

Much appreciation for the instructive and detailed *comments from Anonymous Referee #3*. Please see our replies below.

*Specific minor comments*

*Page 2875 line 3: sulfate should be written as 2-.*

Thanks for noticing the error.

*Page 2875 lines 10-11: by what longitude offshore?*

This is changed to "...west of 78°W."

*Page 2880 line 17: near unit "collection" efficiency*

Suggestion accepted.

*Sections 2 and 3: It seems odd that neither of the 20S over view papers are referred to in either of these sections. Whilst the over view of BL thermodynamics and cloud along 20S is referenced (Bretherton et al 2010) this is specifically in support of the fraction of precip reaching the surface. Neither this paper, nor the chemistry over view of Allen et al is cited in the introductory remarks. Given that the work presented in the paper is directly related to the result in these papers it seems a shame not to discuss the linkages. Notably the longitudinal regions "near shore", and "remote". Allen et al in particular provides a back trajectory analysis that also supports the pollution contributions as a function of longitude that should be referenced.*

We have added the references to Bretherton et al. 2011 and Allen et al. 2011 to the opening paragraph of Section 3. The first author of this manuscript just came back from a 9-week research cruise, and was thus unaware that the Allen et al. paper had been accepted in ACPD. We thank the reviewer for the suggestion.

*Page 2883 line 20: Similarly Allen et al shows aerosol size distributions from the MBL and FT in the nearshore and remote regions. These should be discussed.*

Reference added.

*Page 2884 line 24: 150 gm-3?*

$L_{WC}$  is a typo; it should have been  $L_{WP}$ . The unit is correct.

*Page 2884 lines 25-26 "The optical rain detected sporadic precipitation events" This sentence doesn't seem to make sense*

Should be optical rain gauge...

*Page 2888 lines 9-13: This assumes that the MBL grows in height commensurate with entrainment. If other dynamical processes occur to maintain boundary layer top at a more constant altitude then a better estimate of the net entrainment of sulphate is the former case involving the difference between the concentrations above and below the boundary layer. The authors are right to say that the mass flux into the MBL from above the BL top does not depend on the concentration in the MBL, only on the concentration aloft. However, if BL height is constant the mass of air in the BL can only be maintained with an opposite mass flux to the lower FT and this should be considered. The authors should be clear about whether the BL is growing in response to entrainment or not before favouring one formulation or the other.*

We have decided to remove this section on the 'mass' flux due to entrainment to avoid confusion.

*Page 2889 line 12: "all of which would be converted to SO<sub>4</sub><sup>2-</sup> aerosols" all seems a little strong. If production of SO<sub>2</sub> from DMS is calculated to be approximately 10 times the entrainment flux (see section below) then around 10% of the concentration in the MBL arises from entrainment, Whilst it is a minor component it isn't zero.*

See response above.

*Page 2891: right bracket missing in equation 8*

Corrected.

*Page 2893 lines 16-18: It would be instructive if the authors could put uncertainty estimates on the size of the effect of not considering mass transfer limitations.*

According to a number of papers from S. Schwartz, oxidations of SO<sub>2</sub> by H<sub>2</sub>O<sub>2</sub> and O<sub>3</sub> do not appear to be appreciably limited by mass transfer *per se* under usual cloud microphysical conditions. Cloud droplet size may affect pH, which can in turn influence the reaction rate between SO<sub>2</sub> and O<sub>3</sub>. But in VOCALS-REx, it is the reaction of SO<sub>2</sub> with H<sub>2</sub>O<sub>2</sub>, which is largely insensitive to pH, that dominates. Thus mass transfer as a function of droplet size does not appear to significantly affect aqueous chemistry here.

*Page 2898 line 5: Were DMS measurements not made? If they were why can't the data be also shown in fig 13 for comparison?*

DMS measurements are shown in the new plot (see author's comments #1).

*Page 2898 line 21: "The last term represent" represents*

Corrected.

*Page 2900 line 11" 40,pptv" remove comma*

Corrected.