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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Fast sulfur dioxide measurements correlated with cloud concentration nuclei spectra in the marine boundary layer" *by* D. C. Thornton et al.

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General Comments:

The point is taken that the manuscript presented a complex set of data that needed to be more clearly explained. A revised manuscript is nearly completed that narrows the focus of the manuscript to two specific points that relate to the correspondence of SO2, CCN, and other small aerosols to present a more coherent result. The need for modeling should have been expressed as 3-D cloud modeling because of the difficulty of measurements in cloud for even the most basic properties, including temperature. More measurements would be useful because there were instrumental problems with

DMS instrument during the field project that limited the utility of that species as a conserved species with respect to transport and cloud processing. Measurements of CCN and CN in cloud with inlets that prevent droplet shatter are needed in understanding cloud processing of gases and aerosols.

Specific Comments:

The changes in the wording that the reviewer requested were made and more attention was paid to clearer expressions.

On the question of SO2 solubility one must consider that aerosols, cloud droplet, and rain are not pure solubility systems. In particular atmospheric aqueous systems are affected not only by pH but also significantly by hydrogen peroxide, which is highly soluble and was in abundance compared to SO2. In addition gas phase ammonia will likely be present on the order of 0.5 to 1 ppbv. Under atmospheric conditions heterogeneous oxidation of SO2 would be more rapid than homogeneous gas phase reaction. For example, Bandy et al. (Geophys. Res. Lett. **23**, 741-744, 1996) showed that SO2 produced during the day is lost by heterogeneous processes during the night in the remote CBL.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 14903, 2011.