569b Wavelet Modeling of Dissolved Oxygen Variations in Mobile Bay

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Mobile Bay drains a watershed of 11.3×10^4 km^2, and receives the sixth largest freshwater discharge on the North American continent. Mobile Bay has been suffering from deterioration of its water quality with increasing human impacts. Dissolved oxygen (DO) has been used as a measure of overall water quality of an aquatic system. Hypoxia (low DO) and anoxia (no DO) have been frequently observed in Mobile Bay.

The complex nature of DO, being simultaneously affected by many processes including both physical and biogeochemical, provides a difficult yet challenging task for developing a comprehensive model to understand DO dynamics. Understanding the variations in DO in a water body would require simultaneous consideration of all the causing processes. What make the situation even more complex are the different spatial and time scales at which the causing processes act and the non-linearity of the causing processes. Such dynamic variations of DO merit a modeling system with multi-scale features, which should be able to capture the contributions from various causing processes with different time scales.

Wavelets are a framework of multi-scale basis function that can transform a time-series data into its components with different time scales, with each scale associated with a different frequency. In this research, a wavelet-based model is developed to describe quantitative cause-effect relationships between the physical processes and DO with less refined consideration of biogeochemical processes. In tests with data collected from Mobile Bay, the proposed model provides an effective method for representing causes of the variations in DO.

Keywords: dissolved oxygen, Mobile Bay, wavelet, modeling, multi-scale