



EGUsphere, referee comment RC1  
<https://doi.org/10.5194/egusphere-2022-65-RC1>, 2022  
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## **Review of egusphere-2022-65**

Anonymous Referee #1

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Referee comment on "Effects of brackish water inflow on methane-cycling microbial communities in a freshwater rewetted coastal fen" by Cordula Nina Gutekunst et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-65-RC1>, 2022

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The manuscript by Gutekunst et al. looks at the dynamics of biogeochemistry and microbes in peat profiles of a rewetted coastal fen following a storm surge inflow of brackish water. The response is compared to the results of previous publications on a baseline year and a drought year. Biogeochemistry (CH<sub>4</sub> and CO<sub>2</sub> concentrations, isotopic composition of CH<sub>4</sub> and inorganic C, sulfate, chloride) of water/peat and bacteria and archaea in peat (DNA- and partly RNA-based amplicon sequencing, group-specific qPCRs) were measured in a transect of four sampling points that differ in the proximity to the Baltic Sea.

The results show an increase in abundance of sulfate reducers when sulfate concentrations increased with storm surge. Although methane emissions (reported elsewhere) decreased, there were surprisingly small changes in methanogens and methanotrophs. The decrease in emissions is suggested to be due to methane oxidation in a compartment not included in the measurements, such as the water column or litter above peat.

The strengths of the manuscript include the interesting focus on the connections of sulfate and methane cycling in drought and rewetting. Such information is needed to understand how sulfate dynamics regulate methane emissions in peatlands. This question is particularly relevant in coastal peatlands with sea water as a source of sulfate. The set of biogeochemical measurements and the analysis of microbial groups relevant to methane and sulfate dynamics complement each other well. The manuscript is well prepared and well written.

The weaknesses of the manuscript are in the discussion (see below) and possibly that the effects on methane-producing, methane-oxidizing and sulfate-reducing microbial taxa are looked at the rather coarse order or class level (Fig. 4). This could be hiding relevant patterns. However, I understand that in a manuscript with such a comprehensive set of different types of data it is not possible to cover everything in great detail.

## Major comments:

1. In the discussion, the possible reasons behind the geochemical patterns are considered in great detail and very well, but I was missing more broader context. What do these results mean outside this specific system and outside these specific sampling points? What new was learned that could be generalized to the effect of drought and brackish water inflow in other wetlands with brackish influence?

2. Please mention the accession number for the nucleotide sequences in the main manuscript (now it is mentioned in Table S2). I can't find anything with the accession number PRJEB52161 - are the data not public yet?

## Specific comments:

1. line 156 What is meant with 'for better comparison' here? Same sampling time or something else?
2. l. 274-275 Should the primer concentration be 0.5  $\mu$ M instead of 0.5 mM? 0.5 mM would be an unusually high concentration.
3. l. 275 What was the final volume of the PCR reaction?
4. l. 292 Please mention the concentration of the primers.
5. l. 480-482 Please be careful when directly comparing the results of two different qPCR assays. We can't know if the abundances are affected by primer biases etc.
6. l. 496-498 I understand what is meant here, but please try to rephrase this sentence taking into account that the environmental variables are properties of the soil samples, not bacteria (for example that in the bacterial ordination, these samples were associated with higher EC etc.).
7. l. 522 Please consider reminding the reader here if the sampling point HC2 is closer to Baltic Sea or further inland.
8. l. 539-541 I'm not sure why but I'm having difficulties following this sentence. Please consider if you can clarify the main point of sentence or its connections to what is said above.
9. l. 554 What is meant with 'drought-induced salinization'?
10. l. 579 Please clarify here which time point has the lower values.
11. l. 609-610 Please check if you can clarify this sentence. I'm especially having trouble with the word 'changes' on l. 610.
12. l. 1223-1224 I see from the R markdown file (thank you for including this file!) that the arrows for the environmental factors come from envfit, but this should be mentioned in the methods section too.

## Minor technical or language comments:

- l. 48 Open the abbreviation 'GHG'.
- l. 151 Open the abbreviation 'EC'.
- l. 164 Open the abbreviation 'IC'.
- l. 169 0,45 -> 0.45
- l. 273 'Specific' could be a better word here than 'precise'?
- l. 424 and elsewhere: Methanosarciniales -> Methanosarcinales

