

We thank Mahesh Sha for the helpful comments and suggestions. In the following detailed response to all reviewer comments, the Reviewer Comment is in black, followed by our response in blue and modifications to the manuscript in green.

Response to Review #2

General comments

This manuscript presents a general description of the University of Colorado mobile Solar Occultation Flux instrument consisting of a digital mobile solar tracker coupled to a Fourier Transform Spectrometer (FTS) and a UV-Visible Spectrometer (UV-Vis). The paper describes the characterization of the instrument with respect to the ILS. These spectrometers are used to measure the absorption of NH₃, NO₂ and C₂H₆ along the solar beam from a ground-based moving laboratory. Furthermore it demonstrates the first application of the instruments to characterize structure functions and quantify emission fluxes of NH₃, NO₂ and C₂H₆. Collocated measurements next to a high resolution FTS at the National Center for Atmospheric Research were performed to check the precision and accuracy of NH₃ and C₂H₆ for the low resolution FTS instrument. The manuscript gives an overview of the assessment of errors and biases in the vertical column density (VCD) of NH₃, NO₂ and C₂H₆. The paper gives innovative measurement techniques which will be an added value to the satellite and in-situ community. Therefore I recommend it for the AMT publication with some minor additions as outlined below in the specific and technical comments.

Specific comments

I would appreciate if you could give the precision and accuracy of the NO₂ measurements with the UV-Vis spectrometer even though in section 2.1 and 2.3 you have made reference to the comparison paper made by Baidar et al., 2016.

We have added the following text to the revised manuscript:

Line 280: The LOD and precision of NO₂ from the DS-DOAS are 7×10^{14} and 3×10^{14} molecules cm⁻², respectively (Baidar et al., 2016).

A Stirling cooled detector has been used for the experiment; do you see any vibration related problems in your results? Perhaps a comment on this would be helpful for the reader in section 2.2

The vibrations from the cooler are outside the frequency domain of the vibrational frequencies, and are easily separated. These vibrations do not impact the results of the analysis.

Page 13 Line 358: I suppose the error in the wind calculation cannot be divided by the sqrt of the number of days.

We have included additional information on the model wind and the error on the wind is now determined as ~23 %. See our detailed response to reviewer#1.

Technical comments

Page 3 Line 74: I would include the formula for acetaldehyde here.

We now include CH₃CHO as suggest.

Page 4 Line 110: I would include the full name of SCIAMACHY here.

We now include the full name as suggested.

Page 4 Line 111: for NO₂

We have changed it as suggested.

Page 5 Line 117: May be “Experimental setup” or “Experimental design” is better suited?

We changed it to “Experimental design” as suggested.

Page 5 Line 121: please mention the resolution of the FTIR here.

We have included the resolution here as suggested.

Page 5 Line 128: The instrumentation was mounted inside a trailer with the solar tracker placed on top of the trailer.

We changed the sentence to “The instrumentation was mounted inside a trailer with the solar tracker placed through the roof of the trailer.”

Page 5 Line 139: . . . and NO₂ lines at UV-Vis wavelengths.

We have changed it to include the word “lines”.

Page 6 Line 146: “to change the optical path difference” – this sentence is not so clear?

We changed the sentence to the following: “The EM27 FTS is a Michelson interferometer with a double pendulum corner cube mirror design. The oscillating mirrors determine the optical path difference (OPD).”

Page 6 Line 148: what is the temperature of the detector?

The sentence now includes the temperature information: “[...] and a Stirling-cooled sandwich detector operating at 77 K, [...]”

Page 6 Line 160: “The MCT spectra were background corrected” this sentence is repeated – see two lines above.

We removed this part of the sentence in line 160.

Page 6 Line 166: . . . and water vapor taken from NCEP

We added “vapor” to the sentence.

Page 8 Line 197: Prior to field deployment, collocated measurements were performed with the mobile laboratory at the National Center for Atmospheric Research (NCAR) in Boulder, CO with a high resolution . . .

We changed the sentence as suggested.

Page 10 Line 267: . . . variability is 50 % of the maximum value . . .

We removed “that value” as suggested.

Page 10 Line 273: I suggest giving a plot reference here.

Thank you. The sentence now reads as: Figure 9 shows the structure function [...].

Page 11 Line 298: While driving around a source area

We have updated the sentence.

Page 15 Line 391: . . . a source point that is at a distance . . .

The sentence has been changed as suggested.

Page 21 Line 583: The list of acronyms is not complete: for example you may add RD, NEI,

We added the acronyms for RD and NEI, but decided to leave out less important acronyms such as chemical abbreviations that only occur once and are less critical to the paper.

Page 38 Figure 1: I suggest labeling the components in the UV-Vis spectrometer and the mirror in the FTS spectrometer.

This Figure is already crowded, and the components are part of the standard configuration of these spectrometers. For these reasons we have decided to leave the figure unchanged.

Page 41 Figure 4: Labelling of the X and Y axis are missing.

We have included “arbitrary units”.

Page 43 Figure 6: Labelling of the X and Y axis are missing.

We have included “latitude [deg]” and “longitude [deg]”.