method has been proved to be very good at identifying the life cycle of large eddies
- It is a better way to more fully use information from the valuable satellite altimetry data and a good candidate for creating SSH fields for numerical model initialization and data assimilation
- It could be a good method to study mesoscale features and Rossby wave propagation

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