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Daily to interannual variations of CH_4 and CO_2 fluxes from a deep lake in Arctic Alaska

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Methane and CO_2 fluxes from Toolik lake (68.63°N, 149.60°W, surface area 150 ha, maximum depth 24 m, are generally directed from the water to the atmosphere during summer (mid-June to mid-August). The day-to-day variability of fluxes is considerable, and a pronounced diurnal cycle is typically seen which is related to the mesoscale wind regime that is driven by the thermo-topographical contrast between the mountain range in the south and the cool coastal plain and arctic ocean in the north. This results in smaller fluxes at night with a calm surface, unless surface cooling is strong enough to enhance the vertical mixing in the lake. We report on the last three summer seasons of eddy covariance flux measurements over Toolik Lake, accompanied by gas concentration measurements in the surface waters and the atmosphere above, which for the first time allows us to compare two different methods to measure such fluxes. Additionally, a preliminary assessment of the year-to-year variability of both CH_4 and CO_2 fluxes indicates that lower lake levels and dryer atmospheric conditions in 2012 had a strong effect on gas fluxes.