

Interactive comment on “Improving the Retrieval of XCO₂ from Total Carbon Column Network Solar Spectra” by Joseph Mendonca et al.

Anonymous Referee #1

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This is a very good paper describing accurate measurements of spectral parameters of the magnetic dipole lines in the 1.27 micron band of molecular oxygen. Authors used speed-dependent Voigt (SDV) line shape which is known to produce more accurate results when applied at terrestrial atmospheric conditions. The retrieved parameters were then efficiently used in application to the atmospheric TCCON measurements. The improved line list required smaller empirical correction factors with respect to the previous linelists including HITRAN2012. It is commendable that authors made their line list available. I think the paper should definitely be published after following comments are addressed:

1. In lines 55-62 authors talk about different works on the A-band and mentioning Galatry retrievals. However, for some reason the work of Drouin et al (JQSRT 2016)

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was not mentioned although it also employed the SDV profile.

2. The authors may want to mention that the HITRAN2016 parameters are very similar to those in HITRAN2012 in this particular band and the only change are improved line positions from Yu et al. *J. Chem. Phys.* 141 (2014) 174302. doi:10.1063/1.4900510.

3. It is interesting that the authors do mention the line-mixing with respect to the A-band and CO₂ bands but did not say about this effect in 1.27 micron band that they investigated. It is also not mentioned as potential source of remaining residuals in lines 293-303. It would be interesting to see some discussion about this.

4. Talking about the sources of the residuals and its potential relation to Dicke narrowing it would be interesting what authors think about conclusions of the Torun group (Domyslawska et al papers in JQSRT 2014-2016), that for the electronic transitions of O₂ speed-dependence should have much larger effect than Dicke narrowing.

5. Spectral shifts in the 1.27 micron band had always been very hard to measure. See for instance discussion in Hill et al, *J. Mol. Spectrosc.* 221 (2003) 286–287. doi:10.1016/S0022-2852(03)00227-3 and Newman, et al, *J. Chem. Phys.* 110 (1999) 10749. doi:10.1063/1.479018.

The authors may want to mention this. Continuing the topic of shifts it is well known that while the widths in P and R branches for same rotational quanta should be very similar the shifts should be asymmetric. Therefore I would suggest to plot these separately or using running number m , where $m=-J$ for P lines and $J+1$ for R. The authors may also want to use the upper state rotational quanta because they are not split into spin components.

6. Does one need to account for airglow when analysing the 1.27 TCCON spectra? See Sun et al (<https://doi.org/10.1029/2018GL077823>) for instance, regarding significance of airglow in oxygen's 1.27 micron band at the top of atmosphere.