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Atmospheric Measurement Techniques
Discussions

Interactive comment on "Near-infrared remote sensing of Los Angeles trace gas distributions from a mountaintop site" *by* D. Fu et al.

Anonymous Referee #2

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This paper is very well written. The authors describe a very interesting novel setup for mapping of XCO2, XCH4 and XCO by using an FTIR spectrometer located on a mountaintop. I recommend publication of this relevant contribution in AMT. Below I list a few comments concerning clarifications / extensions for consideration in the final publication in AMT.

Spectrometer description: The metrology laser system seems not to be of the quadrature type, but instead uses a single laser channel. Is it possible to coadd interferograms? Is the optical encoder information used for defining an absolute ZPD (zero path difference) reference or is the location of the centerburst determined for coaligning interferograms before superposition? Is the scan operation mode of the spectrometer forward-backward or forward scan + fast return?

In case of TCCON, it turned out that the presence of sampling ghosts (due to a systematic sampling position mismatch between even and odd laser sampling positions) is an important issue. Did you investigate these artefacts? Can you specify an upper threshold for the ghost to parent ratio?

I appreciate the careful and extensive characterisation of ILS (instrumental line shape) characteristics performed by the authors. There might be a single remaining issue: I wonder whether it can be safely assumed that the background intensity at each ground scene is uniform across the whole FOV (field of view) of the spectrometer? Otherwise the ILS might vary between ground scenes. A near infrared camera could be used to check whether surface albedo variation within the FOV is a non-negligible influencing factor.

Equation 7 does not represent the solar spectrum but just a single solar line.

I have problems to understand the rationale of the CLARS-FTS retrieval (or I misinterpret the description of the procedure): I believe to understand the description of the modifications performed on the radiative transfer calculation within GFIT: in comparison to the standard ground-based solar-absorption observation the scattered path section connecting the ground scene location with the observer is taken into account. Probably the model atmosphere assumes homogeneity in horizontal direction. Therefore, note that any e.g. CO2 enhancement just below the observer altitude on the mountaintop gives a much stronger spectral effect in comparison to a CO2 partial column enhancement of the same size just above the observer elevation. This does not harmonize well with the approach of scaling the a-priori profile (if the scaling is performed at all model levels). In my opinion, a valid retrieval scheme would require in a first step the analysis of a spectralon observation (for determining the scaling factor for the a-priori profile above the observer altitude). In a second step, a ground-scene observation is analysed. In this step, the previous scaling factor for the profile part above the observer remains unchanged, the scaling is only performed on model levels below the observer. This analysis suggests a certain type of observing pattern: the observations should alternate between spectralon observations and scans of several ground scenes. If one finally would challenge the assumption of horizontal homogeneity for the lowest levels near the ground scene, then the exploitation of the recorded spectra would become a very demanding task which calls for either assimilation schemes using a transport model of high spatial resolution or tomographic retrieval techniques or a combination of both approaches.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 8807, 2013.