

***Interactive comment on “Aerosol information content analysis of multi-angle high spectral resolution measurements and its benefit for high accuracy greenhouse gas retrievals” by C. Frankenberg et al.***

**Anonymous Referee #2**

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<General Comments> CO<sub>2</sub> concentration latitudinal, seasonal and year-to-year variation is very small (sub-percent). The scientific results from observations accuracy of 2ppm, 1ppm and 0.5ppm are significantly different. The recent GOSAT observation achieved the 2ppm accuracy. The future missions have to reduce the retrieval errors. The largest systematic error source is aerosol. This analysis extracted the optical parameters of aerosol that affect radiative transfer process. This paper clearly showed how to reduce the error with feasible observation techniques. It also presented the required SNR and spectral resolution quantitatively. It is worth accepting.

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<Specific Comments> (1) Brief explanation or figure of the aerosol scattering geometry such as phase function is helpful for readers. This will probably explain easily why multi-angle measurement will significantly increase the degree of freedom.

(2) P2866 line 8: The authors use the O<sub>2</sub>A band and weak CO<sub>2</sub>/CH<sub>4</sub> as 2-band. If they use the O<sub>2</sub>A and the strong CO<sub>2</sub> as 2-band, is there significant difference between 2-band and 3-band?

(3) P2871, line 1: Please explain why “larger viewing angles would demand higher fidelity in spectroscopic parameters as airmass increases”.

(4) Just comments: The authors can try the real satellite data by requesting target observation to GOSAT over the Lamont TCCON site even though the forward and backward observations are limited to 20 degrees

<Technical Corrections> (1) P2863 Line 10 Effective variance of what? Is it size distribution width?

(2) Table 1 “A prior 1- sigma “: A priori 1-sigma? Please explain “tau”: AOT? Tau = 0.1 is for A priori or for A priori 1-sigma? As kernel driven model is not so familiar to many readers, please explain briefly why sigma of all kernels is 0.5. Please explain why imaginary refractive index is negative (-0.003) and sigma of 0.01 is larger than 0.003.

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