An investigation of enhanced recessions in Poyang Lake: Comparison of Yangtze River and local catchment impacts


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Abstract
Changes in lake hydrological regimes and the associated impacts on water supplies and ecosystems are internationally recognized issues. During the past decades, the persistent dynamics of Poyang Lake, the largest freshwater lake in China, has caused water supply and irrigation crises for the 12.4 million inhabitants of the region. There is conjecture as to whether this dynamic is caused by climate variability and/or human activities. This study examines long-term datasets of catchment inflow and Lake outflow, and employs a physically-based hydrodynamic model to explore catchment and Yangtze River controls on the Lake's hydrology. Lake water levels fell to their lowest during 2001-2002 relative to previous decades. The average Lake size and volume reduced by 164 km² and 11 x 10^6 m³ during this period, compared to those for the preceding period (1970-2010). Model simulations demonstrated that the decrease of the Yangtze River flow was the primary causal factor. Modelling also revealed that, compared to climate variability impacts on the Lake catchment, modifications to Yangtze River flows from the Three Gorges Dam have had a much greater impact on the seasonal (September-October) dynamics of the Lake. Yangtze River effects are attenuated in the Lake with distance from the River, but nonetheless propagate some 100 km to the lake's upstream limit. Proposals to build additional dams in the upper Yangtze River and its tributaries are reported to improve significant challenges for the management of Poyang Lake. Hydrologic engineering to modify the flow regimes between the Lake and the Yangtze River would somewhat resolve the seasonal dynamics of the Lake, but will likely introduce other issues in terms of water quality and aquatic ecosystem health, requiring considerable further research. (C) 2014 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/3.0/).

Keywords: Water level; Mam-Kendall test; Hydrodynamic model; Poyang Lake; Yangtze River; Lake-river interaction

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