

Abstract Submitted
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Numerical Study of Wind Shielding Impacts on Water Quality in a Tropical Urban Lake¹ HAIYAN MIAO, Institute of High Performance Computing, A*STAR, Singapore, ZIKUN XING, Nanyang Technological University, Singapore, LLOYD CHUA, Deakin University, Australia — In this study, we investigate the impact of wind shielding effect on hydrodynamics and water quality in Marina reservoir, a tropical lake located in downtown Singapore. This kind of urban lakes are usually smaller and shallower comparing with naturally formed ones and therefore, subject to a higher degree of interaction with wind. To establish wind field over the lake surface, Computational Fluid Dynamics (CFD) modeling was conducted to simulate seasonal impacts of two dominant monsoon seasons, in which the prevailing wind patterns interact very differently with urban landscape. The CFD model results were then used as input to a 3D lake hydrodynamics and water quality model to study the impacts to the hydrodynamics and water quality in the lake. By comparing simulations using uniform and spatial variable wind field, this study demonstrates that wind forcing variability in urban reservoirs that arise from shielding effects can have significant impacts on the thermal stratification and mixing, and phytoplankton distribution in both vertical and horizontal directions. There exist significant seasonal differences in wind field, hydrodynamics and water quality between the northeast and southwest monsoon seasons.

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