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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Particulate sulfur in the upper troposphere and lowermost stratosphere – sources and climate forcing" *by* Bengt G. Martinsson et al.

Anonymous Referee #3

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The paper describes the use of measurements of sulphur collected onto filters on board CARIBIC commercial aircraft over the past decade. The filters were analysed by PIXE. The data analysis develops a relationship between the concentration measurements and vertical distance to the tropopause derived from a PV analysis of re-analysis data. This is used to build a seasonal profile by combining data from multiple flights in each 3 monthly period. The analysis is used to show the amount of sulphur in the lower stratospheric column and derive an aerosol optical depth resulting from it.

I found the description of how the analysis was done to be less than clear. Some of the sentences were long and not transparent and on a number of occasions the sentence did to scan well or had typos in it e.g. "This was undertaken for 4 up to 7

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groups of data for each season, and a total of 60 regression groups distributed over 12 overlapping seasons were used. This overlapping places each month in the center of a three-month season thus adjusting to smooth seasonal changes in the UTLS." I would recommend this whole section and how this relates to the further description of the approach in the results section need re-writing and clarifying. Further, it is not clear what is meant by "overlapping", does this mean that the some of the same data are used in multiple regressions? I assume this is a 3 month average centred on a particular month from the legend in figure 3. Please clarify. A previous referee is critical of the use of concentration rather than mixing ratio and I can see why in principle. Equally I can understand the authors' use of concentration since the column abundance of sulphur can be retrieved from the regressions and hence the AOD which would not be the case if the mixing ratio was used. This is also true of the use of altitude deriving from a PV definition of the tropopause rather than ozone. However, as far as I can see this only works if the pressure changes over the altitude range of the samples are sufficiently small that the regression derived results from the relative position to the tropopause and not the absolute altitude, this needs to be clarified before the analysis can be verified.

The weighting of the regression isn't described in sufficient detail for a reader to follow and replicate. This needs clarification.

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