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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Porous aerosol in degassing plumes of Mt. Etna and Mt. Stromboli" *by* Valery Shcherbakov et al.

Anonymous Referee #2

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Manuscript: "Porous aerosol in degassing plumes of Mt. Etna and Mt. Stromboli". By Valery Schcherbakov et al.

Reviewer comments

General comments. Manuscript discusses characterization of volcanic aerosols from Mt. Etna and Mt. Stromboli degassing plumes using both in situ and remote sensing techniques. In situ observations consisted of aerosol size distribution (ASD) measurements using Forward Scattering Spectrometer probes (FSSP) and remote sensing approach was based on inversion of combined observations of angular scattering intensities and extinction obtained by airborne Polar Nephelometer. Information content of Nephelometer observations was analyzed using Principal Component technique which showed possibility to distinguish scattering pattern of volcanic aerosols from the one of

clouds (cirrus and contrails). Inversion of Polar Nephelometer data resulted in relatively low values of the real part of refractive index of volcanic aerosol: 1. 35 to 1.38. This was attributed to the presence of cavities inside particles which effectively decrease the real part of refractive index. Manuscript is very well written and the goals and the techniques used are clear. I believe that the subject of the manuscript is in scope of ACP. Paper certainly can be published. Specific Comments. 1. My main concern is the effect of uncertainty in extinction coefficient (25%) and the limited range in scattering angles (15 to 162) on the accuracy of aerosol retrievals. The authors do not discuss these issues at all. However absence of aureole measurements can affect the ASD retrievals, especially Deff. In addition the uncertainty in extinction coefficient can affect the accuracy of retrieved complex refractive index. Therefore I suggest authors to conduct a simple sensitivity studies: calculate synthetic measurements for the complete range of scattering angles and then invert them using 15-162 range only. In addition, add/subtract 25% to/from extinction coefficient and estimate corresponding uncertainty in retrieved aerosol parameters. I believe these sensitivity tests will make the conclusions of the manuscript much more solid. 2. Did authors really try different initial guesses for inversion code to make sure the global minimum is reached as they discussed at page 9? 3. Is Maxwell Garnett mixing rule really applicable to this type of aerosol particles? How the applicability was estimated and what is the accuracy of estimated air voids? 4. In Table 1., the residuals seem too high for "optically" spherical. It would be interesting to look at the dependence of angular measurements fit as a function of scattering angle.

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