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Interactive comment on “Greenhouse gas emissions (CO₂, CH₄ and N₂O) from perialpine and alpine hydropower reservoirs” by T. Diem et al.

Anonymous Referee #4

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REVIEW OF THE MANUSCRIPT “GREENHOUSE GAS EMISSIONS (CO₂, CH₄ AND N₂O) FROM PERIALPINE AND ALPINE HYDROPOWER RESERVOIRS”, submitted to BGD by T. Diem and co-authors

Summary

This manuscript present the fluxes of greenhouse gases (GHGs) CO₂, CH₄ and N₂O in several alpine reservoir in the Switzerland. The sites are located in the temperate region, where the data on the GHG emissions from reservoirs are still sparse. Thus, the data are worth of publishing but the present paper needs major revision and should be resubmitted for another review. In the present form some parts of the data presented

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are not shown in details enough (e.g., turbine emissions) to allow their critical evaluation by the readers, but the paper itself needs condensing. I tried to repeat the comments from the other reviewers in my suggestions for improvement of the manuscript.

General comments

Introduction

The language and style of the paper need revision throughout the manuscript. In the introduction, I suggest to authors to focus on the most evident reason for this kind of a study, the need for GHG flux data from temperate reservoirs. This has became obvious from the 2006 report of the IPCC's NGGIP group, showing published data from different parts of the world.

Materials and methods

Since the alpine settings may differ from many other temperate environment, this would need some clarification. For a critical evaluation of the data and the possible future use of the presented dataset in generalisations for other sites, it would be necessary to offer representative data (from other studied if not determined during this study) describing better the study region (climatic data, flooded ecosystem types, amount of carbon in soils, amount of C and nutrients in water, water colour and oxygen concentrations, primary production in the water column etc.).

All the methods should be rewritten with care- readers should be capable of repeating the measurements after reading this section, this is not the case with the present version of the text. In many cases the number of samples, sampling depth and other similar very basic information were lacking. The order of the presentation of the methods should be followed also in the description of the results (and their discussion) for better readability.

Results

As suggested by other reviewers, authors should focus on their major findings (level of

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the GHG emissions) and pay less attention in their secondary findings; for which they have less data (e.g. ebullition). With the flux calculation method used it would be better to present ranges based on two or more different k-values from the different studies, as already mentioned in other reviews. All the discussion from the results should be moved to the discussion section.

Discussion

As already pointed out I did not either understand the claim that CH₄ was not produced in the sediments. According to earlier studies on CH₄ oxidation more than 90% of the CH₄ produced could be oxidized in the sediment or water column. In this kind of deep reservoirs there should be a lot of time for CH₄ to be oxidized before entering the atmosphere.

Also here I suggest to find key issues which may explain the GHG flux rates found in the alpine sites, compared with the flux rates and their environmental determinants in other types of reservoirs (boreal and tropical). Those include preflood situation (flooded ecosystem types, amount of available carbon in flooded soil and vegetation) and postflood situation (reservoir limnology incl. lake trophy, aerobic vs. anaerobic conditions for decomposition, production of autochthonous C, amount of allochthonous C inputs from the catchments). Some of these factors (if not investigated) could be found/estimated based on earlier scientific literature. Additionally, regional annual and seasonal weather patterns would also be helpful. This kind of comparisons would be highly beneficial for a larger audience and would aim to make deeper conclusions of the factors affecting world-wide the GHG release from the reservoirs. I hope the authors rewrite their paper according to all the given comments since the data on the GHG emissions from temperate reservoirs are very rare, and by condensing their manuscript its publishing after further reviews could well improve the situation in the case of temperate reservoirs in mountainous areas.

BGD

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