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Atmospheric
Chemistry
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Discussions

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.

S. Fuhlbrügge et al.

sfuhlbruegge@geomar.de

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Response to Referee #3:

We would like to thank reviewer 3 for his critical comments, which helps to improve the paper in its written form. Below you find our detailed answers to the specific points.

1. The observational result, “highest VSLS mixing ratios were found near the Mauritanian coast and close to Lisbon” is consistent with the well-known finding of much higher fluxes of those compounds from the coastal waters than from the open ocean (for example, Quack et al., 2003). Nevertheless, the authors conclude marine atmospheric boundary layer (MABL) height variations are an important driver for VSLS mixing ratio variations, only based on the correlations of VSLS abundances and meteorological parameters. Correlation is not sufficient for “cause-and-effect” relationship. I would encourage the authors to carry out further study taking account of the VSLS fluxes.

This suggestion is exactly the content of our second paper and will be addressed in detail there. In contrast to previous studies (e.g. Quack et al 2003), we add a new temporal and spatial high resolution VSLS data set near the Mauritanian coast and combine them with measurements of the MABL conditions. Thus, we think we have included “further studies” in the present study. MABL height and fluxes both together have an influence on the VSLS abundance in the atmosphere as we state in our paper. Now, we include an overall correlation table for the sea-to-air fluxes and the atmospheric concentrations, revealing also the influence of the sea-to-air fluxes on the atmospheric concentrations. The detailed analysis of the sea-to-air fluxes, their driving factors as the sea concentrations and their influences goes beyond the scope of this paper. Low MABL heights and large sea-to-air fluxes, both contribute to an increase of boundary layer VSLS, which are however not equally likely. There are certain combinations and thresholds of MABL heights and fluxes and also there are different driving factors for the sea-to-air fluxes, which are discussed in detail in the second paper “Diel and regional drivers of air sea fluxes by the study of Hepach et al., which will be submitted in the upcoming weeks. See also our detailed answers to reviewers 1 and 2.

2. Too little information is given for the VSLS measurements, in spite that much space is devoted to the description of meteorology. How stable were the VSLS in the canisters? How did the authors estimate the analytical precision to be on the order of 5%? How were the standard gases prepared?

The canisters were analyzed within three months after the expedition. The stability of the atmospheric samples has been demonstrated during more than ten years of work with stainless steel canisters and it has been demonstrated that the compounds reported here are typically stable for at least 6 months or more. For example, we use large volume whole air samples stored in passivated stainless steel canisters as analytical working standards for periods exceeding one year. Thus we expect that no degradation has occurred prior to the time of measurements for the compounds reported here. To be sure, there are occasional exceptions that are found within a batch of samples, but these are rare. The precision estimate for most compounds is better expressed as a minimum uncertainty related to the detection limit (<0.1 pptv - compound dependent) plus an additional uncertainty related to analytical and canister to canister variability. This latter variability can change depending on the operation of the instrument at the time of analysis. For these samples we estimate the variability from our standard to standard variability during analysis (typically standards bracket every four samples), and from examination of multiple samples within the same air mass. The analysis of the gases is performed with GC/MS, while the calibration gases are standardized by gas chromatography with an atomic emission detector (AED) (Schauffler et al., 1999), which is a method that can determine the carbon and halogen composition of trace gases independently of their molecular composition- and the entire standardization procedure was additionally adjusted to the NOAA scale in order to have better comparability to the NOAA measurements at surface stations. The preparation of standard gases is described in Montzka et al. (2003).The method has been clarified in the text now.

3. What is “the so far observed missing VSLS sources in this region”(p. 31206 line 21)?

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 in the text.

4. What is “similar characteristics in the surface water” (p.31216 line 4)? If VSLS concentrations were similar in the surface water at the six diurnal stations, that should be stated clearly.

The stations were clustered, as they show similar physical and biological characteristics in the surface water for different parameters, as salinity and chlorophyll-a production. We stated this clearly now in the text.

5. The authors state “higher VSLS concentrations obviously coincide with a lower MABL height and vice versa”(p.31222 line 11-12). But, Figs. 7-9 show “higher VSLS concentrations coincide with coastal sites and vice versa”, and Fig. 12 show no significant correlation between VSLS concentrations and MABL at each fixed station (cf. the VSLS mixing ratios from station 1 seem to be constant for the variable MABL heights of 700m – 1100m.)

Higher VSLS concentrations don’t coincide with coastal sites and vice versa. Specific meteorological conditions of the MABL height obviously coincide with increases of the marine surface VSLS in our case. In addition, our results just count for this cruise, we cannot generalise them, as we clearly state in our summary. We will rewrite the specific mentioned passages to state this more clearly in the results section as well.

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