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The driving forces behind lake's response to climate change by Flake modeling over lakes on the Tibetan Plateau

Binbin Wang, Yaoming Ma, Bob Su, and Weiqiang Ma
China (wangbinbin@itpcas.ac.cn)

Lakes are considered as an important indicator to climate change and show specific responses and impacts to variations of climatic variables. To investigate lake's responses to climate change and to determine the dominant driving forces behind, in-situ measurements of eddy covariance observations and meteorological data over the small Nam Co lake ("small lake") and Nam Co lake ("large lake") are used to evaluate the performances of lake processes simulation by Flake modeling. The seasonal variations of daily mixed-layer depth (D_ml, showing an observed averaged amplitude of 8 m in diurnal variation) and water surface temperature (T_s) could be generally reproduced, but with significant underestimations in amplitudes of their diurnal variations. The seasonal variations of daily sensible heat flux (H) and latent heat flux (LE) are close to the observations under appropriate extinction coefficient and lake depth, with RMSE values of 1 degree celsius, 8 W m-2 and 22 W m-2 for daily T_s, H and LE, respectively. The simulated LE in the "large lake" show significant differences with forcing by land-environment (e.g. Nam Co station) and lake-environment (e.g. in-situ measurements), attributing to the larger wind speed and higher air temperature in the latter. Whilst no obvious differences exist for the simulations with different forcing used in the "small lake". Lake warming and increasing trends of simulated H and LE during 1981-2016 are obtained, and downward longwave radiation, rather than air temperature, shows the dominant role in lake's responses to climate change.