**Atmospheric
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Discussions**

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Comment

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

Anonymous Referee #1

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General comments:

Thornton et al. report simultaneous measurements of SO2, CN and CCN concentrations from flights during the RICO field campaign. They investigated the relationship between SO2 and CCN, in an effort to examine the role of SO2 on cloud formation.

The paper addresses relevant scientific questions within the scope of ACP, and presents high quality and potentially useful data. However, the interpretation of the data and conclusions were hard to discern in the manuscript.

My impression is that it was difficult to learn much about the impact of SO2 on cloud formation from these measurements. This makes the manuscript often confusing and

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at times hard to read. Based on the correlation plots of CCN and SO2 (Figure 8), I thought they were going to say that the two are related. But they end by saying that they don't understand the relationship, and more measurements and modeling are needed. What are the implications of Figure 8? This linear correlation is also mentioned in the abstract, but what does it tell is? The authors end by saying that more measurements and modeling are needed. Based on the experience of this project, specifically what kind of measurements and modeling are needed to examine this question? I am unsure what I am supposed to learn from this paper.

Specific comments:

Abstract: âĂć "Accumulation mode aerosols were a factor of two greater..." What was greater? Their number concentration?

1 Introduction: âĂć Replace "which were observed visually on occasions but more often than not" with "which were occasionally observed visually".

3 Observations: âĂć Define "cold pool event".

3.2 CN âĂć What is "CONCN"? âĂć Second to last paragraph: Refer to a figure here. Figure 3? âĂć Last paragraph: Elaborate on what makes this remarkable.

3.3 PCASP âĂć What is "CONCP"?

3.4 CCN âĂć Use the word "supersaturation" rather than "S". âĂć The last sentence of the second paragraph doesn't make sense to me.

4 Discussion âĂć I don't consider SO2 itself highly soluble (H = 1.23 M atm-1). Of course, its effective Henry's law constant will depend on cloud pH, which was apparently not measured. The apparent high solubility of SO2 is likely due to rapid oxidation of SO2 to sulfate in cloud droplets. âĂć Line 291: "SO2 conversion to sulfate". How? By SO2 + OH? âĂć Line 297-298 is not a complete sentence. Insert "is" before "in"?

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