

## ***Interactive comment on “Effect of elevated $p\text{CO}_2$ on trace gas production during an ocean acidification mesocosm experiment” by Sheng-Hui Zhang et al.***

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Dear Reviewer #1: We are grateful to your review of this paper and would like to express our thanks for your helpful and constructive comments. We have revised the manuscript and addressed all the comments point by point. The main changes we made are as follows: Increases of anthropogenic emissions of  $\text{CO}_2$  since the Industrial Revolution are known to have influenced organisms and the delivery of oceanic ecosystem services at a global scale. This is an interesting piece of work that shows the effect of elevated  $p\text{CO}_2$  on trace gases production including DMS and four halocarbon compounds through a mesocosm experiment. The study is based on the de-

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velopment of a bloom created by the addition of three different species of cultured phytoplankton to nutrient enriched coastal water enclosed in mesocosms. Considering that the impact of ocean acidification on DMS and halocarbons remains controversial, it is necessary to conduct further study about this aspect. Overall, this paper is well written and the major points are discussed with clarity. I recommend this article to be published in Biogeosciences after modification. My major criticism to the manuscript is that the authors point the algae and their attached bacteria in the coastal environment were removed through filtration process, have you measured the bacterial abundance in the mesocosm before the three different species of algae inoculated? In addition, this manuscript lacks the initial concentrations of *Phaeodactylum tricornerum*, *Thalassiosira weissflogii*, and *Emiliana huxleyi* inoculated into the mesocosm. Thanks for the reviewer's suggestion and we have added some details about this mesocosm experiment in the revised manuscript. P6, L125-129 “*Emiliana huxleyi* (CS-369), *Phaeodactylum tricornerum* (CCMA 106), and *Thalassiosira weissflogii* (CCMA 102) were inoculated into the mesocosm bags, with initial diatom/coccolithophorid cell ratio was 1:1. The initial concentrations of *Phaeodactylum tricornerum*, *Thalassiosira weissflogii*, and *Emiliana huxleyi* inoculated into the mesocosm were 10, 10, and 20 cells  $\text{mL}^{-1}$ , respectively.” P7, L141-142 “Meanwhile, no meaningful numbers of bacteria were counted by flow cytometer in the pre-filtered seawater before the inoculations.” There are also some minor things that I list below: P3, L54 “Further decreases of 0.3–0.4 pH units are predicted by the end of this century (Doney et al., 2009; Orr et al., 2005), which is commonly referred to as ocean acidification (OA).” Please update the latest references in this section. Thanks for the reviewer's suggestion and we have updated the latest references in the revised manuscript. P3, L58-60 “Further decreases of 0.3–0.4 pH units are predicted by the end of this century (Doney et al., 2009; Orr et al., 2005; Gattuso et al., 2015), which is commonly referred to as ocean acidification (OA)” “Gattuso, J. P., Magnan, A., Bille, R., Cheung, W. W. L., Howes, E. L., Joos, F., Allemand, D., Bopp, L., Cooley, S. R., Eakin, C. M., Hoegh-Guldberg, O., Kelly, R. P., Portner, H. O., Rogers, A. D., Baxter, J. M., Laffoley, D., Osborn, D.,

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Rankovic, A., Rochette, J., Sumaila, U.R., Treyer, S., Turley, C.: Contrasting futures for ocean and society from different anthropogenic CO<sub>2</sub> emissions scenarios. *Science*, 349 (6243), aac4722, 2015.” P3, L61 “DMS is the most important volatile sulfur compound produced from the algal secondary metabolite dimethylsulfoniopropionate (DMSP) through complex biological interactions in marine ecosystems (Stefels et al., 2007).” DMSP is not only produced by algae, but also by terrestrial plants and marine bacteria. Please re-word this section. Thanks for the reviewer’s suggestion and we have reworded this section in the revised manuscript. P3, L67-71 “DMS is the most important volatile sulfur compound produced from dimethylsulfoniopropionate (DMSP), which is ubiquitous in marine environments, mainly synthesized by marine microalgae (Stefels et al., 2007), a few angiosperms, some corals (Raina et al., 2016), and several heterotrophic bacteria (Curson et al., 2017) through complex biological interactions in marine ecosystems.” “Raina, J. B., Tapiolas, D., Motti, C. A., Foret, S., Seemann, T., Tebben, J.: Isolation of an antimicrobial compound produced by bacteria associated with reef-building corals. *PeerJ*, 4, e2275, 2016” “Curson, A. R., Liu, J., Bermejo Martinez, A., Green, R., Chan, Y., Carrion, O.: Dimethylsulfoniopropionate biosynthesis in marine bacteria and identification of the key gene in this process. *Nat. Microbiol.*, 2, 17009, 2017.” P4, L75 Replace “attribute” by “attributed”. Thanks for the reviewer’s suggestion and we have reworded this section in the revised manuscript. P4, L80-84 “Several assumptions have been presented to explain these contrasting results and attributed the pH-induced variation in DMS-production capability to altered physiology of the algae cells or of bacterial DMSP degradation (Vogt et al., 2008; Hopkins et al., 2010, Avgoustidi et al., 2012; Archer et al., 2013; Hopkins and Archer, 2014; Webb et al., 2015)” P8, L167-L168 What is “LC” and “HC”, low CO<sub>2</sub> and high CO<sub>2</sub>? Please use the full name for the first time in the manuscript. Thanks for the reviewer’s suggestion and we have used the full name for the first time in the revised manuscript. P9, L192-195 “The initial chemical parameters of the mesocosm experiment are shown in Table 1. The initial mean dissolved nitrate (including NO<sub>3</sub><sup>-</sup> and NO<sub>2</sub><sup>-</sup>), NH<sub>4</sub><sup>+</sup>, PO<sub>4</sub><sup>3-</sup> and silicate (SiO<sub>3</sub><sup>2-</sup>) concentrations were 54, 20, 2.6 and 41 μmol L<sup>-1</sup>

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for the low pCO<sub>2</sub> (LC) treatment and 52, 21, 2.4 and 38 μmol L<sup>-1</sup> for the high pCO<sub>2</sub> (HC) treatment, respectively.” P8, L172 The unit of chl a is not unified with Fig. 1, please check. According to the opinion of reviewer 2#, Fig. 1 was replaced.

Fig. 1. Temporal changes of pH in the HC (1,000 μatm, solid squares) and LC (400 μatm, white squares) mesocosms (3,000 L). Data are mean ± standard deviation, n = 3 (triplicate independent mesocosm bags) (Origin 8.0). P9, L192 Replace “for” by “of” Thanks for the reviewer’s suggestion and we have reworded in the revised manuscript according all reviewers’ suggestion. P10, L207-L209 “At the beginning of the experiment, the mean DMS, DMSP and DCB concentrations were all low in both treatments due to the low concentrations of DMS, DMSP and DCB in the original fjord water and possible loss during the filtration procedure (Fig. 2).” P9, L196 delete “growth in” Thanks for the reviewer’s suggestion and we have modified in the revised manuscript. P10, L217-218 “Compared with DMSP, DMS and DCB concentrations showed similar trends during the mesocosm experiment.” P9, L197-198 Replace “increase in Chl a and cell concentrations” by “increase in Chl a concentrations and algal cells” Thanks for the reviewer’s suggestion and we have modified in the revised manuscript. P10, L210-212 “The DMSP concentrations in the HC and LC treatments increased significantly along with the increase of Chl a concentrations and algal cells, and stayed relatively constant over the following days.”

Please also note the supplement to this comment:

<https://www.biogeosciences-discuss.net/bg-2018-148/bg-2018-148-AC1-supplement.pdf>

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2018-148>, 2018.

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