Biogeosciences Discuss., 7, C3511–C3514, 2010
www.biogeosciences-discuss.net/7/C3511/2010/

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.

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Received and published: 26 October 2010

Dear Referee 2

We appreciate all the comments and suggestions of the referee and hope that the change will meet their expectations. 1-"This paper describes measurements of CH4, N2O and DMSP during a phytoplankton growing in a culture and it found high production of trace gases, especially N2O. However, some points have to be clarified and discussed in more detail. Page 6708, Section 2.1: Authors should give more details on

the mesocosm and sampling strategy".

R: A specific experimental strategy was not carried out, however but our measurements were taken from a real open pond currently used for feeding fish and mollusk species. This work was conducted using the standard culture system for microalgae and we only adapted our monitoring to the daily activities performed by fish farmer in this pond. The results obtained can be extrapolated to other systems in the world where microalgae cultivation is practiced. Therefore, we believe that the term "mesocosm" used here would be inappropriate and confused to the reviewers.

For example, when were the samples collected at each day?

R:Yes, we evaluated each day the variables in this study.

Was all water samples were collected at the same time of each sampling day?

R: Yes, our samples were taken during the morning at the same time each day (10am).

Where were the samples collected in the pond and was the samples representative of the whole pond? The samples were collected from which water depth? Was there any sediment in the mesocosm? Exact composition of the nutrient fertilizer should be given.

R: The samples of gases and DMSP were collected in triplicate and at three points in the pond. This systems was always well mixed with airflow. The floor does not have sediment and all samples were taken at 1 meter depth.. The nutrients were added on day 5 and consisted of a mix of phosphates (calcium triphosphate) and urea (CO(NH2)2) in a final concentration of 24193 μM and 833 μM respectively.

2- Table 2: As we know, the solubility of gases in water is low and dissolved gases in surface waters are easily exchanged to the atmosphere. As the author mentioned, the water in the pond is recirculated and well mixed during the whole study period, then I wonder if the determined variation of trace gases can reflect the real production/consumption in water column?

Indeed, given that the surface of the pond is continuously in gas exchange with the atmosphere and that the efflux might be higher than influx, the real in situ production of gases in the pond could be higher than the reported value. In any case, the accumulation estimated in this work was calculated by subtracting the gas efflux from the daily measured concentration, so the values obtained do reflect real accumulation or consumption. Gas exchange was estimated using standard methodology. In fact it is one of more routinely estimations made in our lab and several results have been published (see for example Carpentier et al., 2010,Farias et al 2009, Cornejo et al, 2007).

3. Fig. 2: Plots of expected equilibrium concentrations of trace gases at the ambient S and T values should be given in the figure. It would be helpful for the reader to judge the potential variation of trace gases due to in situ production/consumption.

Of course, I could have included a curve of gas equilibrium, taking into consideration in situ temperature and equilibrium, but I think that an additional curve would confuse the figure t. We will include this estimation in the table.

4-During the incubation, N2O increased obviously during the first 30 days and then decrease. What's the contribution of nitrification and/or denitrification to the production and consumption? of N2O during this period? More details about the variation of ammonium, nitrate and nitrite in the water column should be added to help learn the bacterial processes involved in nitrogen transformation in the pond.

R:Unfortunately, we did not measure the biogeochemical processes (using N-tracer) in this study that could provide information regarding the biochemical pathway, In fact, we carried out another experiment where we simultaneously measured ammonium, nitrate and nitrite (see below): we can therefore only discuss the potential mechanisms acting in this point. However, our intention is to state and show that this system and maybe others (depending on the species of phytoplankton cultivated) are able to produce larges amounts of N20 and other gases. .

5. The variation trend of CH4, N2O and DMSP were different with each other, the

authors should explain more about the difference.

R:We provide more information in the version final of the ms.

6. Air-water fluxes: Data on wind speeds are currently lacking, please give details of the used wind speeds. This is important for the calculation of the air-sea fluxes because they heavily depend on the applied wind speeds.

R:Yes, the data of wind speed are important in the air fluxes. In effect, we used data from the meteorological station close to the study site in order to estimate the gas fluxes (CH4, N2O and DMS fluxes). All the wind data are involved in the calculation and presented as additional information, since they were not considered of primary relevance.

7. Total suspended matter in the pond should be given since they may be related to the production of CH4 and N2O.

R:We agree with the referee, but could not measure total suspended organic matter in this work.

8. The lost DMSP during an algae bloom was previously found to be converted to methane (Damm et al., Mar. Chem., 2008). Is there any correlation between DMSP and CH4 in this study?. R:We evaluated those compounds in two fractions DMSPd & DMSPt in both phases of culture, but these were not significant in either case ($p > 0.05$). More details should be provided in ms final.

Thank very much for your inputs

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