Atmos. Chem. Phys. Discuss., 11, C9442–C9443, 2011
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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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Received and published: 28 September 2011

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 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 particularly in and very near clouds would be useful

in understanding the interactions in and between gases and aerosols. While there were robust measurements of SO2, O3, and water vapor in cloud during RICO, there were instrumental problems with DMS measurements during this 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 points

Agreed that anthropogenic sources of SO2 also result in particles, that is, primary sulfates as well as soot, ash, etc. The manuscript for Figure 8 did not clearly state that the linear correlation of SO2 with $\leq$0.1% supersaturation CCN in the pollution plumes could have been from non sea salt sulfates produced by combustion or SO2 adsorbed on the $\leq$0.1% supersaturation CCN. These CCN that activate at $\leq$0.1% supersaturation are much more likely to be sea salt (as mentioned in the manuscript) than soot particles, although soot with adsorbed SO2 are certainly possible.

Aerosol number concentrations were used and discussed in the manuscript. The aerosols $>$0.5 um diameter did not vary significantly during the CBL portions of the flight. As was pointed out in the manuscript the changes observed were substantially in the range of 0.06 um to 0.4 um, particularly for CCN $>$0.2% supersaturation, which are $<$100 nm diameter.

Negative fluxes for the near surface circles represent loss of SO2 to the sea surface or aerosols. Negative fluxes near the top of the CBL can be from entrainment from above. The SO2 fluxes and the CCN concentrations are more clearly discussed in the revised manuscript.

To our knowledge there were no remote sensing measurements that could be compared to in situ aircraft gas or aerosol measurements for RICO.

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