

Interactive comment on “Seasonal variation of aliphatic amines in marine sub-micrometer particles at the Cape Verde islands” by C. Müller et al.

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We would like to thank the reviewers for the careful consideration of the manuscript and for constructive comments and suggestions made to improve the manuscript. Those are addressed below. In the case we do not concur with the reviewers' comments, proper reasons have been given.

Responses to reviewer 2

1) *Are all trajectories from Africa are linked to the presence of amine salts?*

Amines were detected independent of air mass origins.

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2) *Can you combine both the backward trajectories with Modis-Aqua images? Or in other words, are those trajectories staying longer above biologically active oceanic region showing larger amine content?*

This is a good point though the time resolutions of MODIS satellite data are not high enough for such analysis. This could be a topic for future field studies.

3) *Can the amines be entrained by bubble bursting in these regions?*

There is a possibility that biologically produced amines in the surface ocean water are entrained by bubble bursting. However, a bubble bursting produces largely coarse particles (0.5 – 50 μm) (Blanchard, 1954; Blanchard and Woodcock, 1957; Resch and Afeti, 1991) that are much larger than the size range in which high levels of amines are observed in this study. Marine particles in this size range were mainly formed by gas to particle conversion of sulfuric acid and little is contributed from a bubble bursting process (Huebert et al., 1993; Kerminen und Leck, 2001; Matsumoto et al., 1998). In addition, amino acids which also exist in the surface ocean water were not detected in our samples, indicating that amines detected in this study mainly originated from processes other than the bubble bursting.

4) *There is also some discussion about the difference between these observations and those made at Mace Head by Facchini et al. (2008) (approximately a factor ten higher in the later study), which is explained by possible different local productivity. But why local? Aliphatic amines are certainly reactive in wet marine aerosol and may degraded during transport from the Western African coast (where the biological activity seems to be the strongest if I correctly understood figure 9). Such observations could be a hint about the importance of particle ageing on their amine content.*

Indeed, this is a good point and a sentence is added to point out another possibility for lower amine concentrations at the Cape Verde island station than the Mace Head station. Based on the reviewer's suggestion, the sentence is modified as follows (Page 14832, Line 21):

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One reason for this difference may be due to lower primary productivity in the region of Cape Verde in comparison to Mace Head. The lower primary productivity is also reflected in the methanesulfonic acid (MSA) concentrations which were about a factor of eight lower in the Cape Verde samples than the values reported for Mace Head (Table 1). Another reason is the degradation of amines during the transport from the source region to the Cape Verde islands though no evidence is found so far for the presence of degradation products.

5) *Can you obtain some information from your samples about the acidity of the aerosols (or its ionic strength)? In fact, the uptake or gas to particles conversion of these compounds may be driven by acidity. . .*

Due to limited sample materials, pH values could not be measured directly at the sampling site. We have attempted to estimate the pH values from thermodynamic model calculations using E-AIM (Clegg et al., 1998) for selected sampling days. The model calculations showed slightly acidic pH values (~ 3.4) for these days which may imply the reactive uptake of amines driven by acidity. A detailed analysis of this kind is beyond the scope of this study and it warrants the future study.

S. L. Clegg, P. Brimblecombe and A. S. Wexler, J. Phys. Chem. A, 1998, 102, 2137-2154.

<http://www.aim.env.uea.ac.uk/aim/aim.php>

6) *The paper is well written but maybe carries too much figures.*

Figures 6 and 8 are moved to Supporting Information of the revised manuscript based on the comments made by the reviewers.