Response to Reviewer Comments

We wish to thank the reviewer for the careful comments. We have addressed these comments in the revised manuscript.

The reviewer's comments are in black and our responses are in red.

Reviewer #2

Summary

The following manuscript provides a review of the current state of retrieving OH from space, and provides recommendations for going forward. OH is the most critical chemical species in the atmosphere, as it dictates the oxidative capacity, i.e., the atmospheric lifetime before chemical removal of the majority of air pollutants and reactive greenhouse gases. I find no issues with the scientific content or accuracy, and agree with the recommendations, so I recommend publication following addressing the following general comment.

General Comment

In Line 72, the manuscript states that it is not possible to retrieve OH directly via remote sensing, but then later in Line 228 states that such technologies could be developed. As a review paper, I would appreciate a greater summary of the physical reasons that OH spectrometry is unable to be retrieved from passive methods, and how active methods like LIDAR may be developed. Also, is it really hopeless that there are no OH absorption lines that might be used in light of the recent work with IASI for VOC retrievals as discussed in section 2.2?

The reviewer's point is well taken. We added a discussion of this issue in the Introduction:

> "A tropospheric OH data product derived from a space-borne instrument is not currently feasible, though it may become feasible with technological development. The total column of OH has been measured for decades during daytime with passive instruments at a few ground-based facilities (e.g., Cageao et al., 2001; Minschwaner, Canty, and Burnett, 2003) and new technology development could lead to an OH lidar (Pan et al., 2022). Studies would need to be performed to assess the suitability of these passive and active instruments for deployment on satellites. If it is feasible to deploy such instruments in space, a tropospheric column of OH could be inferred by subtracting stratospheric column observations from total column observations; space-based instruments that measure stratospheric-mesospheric OH, albeit not down to the tropopause, have already been demonstrated (e.g., the Microwave Limb Sounder, MLS; Wang et al., 2008)."

Also, we have added an additional recommendation at the very end of Section 6:

> "Finally, we recommend additional investment in technology development that may lead to passive and/or active space-based instruments that directly observe OH."

Cageao, R.P., Blavier, J.-F., McGuire, J.P., Jiang, Y., Nemtchinov, V., Mills, F.P., and Sander, S.P.: High-resolution Fourier-transform ultraviolet-visible spectrometer for the measurement of atmospheric trace species: Application to OH, Appl. Opt., 40(12), 2024 – 2030, https://doi.org/10.1364/AO.40.002024, 2001.

Minschwaner, K., Canty, T., and Burnett, C.R.: Hydroxyl column abundance measurements: PEPSIOS instrumentation at the Fritz Peak Observatory and data analysis techniques, J. Atmospheric and Solar-Terrestrial Physics, 65, 3, 335-334, https://doi.org/10.1016/S1364-6826(02)00297-3, 2003.

Wang, S., Pickett, H.M., Pongetti, T.J., Cheung, R., Yung, Y.L., C. Shim, Li, Q., Canty, T., Salawitch, R.J., Jucks, K.W., Drouin, B., and Sander, S.P.: Validation of Aura Microwave Limb Sounder OH measurements with Fourier Transform Ultra-Violet Spectrometer total OH column measurements at Table Mountain, California, J. Geophys. Res., 113, D22301, https://doi.org/10.1029/2008JD009883, 2008.