

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2022-100

Anonymous Referee #1

Referee comment on "Interdisciplinary strategy to assess the impact of meteorological variables on the biochemical composition of the rain and the dynamics of a small eutrophic lake under rain forcing" by Fanny Noirmain et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-100-RC1>, 2022

The manuscript by Noirmain et al entitled "Interdisciplinary strategy to survey phytoplankton dynamics of a eutrophic lake under rain forcing: description of the instrumental set-up and first results" is well written and easy to read. The described interdisciplinary strategy provides a very useful tool to decipher the impact of atmospheric processes on lake ecology.

An enormous work has been performed on the atmospheric sciences part but the authors only quickly discuss the ecological implications related to their study. The authors also need to consider further factors related the cyanobacteria biology and ecology. This could for instance apply to Lines 400-405 and Figures 8AB.

A negative effect of rain on organism abundance was mentioned for few taxa. Effect can be seen on Fig. 8B on unicellular group forming cyanobacteria (e.g. Woronichinia, Microcystis, Merismopedia...). Whereas some unicellular individual cyanobacteria (e.g. Synechocystis, Synechococcus, Pseudoanabena...) seem to undergo a positive effect. Cell distribution factor is important because it impacts the growth dynamic and survival of the species.

Moreover microalgae can move and migrate through the water column. Almost the same concentration of cells were found "before" and "after" RP events in the system (Fig. 8A). The increase concentration at a specific depth implies displacement of the phytoplanktonic community or organismal movement (RP2 towards 1.5 m depth, RP1 towards 3 m). Apparently deeper when the rainfall was more virulent (HIR). This is not described in the results nor correlated to Fig. 8B (diversity) but quickly mentioned in the discussion. Was the water column structure more stable (nutrient, temperature, light, water agitation...) at 1.5 m depth in RP2 and at 3 m in RP1?

All the cyanobacteria taxa retrieved have different ecological requirements. In the discussion Lm and Lo codons are rapidly mentioned. A principal component analysis can further help to characterise which cyanobacteria taxa was favoured under certain rain events (e.g. peculiar nutrient signature).

Moreover, the differences in phytoplankton concentration and taxa diversity between "before" and "after" calls for emission/deposition fluxes (e.g. Dillon et al 2020 [doi:10.1128/AEM.01850-20](https://doi.org/10.1128/AEM.01850-20), Mayol et al 2014 [doi: 10.3389/fmicb.2014.00557](https://doi.org/10.3389/fmicb.2014.00557)), very briefly mentioned in discussion. However this is of ecological importance. Retrieved

cyanobacteria species from the investigated lakes have been reported from atmospheric samples (e.g. Sharma et al 2007 DOI: 10.1111/j.1529-8817.2007.00373.x). Also microalgae can be emitted after local disturbances such as rain (Tesson et al 2016 doi:10.1128/AEM.03333-15, WiÅniewska et al 2019, 2022) from station Fig 1B2 and be redeposited in local system such as station Fig 1B1 or the lake, therefore it is possible that the retrieved peak of Cr1b with highest phycocyanin value could be partly indigenous. I believe that certain of these aspects would enrich the discussion of the manuscript. Moreover it can be useful to run the analysis considering the ecology and behaviour of these organisms to avoid a Simpson paradox.

Minor comments:

Figure 1 - Please add the geographical coordinates on Fig. 1A and the cardinal directions on both Fig. 1A and Fig. 1B.

Supplement Fig. 1 - The geographical coordinates are too small to be readable.

Lines 111 and 113 - Inform about the material manufacturer and country between brackets.

Line 121 - Please add in the text the difference of elevation between the location where the instrumental setup was installed and the lake surface.

Lines 142 and 156 - Spell out the acronyms DSD and PCB.

Lines 182-184 - How was the lake sampling performed? Which parameters were investigated? Do the authors refer to Lines 114-116 in situ measurements or were lake water- and/or phytoplankton samples collected? Please describe further.

Line 198 - Why was a 10 µm pore size used? In these filtrates, all microorganisms of a size inferior to 10 µm would be present (including bacteria, cyanobacteria and other <10 µm eukaryotic microalgae), thus affecting the measurements. Moreover, -20°C storage was applied to the filtrates, conditions under which organismal cell damaging occur, releasing further nutrients in the water. Please explain further.

Line 200 - Which Lugol's iodine solution was used (acidic vs neutral)? What was the final concentration used? How and how long before investigation were the samples stored (temperature, darkness, time)? These are important information for cross studies comparison.

Lines 221-236 - How does the flow cytometer detection method differ from existing protocols? (e.g. Haynes et al 2020, <https://www.agilent.com/cs/library/applications/application-analysis-aquatic-plankton-novocyte-5994-2112en-agilent.pdf>)

Figure 7A - The graphical scale for the water temperature does not cover the whole data spectrum - can the authors extend the x-axis from 6 to 20°C to include all data points?

Line 470 - I disagree with the sentence. First because microalgae encompass both prokaryotic (cyanobacteria) and eukaryotic photosynthetic unicellular organisms. Second because previous studies have investigated the diversity of microalgae in wet depositions including rain. However, the methods used involved capture and growth, not rapid detection based on flow cytometry. The proposed sentence is therefore not proper, please rephrase.

Lines 473-475 - I also disagree with this sentence. One major problem with culturing is that not all organisms can grow in artificial media, therefore applying a selection pressure towards underestimating the environmental biodiversity. Another issue is that all isolated microalgae possess a biome (including bacteria). These bionts can be removed using diverse available methods. However, some microalgae need their bionts to survive. In any cases these should not impede microalgal detection using flow cytometry or microscope-based techniques. Please reformulate the sentence.

The English language and formulations need to be double checked by a native speaker, several mistakes are present in the text.