Biogeosciences Discussions

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Comment on bg-2021-36

Anonymous Referee #2

Referee comment on "Temporal trends in methane emissions from a small eutrophic reservoir: the key role of a spring burst" by Sarah Waldo et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-36-RC2, 2021

General Comments

I agree with reviewer #1 on the high potential of this well conducted study on CH4 emissions from a temperate eutrophic reservoir which includes 2 years of continuous monitoring of total CH4 emissions by eddy covariance (EC) and gap-filling with ANN and ebullition with automated bubble traps at shallow and deep sites and six extensive field surveys during which diffusion (floating chambers) and ebullition (manual bubble traps) were measured at more than 10 sites. The interpretation on the spatial and temporal variability of CH4 emissions can be done on the basis of meteorology (Rainfall, temp, atmospheric pressure), energy balance (H, LE), hydrodynamics (Brunt-vaisala Freq, temp profiles), hydrology (water inputs, water levels) and biogeochemistry (O2, Chloa).

Major comments

My first major comment is about the result section which does not depict the whole dataset. Indeed, only CH4 fluxes are described but not correctly (see below).

Information on meteorology and hydrology would be very welcomed. Description of the energy balance, thermal stratification and its spatial variability, vertical biogeochemical stratification (O2, CH4…) and their spatial variability and chlorophyll a data and its spatial variability are required

For CH4 emissions, I would recommend to separately describe ebullition (funnels, bubble traps), diffusion (floating chambers) and total emissions from EC. As a matter of fact, I wonder whether the gap-filling is not already a kind of interpretation as the gap-filling is based on the covariation of the fluxes with other variables when EC data are available. Therefore, it has to be decided by the authors to keep it in the result section or move it to the discussion. Independently of where the gap-filled fluxes are described (results or interpretation), it would be very informative for the reader to have information on the validated fluxes ("real data") and on the EC fluxes after gap filling for comparison.

The second major comment is related to the absence of information regarding the calculation of total emissions from the reservoir. A critical discussion on the comparison of the different type of measurements is required in order to determine the adequate methodology to combine them for a robust estimation of total emissions. We currently ignore whether the emission factor given in the manuscript is an average of all measurements, whether it is only based on EC… Did the author take into account the bathymetry for the extrapolation of ebullition from the reservoir since ebullition at deep sites is lower than at shallow sites?

Minor comments

-Throughout the manuscript: Does "Static pressure" depict atmospheric pressure or the sum of atmospheric and hydrostatic pressure?

-Did the author explore the role of hydrostatic pressure (water level and their variations) on CH4 emissions?

-Did the authors attempt to decipher diffusive fluxes and ebullition from the EC dataset (at least when they have concomitant surface concentrations and or chamber measurements with EC measurements)?

As the manuscript require substantial rewriting/reorganization in order to properly present the dataset and better focus on key results in the discussion no detail comments are provided.