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Biogeosciences Discussions

Interactive comment on "Eddy covariance flux measurements confirm extreme CH_4 emissions from a Swiss hydropower reservoir and resolve their short-term variability" *by* W. Eugster et al.

Anonymous Referee #1

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Eddy covariance flux measurements confirm extreme CH4 emissions from a Swiss hydropower reservoir and resolve their short-term variability by Eugster et al.

The manuscript describes extremely high CH4 efflux from a hydropower reserve in Switzerland, and tries to instigate the environmental controls on these peak methane emissions. I found the manuscript interesting and well written and the topic relevant as it shows that the conversion of new land areas into hydropower reservoir could substantially increase greenhouse gas emission. However, there are shortcomings that should be addressed before the manuscript could be accepted for publication:

1) CH4 emission are reported, but maybe also CO2 emission are probably very rel-

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evant as well, if CO2 fluxes were not measured in this study, an estimate from the literature should be provided to more completely understand the overall GWP of these freshwater areas. 2) The authors state that the reason why their chambers measurements were not comparable with the eddy covariance estimate was due to the location of the chamber measurements (outside of the footprint), but did they notice a progressive increase or decrease in CH4 fluxes from the chambers moving from the shore to the centre of the lake? A better description and a figure showing chamber vs eddy covariance measurements should be provided. Also where in the lake these chamber measurements were performed? The locations of these measurements should be added in Fig. 6 so that the reader more easily visualizes it. Also, why the near-shore have much different emissions than the centre of the lake? Implement the discussion. 3) Why emissions are higher when the wind is lower? It seems that the higher wind speed would increase water mixing and gas exchange? From Wanninkhof et al., JGR 1992: "for steady winds, the relationship between gas transfer and wind speed is taken to be k = 0.3 lu2(Sc/660)-1/2 The relationship should be applicable to deduce gas transfer velocities at steady winds [. . .]". Maybe the change in wind speed changed the footprint? Again the chambers measurements across the transect from shore to centre of the lake would help in understanding this result. Also the footprint analysis should be presented in Fig. 6 divide for high and low winds. 4) Ebullition is a sudden phenomenon; the authors reported nearly continuous higher CH4 concentration from the lake, which is fairly important. More details should be provided: was there a difference between the two measuring periods (June and August)? 5) Page 5034 lines 5-7: show diurnal cycle in CH4 effluxes; Page 5036 lines 10-14: if these are considered to be an important phenomenon the data should be shown. 6) The discussion should be improved: in the results the authors state that ebullition is an important phenomenon but then they say that water temperature is the main driver: ebullition is probably not driven by water temperature, explain this better. Also, the authors state that the extreme fluxes are mainly driven by water temperature but temperature was only able to explain a minor percentage of the variability (up to about 35%); probably this result is

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important as well (especially if ebullition is an important component of the fluxes) but should be better discussed. 7) Page 5037 line 22, Fig. 8 panel (e) is missing 8) Page 5039 line 13: this is not true, there has been significant research done on boreal lakes and lakes in Alaska, better revise the literature and compare the rates observed in this study to previous studies.

Interactive comment on Biogeosciences Discuss., 8, 5019, 2011.