

Interactive comment on “Characterization of aura tropospheric emissions spectrometer carbonyl sulfide retrievals” by L. Kuai et al.

Anonymous Referee #2

Received and published: 27 August 2013

Review on the paper: Characterization of aura tropospheric emissions spectrometer carbonyl sulfide Retrievals by: L. Kuai et al..

The paper describes the retrieval of atmospheric OCS from the TES satellite instrument and a comparison of the TES results with ground-based data. The topic is appropriate for AMT, but in its current state, the paper is not acceptable. I have several major and minor comments:

Page 6979, line 18-20: Instead of: ‘It is also the OCS column Jacobians. The contour plot of OCS Jacobians (Fig. 1c) suggests that the radiances are more sensitive to OCS between 900 to 200 hPa.’ May be better: ‘This figure gives also the OCS column Jacobians. The contour plot of OCS Jacobians (Fig. 1c) suggests that the radiances

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are most sensitive to OCS between 900 to 200 hPa.’

page 6979, line 20: This sentence is difficult to understand. ‘For comparison to the noise level, the Noise Equivalent Spectral Radiance (NESR) in this region is $1 \times 10^{-8} \text{ W cm}^{-2} \text{ sr}^{-1} \text{ cm}^{-1}$ indicating that the OCS signal to noise ratio in this region is approximately one for each of the strong absorption lines.’

Page 6980, line 1: The authors write: ‘For these reasons, CO₂ and H₂O are simultaneously estimated with OCS but are constrained using estimates from a previous retrieval using different spectral bands measured by TES.’ This I do not understand, are CO₂ and H₂O retrieved or not?

Page 6980, line 14: The authors write: ‘... the current study is limited to over the Pacific.’ This is a strong limitation, and should be named in the abstract and even title.

Figure 4: It does not make sense to plot only the residuals in a Figure. The measured spectrum together with the corresponding residuals on the top must be in one Figure to make a comparison of both by eye.

Page 6981, lines 10-20: I don’t understand what the authors want to say in that paragraph.

Page 6982, line 3: The authors write: ‘Due to the low sensitivity of the TES observed radiances to OCS relative to H₂O and CO₂, the TES spectrum gives limited information about the OCS profile.’ The retrieval of a concentration profile depends mostly on the quality of the spectral line under investigation. The relevance to H₂O and CO₂ is not of importance here. What do the authors want to say with this sentence?

Page 6982, line 9: The authors write: ‘The black line is one tenth of the 10 column-averaging kernel.’ I don’t understand this sentence, what do the authors want to say with this sentence?

Line 22: I would estimate from Figure 6 that the total error is 100 ppt (20% x 500 ppt), not 50-80 ppt.

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Page 6983, line 7: For me, a comparison of monthly means for many years makes no sense. In this way the result will represent the a-priori, and the procedure cannot be named comparison or validation.

page 6983, line 25: The authors write: 'We attribute this result from the uncertainties in the spectroscopic line strengths.' New OCS spectral data are available for a few years, I do not agree that the 13% difference is due to uncertainties in the spectra data. Furthermore, it is not clear to me which spectral data have been used for the retrieval. The whole retrieval is not described in the text.

Page 6985, line 5: The HIPPO data must be averaged over the whole column, not just between 200 and 900 hPa. The TES data are not sensitive outside 200-900 hPa, but the a-priori used contains OCS values, which will be part of the column retrieved. Page 6986, line 23: I don't understand why the bias of -15 ppt is expected. 3.4 km is still far below the tropopause.

Page 6988, line 20: Why do the authors in the conclusions give an uncertainty of 50 ppt, while on page 6982 give 50-80 ppt (and I estimate 100 ppt).

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 6975, 2013.