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Atmospheric Measurement Techniques Discussions



# *Interactive comment on* "Characterization and verification of ACAM slit functions for trace gas retrievals during the 2011 DISCOVER-AQ flight campaign" *by* C. Liu et al.

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The determination of spectrograph slit functions is an important factor in correctly interpreting spectral data. It is a parameter often overlooked in such analyses, and if paid attention to, is often determined poorly or parameterized poorly. This paper presents a general method for detailed characterization and verification of a spectrograph slit function from a system observing the Earth's atmosphere through cross-correlation with a high resolution solar reference spectrum after taking account of atmospheric gas absorption and Ring effect. The paper presents comparisons of atmospheric trace gas retrievals using both the empirically derived slit function and laboratory measured slit



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Interactive Discussion

Discussion Paper

function which show the empirical method is reliable. As such, this paper should be published subject to the following comments.

P2/7 I would replace “improve” with “assure” since the slit function should be determined not just to improve the analysis, but rather as an essential element of the analysis P2/23 SO2 was not also part of the measurement? P3/13 “.... that pass through the atmosphere and are affected by atmospheric ....” P3/21 perhaps add “... narrow band lasers ...” . I see on reading further that there is a telescope (?) – if so, were the measurements of the ACAM slit function made with the telescope installed – see note further down. I gather from p5/18 that the measurements were performed with the telescope on? P3/23 “.... available for comparison .... P4/22 please give the manufacturer of the two C-T spectrometers P4/24 I cannot tell if these are scanning systems or if they have a CCD type detector. I assume CCD type detector – please identify type P4/29 concerning observing modes, one assumes there is a telescope on the system. If so, you might want to mention illumination qualities of the telescope on the spectrometer system since that illumination quality will affect the measurement of slit function. P5/4 remove the reference to HSRL unless it is important in the manuscript P5/23 why was a skewed Gaussian line profile chosen for the fits? Were any other parameterizations investigated? Slit functions are not always Gaussian-like, so some comment on why it is applicable to ACAM would be useful. P5/25 a 3rd order polynomial was selected for the dispersion fits – why was this chosen. If another order was chosen, how much difference would this make in the results? P5/26 I would add “... 0.03nm/0.04FWHM ...” to emphasize the number with respect to actual slit width FWHM P6/3 “.... and fitting trace gas absorptions to retrieve trace gas columns” P6/8 minimize the differences between spectral simulations and the observed spectrum? P6/29 might want to comment on the effect of the lab cross section measurement slit function – i.e. the resolutions of the various lab cross sections used in the analysis are sufficiently high that the slit functions of the lab measurements can be ignored P7/9 Initial comparison of derived with measured slit functions ... P7/23 please clarify the comment about delta lambda =0 as always the slit peak? It is not clear if there is an asymmetric slit representation



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that the slit function is properly centered on the correct wavelength? P8/13 the residual fits after consideration of Ring and gas absorption are really large at 0.2% and 0.34%. Why? Spectral systems routinely achieve spectral residuals below 0.1% these days. P8/20 what is the effect of other parameterizations than the 5 parameters chosen? P10/14 why 6th order? Perhaps a comment on this choice? P10/20 50 ground pixels P12/10 please remove the advertisement for the following paper

General comments: P8 the laboratory cross sections of absorptive gases have wavelength errors – what effect on the analysis do those errors have? A statement recognizing this as a potential problem

P8 the authors have chosen ground pixels for comparison for the obvious reason of increased gas absorption. But why not use the zenith sky observations where the scene is quite uniform so spectrometer illumination is quite uniform and there are still gas absorptions of at least ozone and NO2 at 8.5km a/c altitude. See p9/1-11

P10 and p11 the authors discuss the DSCD changes using derived and measured slit functions. What effect is there on the spectral residuals which seem quite large from the ACAM instrument?

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Interactive comment on Atmos. Meas. Tech. Discuss., 7, 11415, 2014.