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## ***Interactive comment on “Single scattering by realistic, inhomogeneous mineral dust particles with stereogrammetric shapes” by H. Lindqvist et al.***

### **Anonymous Referee #2**

Received and published: 16 July 2013

This manuscript reports the use of stereogrammetric shape retrieval method to derive dust three dimensional particle shapes and to determine inhomogeneous composition of dust particles by mineralogical interpretation of localized elemental information based on energy-dispersive spectroscopy. The optical properties of these particles are then modeled. The manuscript is well written. This reviewer recommends this manuscript be published after revisions as follows

1. Different particle shapes and compositions definitely cause different light scattering properties. This has already been well known for many years. A good research is not satisfied by finding only the differences, but by finding more general things, i.e. the

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general properties of these individual cases. This manuscript should derive more on the latter.

2. The word “invaluable” in the statement “Our results could be invaluable as references in validation of such a method.” Is not appropriate.

3. Texts for surface and shape retrievals by stereogrammetry are not well written. The methods must be clearly described step by step.

4. “The scattering properties of different, individual dust particles are highly dependent on their physical properties, and this essential link . . .” What is “this essential link”?

5. “Both of these are essential since the single-scattering properties of dust have been estimated to be very sensitive to the scale and type of surface roughness (Nousiainen, 2009, and references therein) and inhomogeneity” A much earlier paper of Wenbo Sun, Norman G. Loeb, Gorden Videen, and Qiang Fu, "Examination of surface roughness on light scattering by long ice columns by use of a two-dimensional finite-difference time-domain algorithm", Appl. Opt., 43, 1957-1964 (2004) must be cited here for sufficient bibliography.

6. Section “2 Relevant single-scattering theory” is unnecessary. This section should be removed. Eqs (4) and (5) can be showed in the section for numerical results simply as some notes.

7. When talking about “The Gaussian random sphere . . .” An accurate numerical calculation of light scattering properties of Gaussian-type particles was done in Wenbo Sun, Timo Nousiainen, Karri Muinonen, Qiang Fu, Norman G. Loeb, and Gorden Videen, "Light scattering by Gaussian particles: A solution with finite-difference time domain technique", J. Quant. Spectrosc. Radiat. Transfer, 79-80, 1083-1090 (2003). This paper needs to be cited properly.

8. “From the orientation-averaged computations, we obtained the 10 scattering-matrix elements of . . .” Why 10 elements? not 8? not the 6 independent nonzero elements

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for randomly oriented particles? Do these dust aerosols have orientation preference in the air?

9. It is also interesting to see the depolarization properties of these dust particles. The authors may consider showing the curves for depolarization ratio as in Wenbo Sun, Zhaoyan Liu, Gorden Videen, Qiang Fu, Karri Muinonen, David M. Winker, Constantine Lukashin, Zhonghai Jin, Bing Lin, and Jianping Huang, "For the depolarization of linearly polarized light by smoke particles," *J. Quant. Spectrosc. Radiat. Transfer*, 122, 233-237 (2013).

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