

**Title**

Influences of suspended sediments on the ecosystem in Lake Michigan: a 3-D coupled bio-physical modeling experiment

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**Abstract**

The influence of suspended sediments on the Lake Michigan ecosystem was examined using a 3-dimensional (3-D) coupled biological and physical model developed by Chen et al. (part I). The model was driven by the realistic meteorological forces observed in March 1998, with daily inputs of suspended sediment concentration that were derived from temporally and spatially interpolated satellite imagery. The model results show the significant impact of a seasonally recurring coastal resuspension plume on the spatial and temporal variation of the nutrients and plankton in southern Lake Michigan. The plume-released nutrients played an essential role in maintaining the nutrient level in the lake. Although the growth of phytoplankton in the plume depended on the availability of nutrients and light, the offshore decrease in phytoplankton biomass still satisfied the Sverdrup's relationship. Cross-shore fluxes of nutrients and phytoplankton were controlled by episodic wind events with a period of 5–7 days: offshore during southward winds and onshore during northward winds. The flux estimates for biological variables suggest that the microbial food web is a key contributor to secondary production in southern Lake Michigan and the lower trophic level food web system could be dynamically divided into two decoupled loops: (1) detritus–bacteria–microzooplankton–large zooplankton; and (2) nutrient–phytoplankton–detritus. The model-predicted spatial distributions of nutrients and phytoplankton were in reasonable agreement with observations taken during the 1998 EEGLE interdisciplinary cruises, suggesting that the model was sufficiently robust to capture the basic characteristics of the Lake Michigan ecosystem during the plume event.

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