

## ***Interactive comment on “Vertical profile of tropospheric ozone derived from synergetic retrieval using three different wavelength ranges, UV, IR, and Microwave: sensitivity study for satellite observation” by Yasuko Kasai et al.***

**Anonymous Referee #1**

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This paper presents the results of a study designed to facilitate the combination of space borne spectral measurements in the ultraviolet, thermal infrared and microwave wavelength ranges to determine ozone concentration in the tropospheric/lower stratosphere. The study combines nadir viewing (UV and TIR) with limb-sounding (MV) remote sounding techniques. Standard optimal estimation retrieval theory is used to evaluate the expected performance of this triad of remote sounding measurements. Results presented include degrees of freedom for signal, partial column errors and elements of the averaging kernel matrices for a range of East Asian summer and winter

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atmospheric conditions. Although the MW instrument itself has no sensitivity below the middle troposphere, the MW provides additional constraints in the stratosphere that actually benefit the retrievals of ozone in the lowermost troposphere than compared to using UV+TIR alone.

The paper is well written and the material is presented in a clear manner. My main concern though is the extent to which the study is applicable to real world instruments, since for example the complications arising from clouds are not considered and neither are the inevitable inconsistencies of instrument biases, both which of course are the bane of researchers trying to perform multi-instrument simultaneous retrievals. I would have liked at least some discussion on these points. Aerosols are mentioned in connection with the UV instrument, but it is not clear if these are in a layer below the sensitivity of the TIR instrument.

I recommend publication of this paper in AMT.

Minor corrections.

P4,L20: MLS also has other ozone bands (in the 190GHz, 640GHZ and THz radiometers) in addition to the standard product at 240GHz.

P4,L30: This seems to be a suggesting 17.5 second vertical limb scan. It would be worthwhile to point this out in connection with Fig 1. Also the paper state that the time delay between nadir and limb views (5 mins) has been ignored. Is that because the time difference has negligible effect on the atmospheric scenes?

P7,L28: There is almost certainly covariance in the apriori, but you are using none. Have you done any simulations with off-diagonal components in  $S_a$  to see how the results are affected?

P9: A lot of values are given in the text. Could these be placed in a table?