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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterization of the South Atlantic marine boundary layer aerosol using an Aerodyne Aerosol Mass Spectrometer" *by* S. R. Zorn et al.

Anonymous Referee #1

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The paper presents the first AMS measurements of remote marine air in the southern hemisphere. As written, the paper is informative but it could be greatly improved if more detail were offered as outlined below. The most significant contribution of the paper is the method developed for quantifying MSA from the ToF-AMS. The paper should include a discussion of how applicable this method is for other ToF-AMS instruments and sampling conditions. Can other AMS users take the results shown here in order to quantify MSA without any modification of the method? The remainder of the paper, which describes MSA in the marine atmosphere, does not recognize the significant body of literature concerning MSA, its sources, its importance in MBL atmospheric chemistry, and its lifetime. For example, on p. 4846, lines 18 to 26 it is stated that

MSA is produced mainly over the ocean with no references sited. It is also stated that this could make MSA an excellent tracer for marine aerosols with no references cited even though this has been known and published since the early 1990s or before. Many papers describing MSA in the marine atmosphere have been published including discussions of lifetime and evaporation and transfer between particles of different size. This body of literature should be recognized so that the discussion in this paper can be brought up to date. Finally, much more could be done to enhance the discussion of aerosol composition downwind of the phytoplankton blooms. Are there previous measurements that can place the results presented here in the context of the biology occurring within the plumes? An extensive literature review is not necessary but information about the potential biological source of organics and nitrate from the blooms would make the results presented here much more meaningful (even if the blooms are the planned subject of another more detailed paper).

Abstract, line 22: Define diameter type. I assume vacuum aerodynamic diameter at low RH?

Introduction, first paragraph: Many statements are made that need to be supported with references. For example: "Atmospheric research is a scientific field that has become more and more important in recent years", "processes taking place in the atmosphere are barely understood", "The major source for MBL aerosol particles in the super-micron size range is sea spray".

Introduction: It is stated that supermicron aerosol is primarily made of sea salt in the MBL and that "under certain conditions a significant fraction of the sub-micron aerosol is of secondary origin."; Clarify what other constituents make up submicron aerosol (i.e., sea salt) and provide references.

p. 4834, line 17: Loosing should be losing.

p. 4835, lines 10 to 12: How did Coe et al. use the AMS to measure sea salt, organics, and sulfate? Did they run the vaporizer hot enough to see sea salt?

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p. 4843, line 22: Loosing should be losing.

p. 4844, lines 20 to 25: It seems unlikely that atmospheric conditions will affect the composition of the ship plume if the plume were measured close to the point of emission. Was there a re-fueling of the ship or a switch in fuel tanks?

p. 4845, lines 12 to 17: Please provide more information on the cause or source of the blooms? Is this upwelled, nutrient rich water?

p. 4845, lines 20 to 21: Is there another hypothesized source of MSA than DMS? This statement gives the impression that DMS is not known to be the source of MSA which is in contrast to a large body of refereed literature.

p. 4845, last paragraph: Could the lower MSA to SO4 ratio also be due to independent sources, i.e., is there a possibility of long range transport of anthropogenic SO4?

p. 4846, line 12: What does "on the other side" refer to?

p. 4847, lines 10 to 16: Is the nitrate here identified as inorganic or organic NO3 in the ToF-AMS fragmentation patterns?

p. 4848, lines 7 to 9: Can something be said about the size distribution of the organics measured in the MBL? Contrasting it to what is observed in more urban air would provide a nice balance for the large body of AMS urban measurements. In addition, there are many recent papers describing the flux of organics from the ocean but these are based on low size resolution impactor samples. AMS measurements with much finer size resolution would make a large contribution to this literature.

p. 4848, lines 11 to 17: What concentrations of NH4 would be required for an NH4 to SO4 molar ratio of 1 or 2 given the measured SO4 concentrations? Are these concentrations above the detection limit of the instrument? If not, than the assertion of a sulfuric acid composition based on below detection limit amounts of NH4 is questionable.

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p. 4850, lines 15 to 17: How does the MSA to SO4 ratio for the Antarctic compare to those previously reported?

p. 4853, line 16: Change to "are too low"

p. 4854, line 4: Change to "were too low"

p. 4855, lines 2 to 4: The reference to supporting the CLAW hypothesis should be removed from the paper. The CLAW hypothesis involves the entire loop of DMS to sulfate to CCN to cloud properties and back to production of DMS. The measurements presented here only include the DMS to sulfate portion of the loop and do not address even that one small part in a direct way, i.e., there is no direct measurements of DMS.

p. 4855, line 27: What is meant by the "miss of a cation?"

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