

Interactive comment on “Impact of the marine atmospheric boundary layer on VSLs abundances in the eastern tropical and subtropical North Atlantic Ocean” by S. Fuhlbrügge et al.

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Received and published: 21 March 2013

Response to Referee #1:

We would like to thank reviewer 1 for his valuable suggestions, which help to improve the manuscript in its written form. Below you find our answers to your specific points.

General comments The graphical presentation of the manuscript is satisfactory. However, the text presentation in the manuscript would need more effort to better convey the idea of the paper: (1) Grammatical errors were found in various places in the manuscript.

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The revised paper has been edited by a native speaker to improve the English grammar.

(2) Discussion in many sections can probably be shortened. For example, sections discussing meteorology and marine boundary layer can be significantly shortened, as the main focus of the study is the VSLs.

The addressed sections have been shortened (see also detailed answers below) to the point that they still represent important meteorological facts. Although a focus of our paper was on the VSLs, it was in respect to the atmospheric conditions encountered during the cruise, which we need to address in detail as background information.

(3) In general, manuscript text should present the scientific information extracted from the figure but not discuss the figures themselves. Any specific reference to a specific colored line or panel should be referred to in the figure captions not the text.

Those text passages have been rewritten; descriptions of coloured lines or panels are included in the figure captions now.

(4) Throughout the manuscript, the authors often refer to Hepach et al., 2012 for measurements in the seawater. However, it seems this manuscript is still under preparation, which is not appropriate to cite. Moreover, even if Hepach et al., 2012 is focusing on the seawater side of the story and it is understandable that the authors do not want to present overlap details in two places, certain aspects should still be included. For example, at least mention where and how the water samples were collected, since ΔC was presented; e.g. collected from surface? X m below the surface? from the Niskin bottle? or from an equilibrator?

We highlight that Hepach et al. is in preparation in the ms. The missing informations have been added to the 'Data and methods' Section.

(5) The authors have made the effort to also examine the relationship between VSLs fluxes and marine boundary layer height, and concluded that seawater concentrations

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were actually the dominant driver for the fluxes. Then I would be surprised why not also compare the atmospheric abundances in the same fashion. While the boundary layer height is obviously influencing their atmospheric abundances, I am sure seawater sources must be to some degrees influencing their abundances in the atmosphere as well, as observed in many studies. I would think the authors should also include the seawater concentration influences and compare it with boundary layer height, in order to make a stronger case.

As the reviewer has stated correctly above that we have two papers dealing with different aspects of VSLs in the Mauritanian upwelling and we do not want to present overlapping details here. Thus, this paper addresses the meteorological and atmospheric conditions encountered during the cruise and how those affect the VSLs distribution in the atmosphere. The main goal of this paper is to reveal the strong influence of the MABL height variations on the atmospheric concentrations, which is neglected in previous studies and leads to different conclusions concerning trace gas distributions and their sources. We also included the sea-to-air fluxes of the compounds, which form an interface between the two papers. However, the intent of this paper is only to mention the general influence of the sea-to-air fluxes and to give an outlook to the second paper. The detailed analysis of the sea water concentrations, the sea-to-air fluxes and the driving factors goes beyond the scope of this paper. Since those belong to the influence of the VSLs fluxes on the atmospheric abundances, both are included in the paper by Helpach et al. in preparation. These details are now better clarified in the text. If the reviewer wishes, we can provide a preliminary version of the Helpach et al. paper, which is intended to be submitted to ACPD within the upcoming weeks. In the revised paper, we now include the overall correlations of the sea-to-air fluxes with the atmospheric concentrations, due to the suggestions of reviewer 2 and 3, which reveal also the influence of the sea-to-air fluxes on the atmospheric concentrations.

(6) Throughout the manuscript, the statistics should be presented with a p-value and number of samples (n).

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These have been added now.

(7) The title itself is a bit confusing, perhaps "impact of the marine boundary layer conditions..."

We agree and change the title.

Specific comments: 31206 Line 21. The "missing source" was not discussed in the manuscript, and what "missing source" do the authors refer to?

The "missing source" was denoted by Quack et al., 2007, who claimed that coastal or inland strong sources must exist in West Africa to obtain the high atmospheric mixing ratios. A reference and explanatory text was added at this point and in the summary.

31208 Lines 15 to 20. I think this paragraph can be omitted.

Thanks for the hint, but we would like to keep it, as it is intended to give a short overview of the paper.

21209 Line 1. Should read "...to investigate the diurnal..."

Amendment approved.

31209 Line 2. What does "mutual interaction between ocean and atmosphere" mean?

We have rewritten this part to "oceanic influences to the atmosphere".

31209 Line 6. Transit between where?

"Transit" has been removed and the starting location and destination have been added.

31209 Line 24 to 26. This sentence sounded confusing, can the authors explicitly indicate the number of samples? For example, from "x" samples increased to "y" samples?

The "frequency" was unfortunately converted to time format. Corrected.

31210 Line 25 "lower meters of the boundary layer" sounded awkward; maybe "lower boundary layer"?

C13551

Amendment approved.

31212 section 3.1. This section can be shortened.

Section has been shortened.

31212 Line 14. Is it typical to use “fresh” to describe windspeed? Maybe fast? Or did the authors mean the age of the air mass?

Yes, it is meteorological convention to use “fresh” to describe wind speed for 8-11 m/s respectively beaufort scale 5.

31213 section 3.1.1. This section can be shortened.

Section has been shortened.

31216 Line 4. How do the authors define “coast”? From depth, nutrient, or primary production?

The ‘coastal’ stations show similar physical characteristics in the surface water for different parameters, as salinity and chlorophyll-a production. The sentence was rewritten and the information was added.

31216 Line 14. From here and onward, the authors reported the CH₂Br₂/CHBr₃ ratios in the atmosphere. What do these ratios imply during this expedition? Can any of the atmospheric processes or degradation of the compounds explain that? Simply reporting a ratio and not further discussing it does not seem useful or relevant.

Background information of the emission ratio was added.

31216 Line 25. Why should the VSLs increase at sunrise? Can such a finding relate to increase in seawater concentrations due to photosynthesis? Otherwise, I would be surprised to see an increase in the atmosphere because these compounds can be degraded through photolysis. Did a change in boundary layer height lead to such an apparent increase?

C13552

The sentence has been rewritten to “They show a slight decrease from 12 UTC to 00 UTC (UTC is equal to local time) followed by an increase from 06 UTC to 09 UTC on the following day, which coincides with a decrease of the MABL height and the sun rise at about 06:30 UTC.”

31217 Line 2. How do the authors identify outlier? Was any statistical criterion, such as greater than 2 standard deviations used?

The hourly variations of the outliers were greater than 2 standard deviations. This has now been stated clearly in the text.

31218 Line 8. I think this kind of description should be in the figure caption.

The description was removed from the text and added to the figure caption.

31218 Line 18. I cannot find a description about what the color means in the manuscript or the figures. Do the blue, yellow, and orange mean different initial altitude for running the Hysplit model?

The colors indicate the time to distinguish when which trajectory reached the ship. The information has been added to the figure caption.

31222 Line 20. Maybe also due to CH₃I lifetime in the atmosphere?

Thanks for the good hint, but as methyl iodide was mostly highly supersaturated in the ocean, the influence of atmospheric CH₃I on oceanic surface CH₃I is low. Further details will be presented in Hepach et al. in preparation.

31223 The summary is somewhat redundant, much information already included in the introduction. I recommend maybe shorten to only include the key findings of the study.

The summary has been shortened.

Table 3. Please include p-values and number of samples (n).

P-values and number of samples have been added now.

C13553

Table 4. Although much of the information was already mentioned in the table 3 caption, it should still be mentioned again. Each table and figure should be self contained.

We agree, the information has been written to the table caption.

Figures 8 and 9. Detailed figure captions are needed, see above.

We changed it to: "Fig. 8: Dibromomethane mixing ratios [ppt] measured during the DRIVE ship campaign from 31.05. to 24.06.2010. Six 24 hr stations (S1 – S6) and underway measurements are color-coded according to the scale on the right side." and "Fig. 9: Methyl iodide mixing ratios [ppt] measured during the DRIVE ship campaign from 31.05. to 24.06.2010. Six 24 hr stations (S1 – S6) and underway measurements are color-coded according to the scale on the right side."

Figure 10. Please include a description about the colored trajectory.

Description included.

Figure 12. Please also include p-values.

P-values have been added.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 31205, 2012.