Geophysical Research Abstracts
Vol. 15, EGU2013-10075, 2013
EGU General Assembly 2013

Contrasted effects of climate change on temperate large lakes oxygen-depletion (Lakes Geneva, Bourget, Annecy)

Jean-Philippe Jenny (1), Fabien Arnaud (1), Jean-Marcel Dorioz (2), Benjamin Alric (2), Pierre Sabatier (1), and Marie-Elodie Perga (2)

(1) EDYTEM - UMR CNRS 5204, Université de Savoie Campus universitaire, - 73376 Le Bourget du Lac Cedex, France (jean-philippe.jenny@univ-savoie.fr), (2) INRA - UMR 42 CARRTEL, Centre Alpin de Recherche sur les Réseaux Trophiques des Ecosystèmes Limniques - 74203 Thonon-les-bains Cedex, France

Among manifestations of the entry in a new geological era -The Anthropocene- marked by the fingerprinting of human activities in global ecology, the development of persistent zones of oxygen-depletion particularly threatens aquatic ecosystems. This results in a loss of fisheries, a loss of biodiversity, an alteration of food-webs and even, in extreme cases, mass mortality of fauna1. Whereas hypoxia -defined as dissolved oxygen $\leq$2 mg/l- has long been considered as a consequence of the sole eutrophication, recent studies showed it also depends on climate change. Despite basic processes of oxygen-depletion are well-known, till now no study evaluated the contrasted effects of climate changes on a long-term perspective. Here we show that climate change paced fluctuation of hypoxia in 3 large lakes (Lake Geneva, Lake Bourget and Lake Annecy) that were previously disturbed by unprecedented nutrient input. Our approach couples century-scale paleo-reconstruction of 1) hypoxia, 2) flood regime and 3) nutrient level, thanks to an exceptional 80 sediment core data collection taken in three large lakes (Geneva, Bourget, Annecy), and monitoring data. Our results show that volume of hypoxia can be annually estimated according to varve records through large lakes. Quantitative additive models were then used to identify and hierarchy environmental forcings on hypoxia. Flood regime and air temperatures hence appeared as significant forcing factors of hypolimnetic hypoxia. Noticeably, their effects are highly contrasted between lakes, depending on specific lake morphology and local hydrological regime. We hence show that greater is the lake specific river discharge the more is the control of winter mixing and the lower is the control of thermal stratification on oxygen depletion.

Our study confirms that the perturbation of food web due to nutrient input led to a higher vulnerability of aquatic ecosystems to climate change. We further show specific hydrological regime play a crucial role in oxygen-depletion processes. This implies a careful attention must be paid to changes in hydrological patterns while assessing the effect of climate change on large water bodies.