

Atmos. Meas. Tech. Discuss., referee comment RC1  
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## Comment on amt-2021-103

Anonymous Referee #1

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Referee comment on "Ash particle refractive index model for simulating the brightness temperature spectrum of volcanic ash clouds from satellite infrared sounder measurements" by Hiroshi Ishimoto et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-103-RC1>, 2021

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This paper describes and discusses tests of refractive index data-sets and parametrisations for simulating brightness temperatures for ash clouds observed by the IASI sensor. A useful set of examples are provided and definite conclusions can be drawn subject to the caveats the authors identify. An interesting result that appears from the work is the retrieval of smaller than usual effective radii - a result that is intuitively sound but goes against some more recent work on the size of ash particles at great distance from source.

This is an excellent paper building on prior work and providing novel insights to the field. The authors have been very selective with their use of measurements and this ensures that the data are of high quality and not so influenced by meteorological clouds. The minor issues listed below are quite optional - I think the paper would be improved but it is fine as is.

Some minor issues:

1. It would be worthwhile (for completeness) to include salient details of IASI. For example, the pixel size, wavenumber range, wavenumber interval and NEDT (@240K) would be useful. A sentence will do.
2. A good test of this procedure might be to study an eruption cloud that changed composition over the time period of the eruption. I think this happened with Eyjafjallajökull 15 April eruption and there may be other examples.
3. Table 3 is an excellent addition to the literature as this could provide a much-needed benchmark for comparison with other retrieval schemes. Accepting that this retrieval (and others)

are not "truth", having a small and manageable data-set like this is still of immense value.

4. It would be interesting to know if the RI models have any effect on the wavenumber interval 1300-1400  $\text{cm}^{-1}$  where there is another  $\text{SO}_2$  absorption which is usually considered unaffected by ash.

5. It is not entirely clear to me from Fig.7 how reff and composition are changing the spectra. Maybe the spectra could be plotted as differences to make it clearer. For example, does changing reff while keeping the RI model the same alter the "shape" and/or magnitude of the spectra? Similarly, does changing the RI model for the same reff alter the "shape" and/or magnitude of the spectra?

6. Suggestion: it might be quite informative to plot the compositions of the example volcanoes used on a TAS diagram.

Some other suggestions are included on the attached annotated m/s.

Please also note the supplement to this comment:

<https://amt.copernicus.org/preprints/amt-2021-103/amt-2021-103-RC1-supplement.pdf>