

# Numerical simulations of nutrient transport changes in Honghu Lake Basin

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Nutrients transported from catchments are one of the most important sources for lake eutrophication. The Honghu Lake Basin, located at the middle reaches of the Yangtze River, was chosen as the study area, the numerical simulations were used to assess the relative roles of natural, climate-induced changes versus human-related activities in changes of the nutrient transportation. The simulation results showed that the effect from human activities increased rapidly, and had become a dominant factor.

The research by Gui Feng & Yu Ge showed the relative role of natural, climate-induced changes versus human-related activities in nutrient transportation changed over time. The study has been reported in Volume 53, Number 15 (August, 2008) of *Chinese Science Bulletin* because of its significant impact on lake eutrophication study.

And the numerical simulations were applied in this paper to get long time series of data to estimate the nutrient loading from watershed. The simulation results showed that there were variations in nutrient production and changes in the range and rate. The effect from human activities on the watershed nutrient transportation increased rapidly, and had become a dominant factor in changes of the nutrient transportation.

Nitrogen (N) and phosphorus (P) are the main driving forces of primary productivity in a lake, excessive input and enrichment of N and P will induce the occurrence and persistence of harmful alga bloom. Although lakes naturally receive nutrient inputs from their catchments and the

atmosphere, many human activities such as sewage inflows, runoff from agricultural fields have greatly accelerated the eutrophication process. Our research aimed to evaluate the trajectory of nutrient transportation over the catchments and its contribution to a lake's eutrophication, to assess the relative roles of natural, climate-induced changes versus human-related activities in changes of the nutrient transportation.

Based on the analysis of driving factors, three experiments corresponding to natural, traditional and modern agriculture processes respectively were designed to evaluate the changes of nutrient inputs from catchments under the three environments.

The simulation results showed that there were variations in nutrient production and concentration. For three periods of the experiments, production and concentrations of TN (total nitrogen) and TP (total phosphorus) increased greatly. And there were also variations in increasing range and rate over time. The nutrient transportation experienced slowly long-term increases during 1840?1950, then showed a relatively rapid increase during the period of 1950?1980s and the period from 1980 to the early 1990s. And from the later 1990s to now, an obviously increasing trend occurred.

Three periods were divided based on the nutrient transportation changes. During 1840?1950, the Honghu Lake Basin experienced a long-term slow increase, while it experienced an increasing rate of 1.4%, 2.4% and 15% individually during the periods of 1950?1980s, 1980?early 1990s, and later 1990s?now, showing an obviously increasing trend of eutrophication.

The study showed that there might be a critical value of the nutrient concentration and production transported into the lake system. To delineate the critical state of the watershed nutrient transportation may help determine the limitation of total amount that can control pollutants

sourced from the basin, and restore lake water environments.

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