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A simple model of the eco-hydrodynamics of the epilimnion of Lake Tanganyika

Jaya Naithani(1), Pierre-Denis Plisnier(2) and Eric Deleersnijder(3)

(1) Université catholique de Louvain, ASTR, Belgium, (2) Royal Museum for Central Africa, Geology and Mineralogy Dept, Belgium, and (3) Université catholique de Louvain, ASTR and CESAME, Belgium.

The ecosystem response of Lake Tanganyika is studied using a four-component Nutrient Phytoplankton Zooplankton Detritus (NPZD) phosphorus-based ecosystem model coupled to a non-linear reduced-gravity circulation model. The ecosystem model, an improved version of the earlier ECOH model developed for Lake Tanganyika, is used to estimate the annual primary production of Lake Tanganyika and its spatial and temporal variability. The simulations are driven with the National Centres for Environmental protection (NCEP) winds and solar radiation forcing. The simulated annual cycles of the four ecosystem variables and the daily net primary production are compared with the observations. The comparisons show that simulations reproduce realistically the general features of the annual cycles of epilimnion, phosphate, net primary production and plankton dynamics. The climatic simulations for the years 1970 through 2004 yield an integrated upper layer net production ranging from 224 and 284 g C m^{-2} yr^{-1} (0.61-0.77 g C m^{-2} d^{-1}). The simulated mean net primary production for Lake Tanganyika for the whole period is 254 g C m^{-2} yr^{-1} (0.67 g C m^{-2} d^{-1}). Although the nutrient levels in the epilimnion during the strong wind years are high, the net production is low which is partly because of the greater vertical mixing, produced by strong winds, exposing the phytoplankton to low light conditions at deeper waters. The simulated annual net production agrees quite well with observed production available in the literature. It is envisaged to use this model to predict the future scenarios of primary productivity of the lake.