Hydrodynamic investigation of a shallow tropical lake environtment : Laguna Lake in Philippines and associated implications of eurotropic vulnerability

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Abstrak

In this study, a three-dimensional (3D) hydrodynamic model was developed to investigate the Water circulation characteristics of a shallow tropical lake environment (Laguna Lake, Philippines) under varying wind stress, watershed river discharge, and sea interaction (Manila Bay, Philippines) to elucidate hydrodynamic implications to eutrophic vulnerability. The analyses were based on ﬁeld observations and numerical simulations covering longterm periods (dry and wet season) and intensive ﬁeld measurements. The results demonstrated different circulation pattems and vertical current regimes in time and space that accentuated a thermally stratified lake environment in spite of a shallow water depth (2.5 meter average). In the wet season, current movement is generally toward Pasig River, the lake’s only outlet, with embayment water mass moving in the clockwise direction. The dry season lake ﬂow pattern was characterized by counter-clockwise gyre circulations, Pasig River backﬂow, and salinity intrusion. Wind forces showed strong inﬂuence on
lake hydrodynamics due to the complex surrounding topography, steep land-ake thermal difference, regular passage of tropical storms and typhoons, and shifts in the monsoon wind direction. The resulting mixed layer hydrodynamics revealed important implications to the planktonic movement, nutrient recycling, and primary production of the lake. Long term continuous observations and numerical analyses also demonstrated the intrusion of seawater to Laguna Lake that potentially adds to its eutrophic vulnerability with the associated entry of nutrient and microorganism-rich polluted waters from Metro Manila.