Geophysical Research Abstracts
Vol. 21, EGU2019-4439, 2019
EGU General Assembly 2019

Spatial and temporal dynamics of pCO_2 and CO_2 flux in tropical Lake Malawi

Maxon Ngochera
Monkey Bay Fisheries Research, Department of Fisheries, Mangochi, Malawi (ngochera@gmail.com)

Numerous studies have documented CO_2 dynamics in temperate lakes, but only a handful of such studies have been conducted on tropical lakes. In this study, spatial and seasonal variation of air and water pCO_2, along with supporting limnological and meteorological variables, were measured along the north-south axis of Lake Malawi aboard a vessel of opportunity. These measurements were used to estimate annual net lake-air CO_2 flux and infer mechanisms regulating it. Lake surface pCO_2 and CO_2 flux varied significantly with season and location. Temporally, the lake was CO_2 undersaturated during the rainy season (December–March) and the mixing season (July–September), while it was CO_2 supersaturated at the onset of the mixing season (May) and during the stratified season (October). Concurrent measurements of lake thermal structure, weather conditions, phytoplankton biomass and seston δ13C suggest that increased nutrient supply due to vertical mixing and allochthonous nutrient inputs promotes high phytoplankton growth rates and net CO_2 uptake during the mixing and rainy seasons. Unlike the rest of the lake, the southernmost region of the lake was usually CO_2 supersaturated, even though phytoplankton productivity is highest in this region. While the upwelling of hypolimnetic water at the southern end of the lake is a major source of nutrients that drive phytoplankton photosynthesis and CO_2 uptake, the CO_2 introduced in upwelled water appears to overwhelm the photosynthetic capacity of the lake, especially at the onset of the mixing season. Over an annual cycle, the lake appears to be a net CO_2 sink with a mean CO_2 flux from the atmosphere to the lake of 1,005$\pm$99 mmol C m-2 yr-1. This contrasts with observations for many temperate lakes and may be due to the efficiency of phosphorus recycling in Lake Malawi.