Dynamics of spatiotemporal heterogeneity of cyanobacterial blooms in large eutrophic Lake Taihu, China

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Cyanobacterial blooms caused by eutrophication in Lake Taihu, China are recognized as highly heterogeneous spatiotemporally. It is assumed that the high spatiotemporal heterogeneity of algal blooms is determined by divergence/convergence processes in the fluid medium. To address this issue, three episodes of the dominant spatial patterns of hourly simulated divergence fields of current in Lake Taihu in July of 2012 were analyzed using a hydrodynamic numerical model combined with the Empirical Orthogonal Function (EOF) method. The results showed that, on days that blooms occurred, the first two EOF modes explained 89.4% of the variability and the dominant spatial patterns of stronger convergence zones were in agreement with the regions of bloom occurrence and accumulation. When no blooms occurred, the first EOF mode explained 72.5% of the variability and divergence zones were dominant in the lake. Both the simulated hourly average divergence field and the first EOF mode in the time interval in which blooms occurred further confirmed that blooms accumulate in the current convergence zones. These findings explain the dynamic mechanism of occurrence of cyanobacterial blooms and will facilitate forecasting of short-term blooms for protecting drinking water supplies and managing risk.