Off-line lake water and ice simulations: a step towards the interactive lake coupling with the Canadian Regional Climate Model

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Lakes and internal seas are important for the regional climate of the moderate and northern North America and Eurasia. In Canada, they cover more than 10% of the country's territory. Coupling of the Canadian Regional Climate Model (CRCM) with 1D lake models can increase the quality of the regional climate simulations. The first step towards the full interactive coupling is testing and validation of suitable lake models. The lake models should perform well in a wide range of lake parameters, characteristic for Canadian lakes: from Great Lakes to numerous small subgrid lakes, which can also be important for the regional climate because of their cumulative influence.

The Hostetler's lake model and the FLake model were chosen for tests and validation. Two kinds of simulations were conducted: one for small subgrid lakes and another for the Great Lakes. In the first series of simulations the NTL LTER data were used. Two small lakes were simulated in the single column mode, using experimental observations data for the air temperature and humidity, wind force, and radiation fluxes. The outputs of the two lake models were compared with observed water and ice temperature profiles and sensible and latent heat fluxes. In the second series of simulations the Great Lakes were simulated, using the ERA40 reanalysis data at a 45 km horizontal resolution, which is similar to the resolution of CRCM. The outputs of the lake models were compared with observations.

The results of off-line tests suggest that both lake models simulate reasonably well the surface/water temperatures and therefore will be used for the full interactive coupling

with the CRCM climate model.