



Evaluating COSMO's lake module (FLake) for an East-African lake using a comprehensive set of lake temperature profiles

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The African great lakes are of utmost importance for the local economy (fishing), as well as being essential to the survival of the local people. During last decades, these lakes have been changing rapidly and their evolution is a major concern. Hence, it is important to correctly represent them in regional climate models for simulations over tropical Africa. However, so far lake models have been developed and tested primarily for boreal conditions. In this study, for the first time the freshwater lake model FLake is evaluated over East-Africa, more specifically over lake Kivu. Meteorological observations from January 2003 to December 2008 from an automatic weather station in Bukavu, DRC, are used to drive the standalone version of FLake. For the evaluation, a unique dataset is used which contains over 200 temperature profiles recorded since 2002. Results show that FLake in its default configuration is very successful at reproducing both the timing and magnitude of the seasonal cycle at 5 m depth. FLake captures that this seasonality is regulated by the water vapour pressure, which constrains evaporation except during summer (JJA). A positive bias of ~ 1 K is attributed to the driving data, which are collected in the city and are therefore expected to mirror higher temperatures and lower wind speeds compared to the lake surface. The evaluation also showed that driving FLake with Era-Interim from the nearest pixel does only slightly deteriorate the model performance. Using forcing fields from the Canadian Regional Climate Model, version 5 (CRCM5) simulation output gives similar performance as Era-Interim. Furthermore, a drawback of FLake is that it does not account for salinity and its effect upon lake stratification, and therefore requires artificial initial conditions for both lake depth and bottom temperature in order to reproduce the correct mixing regime in lake Kivu. Further research will therefore aim at improving FLake's representation of tropical lakes.