SIMULATION OF LAKE GENEVA TEMPERATURE PROFILES UNDER OBSERVED AND FUTURE WARMER CLIMATE CONDITIONS WITH A SINGLE COLUMN LAKE MODEL

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Abstract

The objective of this study is to evaluate the vertical temperature profiles of lake Geneva, Switzerland, in the case of a warmer climate using one-dimensional (1D) lake models. Considering the depth of the largest lake of Western Europe (309m), the first step consists at testing various models and at investigating the most suitable one to reproduce the evolution of thermal profile of this lake. Experiments to assess impacts of climate change over a deep lake are presented by using both one-way and two-way coupling methods (companion paper by Goyette and Perroud) with the processes at the lake-atmosphere interface.

Four models whose ability to simulate lake water thermal structure has been proven in numerous studies, have first been selected. Temperatures predicted by the Hostetler, DYRESM, Simstrat and Flake models are then compared to observations for a 10-years period ranging from 1996 to 2005. For applications in biological processes, thickness and stability of the metalimnion have also been studied.

The numerical lake model Simstrat is appropriate to reproduce thermal profiles prevailing at the centre of the lake and is used to evaluate future climate conditions. The one-way method of assessing impact of climate change consists at running the model with meteorological data perturbed according to outputs produced by RCMs in the context of EU-PRUDENCE project based on the IPCC A2 scenario. The 2 ways method consider mutual exchanges between the lake surface and the atmosphere by coupling Simstrat to an atmospheric column model (FIZ) as will be shown by Goyette and Perroud.