A new interpolation method for high frequency forcing fields

Jorge Zavala-Hidalgo[1], Peng Yu, Steven L. Morey, Mark Bourassa, and James J. O'Brien

Center for Ocean-Atmospheric Prediction Studies, The Florida State University

A new generation of very high-resolution ocean numerical models allows the study of processes close to the inertial frequency and even in superinertial frequencies. These processes require that the models be forced by high frequency forcing fields, which in many cases are obtained from atmospheric numerical models, typically in 6 hourly fields. These fields commonly represent the values of surface fluxes of wind stress, evaporation, precipitation, and heat fluxes at the specified date and time instead of averages for a given period. Oceanographers usually linearly interpolate these fields in time to the model time step. This is a good approximation for features that behave like standing waves, i.e., change their amplitude without displacement When there are strong moving features, such as fronts, the interpolated fields behave like duplicated standing fronts changing their amplitude instead of moving. Here, a new technique for the interpolation of the forcing fields in time that recovers the movement of features is tested in a simple case. This method decomposes the fields into their complex empirical orthogonal functions, then the information from each mode is used to interpolate in time and finally the significant modes are added. This technique is a particular case of the time and space interpolation that is currently applied to altimetry data at the Center for Ocean-Atmospheric prediction Studies (Yu et al., 2003).

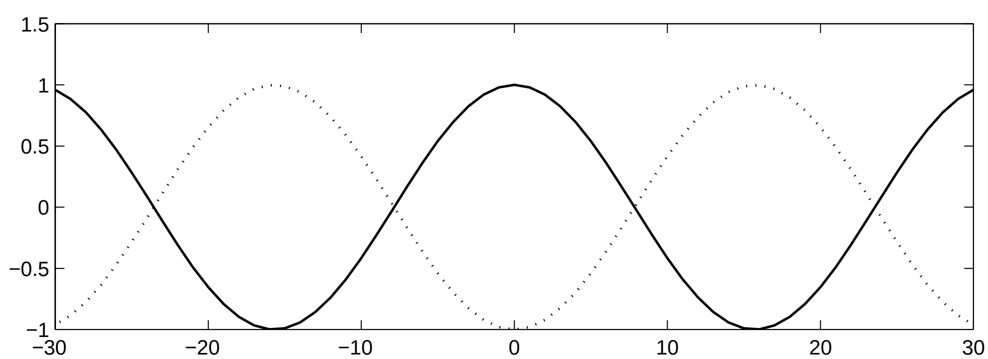

Figure 1. Position of the synthetic feature at time t = 0 (continue line), and at time t = 1 (dotted line). The abscissa axis is the distance in arbitrary units and the ordinate axis is the amplitude.

A moving feature defined by a cosine shape moving to the right illustrates the technique (Fig. 1). A standard weighted linear interpolation between two sampled fields shows that the feature in the interpolated field changes its amplitude, duplicates, and does not translate in space. In contrast, with the new technique, the amplitude has a smaller variation, and the feature translates (Fig. 2).

[1] zavala@coaps.fsu.edu

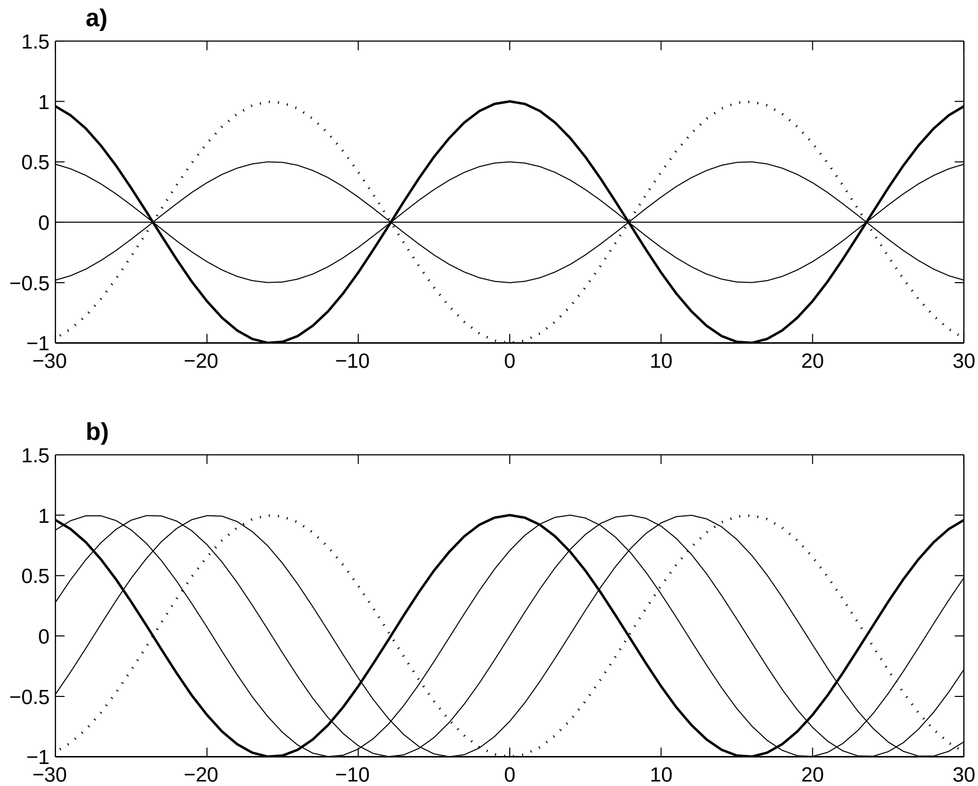

Figure 2. Position of the feature between two sampled times interpolated by a) weighted linear interpolation and b) the complex empirical orthogonal function interpolation method. The thick and dotted lines represent the position of the wave at time t = 0 and t = 1 respectively, and the thin lines represent the estimated positions at times t = 1/4, t = 1/2, and t = 3/4.

A generalization of this technique is being developed and applied to the high frequency forcing fields used to force the COAPS/Florida State University Gulf of Mexico simulation (Morey et al., 2003).

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References

Morey, S. L., P. J. Martín, J. J. O'Brien, A. A. Wallcraft, and J. Zavala-Hidalgo: Export pathways for river discharge fresh water in the northern Gulf of Mexico. Submitted to *J. Geophys. Res.,* 2003.

Yu, P., J. Zavala-Hidalgo, J. J. O'Brien, A new gridding method for satellite altimeter data, Research Activities in Atmospheric and Ocean Modeling, CAS/JSC Working Group on Numerical Experimentation, 2003.