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Biogeosciences Discussions

Interactive comment on "Greenhouse gas emissions (CO_2, CH_4 and N_2O) from perialpine and alpine hydropower reservoirs" *by* T. Diem et al.

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Although the paper addresses relevant scientific questions within the scope of BG, has an appropriate title, and presents new data regarding GHG cycling/emissions in European dams, its idea construction and development are rather confusing and methods are somehow obscure. Figures are not very helpful in clarifying arguments made by the authors. The article structure need further revision to make it more objective and clear, including recent discussions on CO2 (Soumis et al 2007, Biogeochemistry, Springer), CH4 (Lima et al 2008, MITI, Springer), and N2O emissions (Guerin et al 2008, GRL, AGU).

Authors demonstrate difficulties to synthesize their own data to provide convincing arguments. Figures, even in supplementary material, should be clear and show someway all measured variables to sustain most of arguments. For instance, there is not a single figure comparing mean (plus or minus standard deviation) of fluxes or profiles between factors.

CH4 inflow/outflow data is peculiar (Table 2). How can CH4 outflow be superior to CH4 inflow in some cases? Is there methane formation in turbines? Most likely not, therefore there is CH4 entering turbine ducts by a widen water suction cone than authors presume, or there are upwelling processes taking place at the dam, induced by constant winds, that authors are not taking into account. Authors need to fully review upstream/downstream CH4 mass balance.

Methodological aspects:

1 - Dissolved CO2 should have been measured by headspace technique as similar as done for other gas species.

2 - Authors must explicitly state/clarify how they performed "spilled" and "turbined" waters downstream the dams. It is fully unclear how mass balance upstream/downstream has been made.

3 - Dam CO2 is an anthropogenic GHG only when it is derived from land-use change. Be careful because dams under analysis must have CO2 efflux from (allochthonous) transient atmospheric carbon (photosynthesis/mineralization cycle). What fraction of CO2 efflux is autochthonous/allochthonous? What about photo-mineralization and or carbon sequestration in sediments? These aspects are actually gaining importance and were never discussed by the authors.

4 - Authors cannot correlate CO2 exchange and pH because the later was used to derive the former (statistics in this case is spurious).

5 - ANOVA is used to test mean differences (not correlation!) for normally distributed

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data. Authors should consider normality (e.g., KS one-sample test) and perhaps use nonparametric statistics instead to check gas exchange differences between (factors) time/elevations (Statistical analyzes are usually unclear).

6 - It is imprecise the idea that shallow areas are of minor importance regarding GHG emissions from dams. Note that most of CH4 bubbling takes place at the littoral, and CH4 bubbling is a major source of GHG from dams. Thus you must explicitly clarify that your arguments are for diffusive fluxes only.

7 - Note that if CO2 is derived from CH4 oxidation of methanogenesis from "flooded" carbon, thus CO2 diffusive efflux from deep waters is relevant in terms of global warming. Otherwise is just carbon recycling, net null.

8 - No method in use is able to determine the amount of methane released downstream of dams. It might be necessary several (diffusive and bubble) measurements along the river downstream, or some other new devices. Near turbine outlet is even worst due to strong turbulence, and perhaps eddy covariance techniques would be adequate. The present data, despite of its "peculiarity", are only trivial with this respect and is never well defined or ideally explained.

9 - Authors are suggested to use Rayleigh model to calculate for each reservoir methane oxidation rates from isotopic/concentration CH4 data.

In general, the results, as presented, are insufficient to support the interpretations and conclusions made by the authors. The description of experiments and calculations are not sufficiently complete and precise to allow their reproduction.

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