Modeling circulation in lakes: Spatial and temporal variations

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ABSTRACT: The influence of spatial and temporal variations in wind forcing on the circulation in lakes is investigated using field data and the three-dimensional Estuary and Lake Computer Model (ELCOM) applied to Lake Kinneret. Lake Kinneret field data from six thermistor chains and eight wind anemometers deployed during July 2001 are presented. Internal wave motions are well reproduced by the numerical model when forced with a spatially uniform wind taken from a station near the lake center; however, simulated seiche amplitudes are too large (especially vertical mode 2) and lead observations by 3-10 h (for a 24-h period wave) at different locations around the lake. Consideration of the spatial variation of the wind field improves simulated wave amplitude, and phase error at all stations is reduced to less than 1.5 h. This improvement is attributable to a better representation of the horizontally averaged wind stress and can be reproduced with a spatially uniform wind that has the same horizontally averaged wind stress as the spatially varying wind field. However, a spatially varying wind field is essential for simulating mean surface circulation, which is shown to be predominantly directly forced by the surface-layer-averaged wind stress moment.

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