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Biogeosciences Discussions



# *Interactive comment on* "High production of nitrous oxide ($N_2O$), methane ($CH_4$) and dimethylsulphoniopropionate (DMSP) in a massive marine phytoplankton culture" *by* L. Florez-Leiva et al.

**Anonymous Referee #1**

Received and published: 7 September 2010

Overall comments:

The ms of Florez-Leiva et al. open for Biogeosciences discussion reports a high production of nitrous oxide, methane and DMSP in a fertilized marine phytoplankton culture. Trace gases, oxygen, salinity, temperature, pH value, Chla and cell abundance were monitored over 46 days, fertilization took place on day no. 5. It remains unclear, at which time point the inoculation with Nannochloris took place, but regarding the cell concentration per mL it must have taken place around day 7. The potential impact of aquacultures on the production of N2O, methane and DMSP is scientifically of high in-

terest but could not be shown or discussed sufficiently, here. The dataset itself shows interesting details about production of the mentioned parameters during a fertilized phytoplankton bloom, but the interpretations and conclusions should be reassessed. A connection between the phytoplankton bloom and changes in the measured parameters could not be shown due to a methodological lack: A mesocosm without the Nannochloris culture should have been run in parallel to differentiate between the effect of the culture and the effect of the fertilization.

Major revisions:

General comments:

Nannochloris (this should be written in italic): it is not mentioned which species or strain was used for the experiment. Also, it is not described how the organisms were grown before using them, here.

Incubation took place in a mesocosm, which is not reported to be run in replicates or with a control without the culture. Also, the mesocosm was filled with seawater which was not characterized regarding nutrient background, DOM, or planktonic or microbial community structure. The production of methane and nitrous oxide is assumed to take place exclusively by microbes. Consequently, it is of highest importance to clarify, whether the commonly known producers are present or absent, e.g. by 16S rDNA analysis, any key gene assay or isotopic studies.

In general, it is doubtful to use an open pond of this size without protecting it from environmental influences such as rain, which can also influence the whole ecosystem in the tank and bias the community structure. Additionally, the sampling interval (at least between day 20 and day 30) seems to be insufficient.

It is unclear, which connection is there between the production of N2O in phase II and the presence of Nannochloris sp.. The observed formation could also be interpreted as the classical dependency between N2O being produced by nitrification when oxy-



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gen decreases. To me, it is not clear, why a certain phytoplankton species (or genus) should be responsible for N2O production or uptake, especially, when the bloom already broke down. It is likely, that a consecutive bloom of micro organisms accounts for the biological formation, here.

Specific comments:

Concentrations mentioned in the abstract are not consistent with those shown in the results part.

p.6760, l.15: the time unit is missing

p.6707, l.12: cost efficient

p.6707, l.20: global trace gas production Table 2 is not mentioned in the results part, don't introduce new results in the discussion part.

Is Nannochloris sp. known to produce algal blooms in the environment? Please discuss.

p6711, l.7: A clear association of methane and Chla is not shown, here. Methane shows a peak, before Chla reaches a maximum. Additionally, the possibility of CH4 being formed from DMSP was not discussed, here (Damm,E. et al., 2010, Methane production in aerobic oligotrophic surface water in the central Arctic Ocean, BGS); even though it could be a possible pathway, here.

p6711, l.10: The maximum of N2O occurred in phase II and not in phase I as it is said here. Rewrite this paragraph; it is not consistent with your figures and your introduction.

The overall impact of aquacultures on trace gas production is not shown or discussed sufficiently, here. Additionally, the discussion about environmental trace gas fluxes does not really refer to the topic. Please clarify. A comparison to Williamson & Crutzen, 2010, Nitrous oxide from aquaculture, Nature Geosciences, is missing, here.

p.6714, l.5ff.: The conclusion of N2O and CH4 being produced in dependency of or



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connectivity to a Nannochloris bloom or any other phytoplankton bloom could not be shown here. Production could also be due to (i) microbial formation due to fertilization in case of N2O, (ii) a consecutive zooplankton bloom and production by archaea in anoxic or suboxic micro- environments (e.g. faecal pellets) in case of methane

p.6714, l.24: citation: Wheathers et al.: please correct in the text and in the list of references

p.6715, l.14: I disagree on that point.

Minor revisions

The spelling and the use of the English language is not appropriate.

p. 6707, line 25: Please paraphrase this sentence, it should be about production and not about recycling of this gas; additionally, Bange, 2005 is not an ideal citation, here (better: Bange et al., 2010, Marine pathways to nitrous oxide (N2O), in "Nitrous Oxide and Climate Change", edited by K.A. Smith)

The fertilization with urea is not very common, why was this used here, instead of ammonia? Please mention the exact composition of fertilizers and the corresponding concentrations.

p6708, l.22: How are representative water samples characterized? Took the sampling place at day or night times?

p6709, l.20: the description of nutrient measurements is not clear to me: did you pre-filter those samples before freezing?

p6709, l.23: Did you only measure the cell abundance of Nannochloris sp.? It is unclear, if this method excludes bacterial and archaeal cells.

p6710, l.2: tracers and. . .

p6710, l.4: rephrase tracer



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p6711, l.3: the maximum in DMSPd is not so pronounced regarding the error bars, here.

p.6715, l.11: Rephrase this sentence.

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Interactive comment on Biogeosciences Discuss., 7, 6705, 2010.