

Simulation of Lake Victoria circulation patterns using the Regional Ocean modeling system (ROMS). (2016).

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Abstract

Lake Victoria provides important ecosystem services including transport, water for domestic and industrial uses and fisheries to about 33 million inhabitants in three East African countries. The lake plays an important role in modulating regional climate. Its thermodynamics and hydrodynamics are also influenced by prevailing climatic and weather conditions on diel, seasonal and annual scales. However, information on water temperature and circulation in the lake is limited in space and time. We use a Regional Oceanographic Model System (ROMS) to simulate these processes from 1st January 2000 to 31st December 2014. The model is based on real bathymetry, river runoff and atmospheric forcing data using the bulk flux algorithm. Simulations show that the water column exhibits annual cycles of thermo-stratification (September–May) and mixing (June–August). Surface water currents take different patterns ranging from a lake-wide northward flow to gyres that vary in size and number. An under flow exists that leads to the formation of upwelling and downwelling regions. Current velocities are highest at the center of the lake and on the western inshore waters indicating enhanced water circulation in those areas. However, there is little exchange of water between the major gulfs (especially Nyanza) and the open lake, a factor that could be responsible for the different water quality reported in those regions. Findings of the present study enhance understanding of the physical processes (temperature and currents) that have an effect on diel, seasonal, and annual variations in stratification, vertical mixing, inshore—offshore exchanges and fluxes of nutrients that ultimately influence the biotic distribution and trophic structure. For instance information on areas/timing of upwelling and vertical mixing obtained from this study will help predict locations/seasons of high primary production and ultimately fisheries productivity in Lake Victoria.

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