**Improving Estimates of Ecosystem Metabolism Computed from Dissolved Oxygen Time Series**

Marcus W. Beck, M. C. Murrell, J. D. Hagy III

Abstract/Concept Overview

In aquatic ecosystems, time series of dissolved oxygen (DO) have been used to compute estimates of integrated ecosystem metabolism, including primary production, respiration and net ecosystem metabolism. Central to this open water or “Odum” method is the assumption that the dissolved oxygen time series is a Langrangian specification of the flow field. In reality, most DO time series are instead collected at fixed locations such as moorings or docks, such the method must assume that changes in dissolved oxygen principally reflect ecosystem metabolism and that effects due to advection or mixing can be neglected. A statistical model using weighted regression was applied to separate variability in DO associated with the metabolism from variability attributable to other such as tidal or other advection in estuaries, thereby helping to partially relax this assumption and improve estimates of ecosystem metabolism. The model is based on the recognition that that daily fluctuations in DO caused by metabolism are associated with the solar cycle, whereas other fluctuations in estuaries are likely to be associated with water level changes and generally exhibit pregression of phase relative to the solar cycle. The weighted regression model was applied, rather than methods commonly used for detiding in physical oceanography, to allow for the complex and dynamic patterns of DO changes relative to advection. The method was developed and tested using a simulated DO time series with known biological and physical components, and then applied to one year of continuous monitoring data from four water quality stations within the National Estuarine Research Reserve System. The results indicate that over relatively long time series, unbiased estimates of average metabolic rates can be computed without separating physical transport effects from metabolism effects on DO. However, the weighted regression approach is a useful way to reduce variability in estimates of ecosystem metabolism caused by advection, particularly when the magnitude of tidal influence is high. We suggest that by reducing the effects of physical transport on metabolism estimates, there may be increased potential to empirically relate metabolic rates to causal factors on times scales of several days to several weeks. Estimates of variability associated with physical advection may also be more interpretable, since convolution of physical and biological effects can be reduced, providing increased potential to resolve differences in metabolism across a mosaic of estuarine habitats such as open waters, tidal creeks, and intertidal marshes.