Atmos. Meas. Tech. Discuss., 6, C3642–C3644, 2013
www.atmos-meas-tech-discuss.net/6/C3642/2013/

Atmospheric Measurement Techniques
Discussions

Interactive comment on "Volcanic ash infrared signature: realistic ash particle shapes compared to spherical ash particles" *by* A. Kylling et al.

Anonymous Referee #3

Received and published: 9 December 2013

The assumption of spherical ash particles is commonly made when using Mie theory to calculate optical properties from measured refractive indices. Here the authors analyze the impact of this assumption on retrieved mass loadings.

The topic of the paper is very important and overall I found the paper well written and interesting. However, some of the analysis, presentation and discussion can be improved as outlined below, and as pointed out by the other (excellent) referee reports. Here I focus only on those comments not addressed by the other referees.

- Only porous ash is considered (with the presence of vesicles). The conclusions of the paper therefore only apply to this type of ash. I would strongly suggest to change the title to reflect this, or alternatively expand the analysis to include non-vesicular ash

types. I am not an expert in the topic, but the latter do not seem to be uncommon (e.g. Riley, C. M., W. I. Rose, and G. J. S. Bluth (2003), Quantitative shape measurements of distal volcanic ash, J. Geophys. Res., 108, 2504, doi:10.1029/2001JB000818, B10)

- In addition to this, a discussion is needed of how realistic the assumed particles are for those particles encountered in long-range transported plumes. How does wetting & coagulation processes affect the porosity and particle shape?

- Using volume-equivalent spheres is a good idea, but I do not see the point of applying mixing rules. Instead I would find it more interesting and simpler to consider only volume-equivalence with the refractive index of the material.

- For remote sensing, section 4 & 5 are the most important. However, the analysis lacks depth. In particular data is missing on the effect of the spherical assumption on the retrieved mass and radius. Only two examples are given for the mass and none for the radius. I would suggest color contour figures 'dbt vs BT 11', but this time showing the % difference of the retrieved mass/radius as a function of color for each pair (dbt, BT11). So BT11=259.3K, DBT=-5.1K, gets a color corresponding to 60%. So BT11=233.3K, DBT=-20.2K, gets a color corresponding to 80%.

Here as the reference, you could take the average mass loading of all realistic ash shapes for that data point. The same type of plot can be made for the retrieved radius, which is not discussed in detail in this manuscript but also constitutes an important remote sensed quantity. Making these figures will allow to better more quantitative analyze the results and will make the current study more relevant for the remote sensing community.

Figure 1. Please add also some scanning-electron microscope images of real volcanic ash particles for comparison

Figure 2 to 6. What is the particle size here? How was it calculated for the realistic ash shapes? Does one abscissa refer to one 'equivalent' particle (with different Rm, Rv, etc..?) or does it refer to different particles such that Rm = Rv = ?

Figure 2 & 3. The red lines in Fig 2 and Fig 3 are almost identical, can you comment on this?

Fig 4. Please expand the legend, currently it is absolutely unclear. Also, there seems to be more than 4 red curves.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 8937, 2013.