Referee report　　bg-2018-338

Contrasting effects of acidification and warming on dimethylsulfide concentrations during a temperate estuarine fall bloom mesocosm experiment.
R. Benard et al.

1. General Comments

In this paper, authors measured and analyzed the DMSP and DMS concentrations during the mesocosm experiment to investigate the effects of ocean acidification and warming on the phytoplankton bloom and the productions of biogenic sulfur compounds (DMSP and DMS). During the development and decline of diatom (*Skeletonema costatum*) bloom, they observed no detectable effects of acidification and warming on the average concentrations of DMSPt, while increasing the pCO2 (acidification) reduced the averaged DMS concentrations at both temperatures (10℃ and 15℃). On the other hand, a 5℃ warming (at 15℃), the DMS concentrations increased as compared to that at 10℃ mainly due to an increased bacterial production (bacterial DMSP metabolism). Authors also concluded that the warming effects (caused by CO2 increase) on DMS production mitigate the negative effect by acidification on DMS production. These experiments are needed to help our understanding for the responses of the marine biogenic climate-active gas productions and to improve our prediction of future climate.

To address these problems, authors conducted a well planned experiment and carefully considered the results obtained from this experiment. However, as mentioned in 4.4 "Limitations", it seems no easy task how we incorporate the results obtained under the conditions (abrupt changes in pCO2 and temperature, and no changes in phytoplankton species) into future projections. Nevertheless, the discussions on the results are contemplated, and it is thought that the results and discussions can contribute to future studies on this field. This paper would be acceptable if the authors reconsider and correct the parts pointed out in Specific Comments and Technical Corrections.

2. Specific Comments

(1) What interpretation can be made about the fact that there is a positive correlation between the bacterial production rate (dimension is Mass/Volume per Time) and DMS concentrations (Mass/ Volume)? In L434-435, "these findings reinforce the idea that bacterial metabolism, rather than,,,," is the interpretation of this result?

(2) Why the results of drifters were not shown in Figure 2(f) (these were plotted in Figure 2(b)(d))?

(3) L291-L293

Authors compared the fraction of the lost of DMSPt between the peak day and the end of the experiment (day 13), and the lost at 15℃ (79±3%) was much larger than that at 10℃ (19±4%). However, almost all of the DMSPt was lost at 15℃ by day 13, while the DMSPt just started to decrease at 10℃ at day 13. Therefore it is not appropriate to compare their fractions of DMSPt lost between the peak day and day 13.

(4) This problem (in (3)) also arises when comparing the average concentrations of DMSPt over the course of the experiment. Including the DMSPt concentration in the decline phase of the bloom at 15℃ results in lower value of the average concentration than that not including the concentrations in the decline phase as is the case at 10℃.

(5) This problem (in (3)) also arises when comparing the average ratio of DMSPt:Chl a over the course of the experiment.

(6) The DMSP:Chl a ratio has been used as an indicator of phytoplankton specific DMSP production ability since Keller (1989). But I do not understand the meaning of the DMS:Chl a ratio although this has been used in some papers. What does this ratio (DMS:Chl a) in your study (Figure 5) ?

(7)L296-L299

The averaged DMSPt:Chl a ratio was significantly higher at 15℃ (~19.0) than at 10℃ (~.11.4). Does result mean that the DMSP content in *Skeletonema costatum* was affected (increased) by warming? In 4.2.2. L357-358, authors explained this higher DMSPt:Chl a ratio at 15℃ due to the faster degradation of cells under warming. Does this mean that higher DMSPt:Chl a ratio was caused by more dissolved DMSP (DMSPd)?

But DMSPd data was not available in this experiment, so is this explanation reliable?

(8) Scatter plot between the DMS concentration vs bacterial production should be present because this relation is important to draw the conclusion that there is significant positive correlation (L483-L484).

3. Technical Corrections
(1) L34 coastal and marine surface waters ➔ coastal and oceanic? Or coastal and pelagic

(2) L74
Removal processes of DMS from surface waters include photo-oxidation, bacterial degradation and efflux across the air-sea interface, the individual intensity of which depends on several factors such as light intensity, wind velocity, the depth of the surface mixed layer and the gross production of DMS.
➔Removal processes of DMS from surface waters include photo-oxidation, bacterial degradation and efflux across the air-sea interface, **and** the individual intensity **of which** depends on several factors such as light intensity, wind velocity, the depth of the surface mixed layer and the gross production of DMS.

(3) L82
according to the business-as-usual scenario RCP 8.5 and global ocean circulation models, ➔according to the results of the global ocean circulation models under the condition of the business-as-usual scenario RCP 8.5

(4) L184 Total alkalinity (TA) samples ➔ Samples for total alkalinity (TA)

(5) "bacterial production" is the same meaning as "bacterial production rate" ?
If so, you should use whichever is more appropriate.
    "bacterial production" in L21, L30, L210, L280, L281,L283, L361, L387,
    "bacterial production rates" in L434, L483

(6) L423
Is the word "Phase II" necessary? "Phase II" was used only here, and never referred again in this paper.

(7) Make "DMS concentrations" and "bacterial production rate" the same order.
    L434 between overall DMS concentrations and bacterial production rates

L483 between bacterial production rates and DMS concentrations

(8) L464 (Vogt et al.; Hopkins et al. 2010,,,,, ➔ (Vogt et al., **2008**; Hopkins et al., 2010,,,,

(9) L471 development and declining phase of **the** bloom

(10) L473-474 but **their** peak concentrations were reached as the bloom was declining

(11)L524-L526 Benard et al. Biogeosciences Discussion
➔ Biogeosciences 15, 4883-4904, 2018

(12)In Figure 2 (e), unit of the Y-axis "(µg C L-1 h-1)" ➔ "(µg C L-1 **d-1**)"

(13) You should write the figure captions of Fig 4 and Fig 5 in the same way.
Figure 4. (a) Maximum DMSPt concentrations, (b) maximum DMS concentrations reached over the full course of the experiment (day 0 to day 13). For symbol attribution to treatments, see legend.➔ **Averages over the course of the experiment (day 0 to day 13) for** (a) Maximum DMSPt concentrations, (b) maximum DMS concentrations reached over the full course of the experiment (day 0 to day 13). For symbol attribution to treatments, see legend.
OR
Figure 5. Same as Figure 4 but except for: (a) DMSPt:Chl *a* ratio, (b) DMS:Chl *a* ratio.