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Modeling evaporation from northern waterbodies, the case of an 85-km^2 reservoir

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Freshwater bodies represent 9% of Canada's total land area, with more than half of these having a surface area smaller than 100 km^2. Taking into account the interactions between lakes and the atmosphere in meteorological models is crucial, considering the marked differences with the surrounding land masses (low albedo, unlimited source of water, high thermal capacity, etc.). Open water evaporation, in particular, is often a challenge because of its intangible nature and the scarcity of direct observations. This project focuses on the modeling of the surface energy budget of a reservoir located in the boreal biome of eastern Canada, with an emphasis on the evaporation. Observations are available for the 85-km^2 La Romaine 2 hydroelectric reservoir (50.7°N, 63.2°W), where two micrometeorological towers were deployed: one operated yearlong on the shore and one operated on a floating deck during ice-free conditions. Modeling resorts to the Canadian Small Lake Model (CSLM), a one-dimensional land surface model designed to integrate the lake-atmosphere fluxes into meteorological models. The model also simulates the thermal regime of the water body, including ice formation. Lastly, the model can be used for climate and weather prediction, which may be a useful for reservoir management. Comparison of field observations and simulations confirms the CSLM ability to reproduce the turbulent fluxes and the temperature behavior of the reservoir except for some specific periods, in particular the ice breakups and freeze-ups. The model somehow underestimates the water temperature resulting in a premature depletion of the lake heat storage in autumn. It also overreacts to high wind episodes.