Throughout a finite element reduced-gravity model of Lake Tanganyika: thermocline oscillations and renewal of epilimnion water

Olivier Gourgue[1], Eric Deleersnijder[2,1], Vincent Legat[1], Jaya Naithani[2], Pierre-Denis Plisnier[3], Laurent White[1,2]

[1] Centre for Systems Engineering and Applied Mechanics (CESAME), Université catholique de Louvain, Louvain-la-Neuve, Belgium.

[2] G. Lemaître Institute of Astronomy and Geophysics (ASTR), Université catholique de Louvain, Louvain-la-Neuve, Belgium.

[3] Geology and Mineralogy Department, Royal Museum for Central Africa, Tervuren, Belgium.

September 29, 2006

Poster presentation

Abstract

Within the framework of the development of SLIM (Second-generation Louvain-la-Neuve Ice-ocean Model), we have built a finite element reduced-gravity model of Lake Tanganyika. This lake is well stratified, so we may define two main layers (the epilimnion at the top and the hypolimnion at the bottom) separated by a thin thermocline. This thermocline undergoes oscillations due to wind stress. The wind stress may be decomposed between a seasonal component and an intraseasonal variability, respectively responsible for the free and forced oscillations of the thermocline. The first part of this work was to evaluate the relative importance of these two types of oscillations (*Gourgue et al*, 2006).

In the second part of this work, we present a method, based on the concept of age and residence time, to study the renewal of epilimnion water (*Gourgue et al*, 2006). We split the water in the epilimnion into different water types. The initial water is the water initially present in the epilimnion. The renewing water is defined as the water entering it. Different renewing water types may be considered : the water from the hypolimnion, the water from the precipitations and the water from the rivers. We present the equations for computing the age and the residence time of a certain water type. These timescales are of use to understand the rate at which the water renewal takes place. Moreover, computing these timescales can be achieved at an acceptable extra computer cost and this method can be easily applied to a more general semi-enclosed domain than the epilimnion of Lake Tanganyika.

References

Gourgue, O., Deleersnijder, E, Legat, V., Marchal, E., Naithani, J., Plisnier, P.-D., White, L. (2006). Influence of the wind on the free and forced oscillations of the thermocline of Lake Tanganyika, in preparation.

Gourgue, O., Deleersnijder, E., White, L. (2006). Toward a generic method for studying water renewal, with application to the epilimnion of Lake Tanganyika, *Estuarine, Coastal and Shelf Science*, submitted.