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Atmospheric Measurement Techniques Discussions

Interactive comment on "Columnar aerosol size distribution function obtained by inversion of spectral optical depth measurements for the Zanjan, Iran" *by* A. Masoumi et al.

Anonymous Referee #2

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General Comments This study examines the aerosol size distribution over the arid environment of Zanjan in northwestern Iran. More specifically the authors used an inversion scheme for the retrieval of the aerosol size distribution from sun photometer measurements. In this field there are already some widely used algorithms, like King's inversion method, the algorithm by Dubovik and King used also in AERONET and the algorithm of Nakajima applied for measurements of the PRIDE sun photometer. These widely used algorithms are not discussed in the manuscript and the authors do not emphasize on the usefulness of their proposed methodology. Moreover, the results obtained are not compared at all with those of the aforementioned algorithms,

which is a critical point for the justification of the method used. Since the results are somewhat interesting and the new method proposed may be also applied in other regions throughout the world I believe that more sensitivity analysis and comparison with other algorithms must be done in order the manuscript to warrants publication in AMT.

Specific comments It is really unexpected that the authors used a refractive index without imaginary part (purely scattering aerosols) since it is well known that the dust, especially in UV, has a significant absorption. The refractive index is an important parameter for retrieving the aerosol size distribution. The inclusion of an imaginary part how much would differentiate the results? This is a critical point of the article and the overall analysis. Over an arid environment as Iran is, I would expect a larger coarse-mode fraction in the aerosol size distribution. However, in the discussion of the figure 1 the authors state "As it appeared in Fig. 1, even though always the number of very fine aerosols is more than other aerosol sizes, but for 82% of the days, number of coarse aerosols is more than fine ones and for these days alpha<1.2. For rest of the days, number of fine aerosols is more than coarse aerosols and alpha >1.2." This sentence is really confused and it has no good sense. I cannot understand if the number of coarse or fine aerosols is larger than that of the coarse-mode ones and in which case. Also, this is very hard to use as criterion for the discrimination between coarse and fine aerosols the alpha value 1.2. Some more clarification and discussion is needed here. Regarding the Fig. 2, it seems somewhat unexpected that all the 3 days to present aerosol size distribution with the same mode radii. I doubt if somebody can fix initially in the methodology-algorithm the radii values for individual aerosol sizes. The radii as well as the logarithmic stdev are usually retrieved by the algorithms (e.g King's algorithm, Dubovik's algorithm, Nakajima's algorithm). It is expected that the most of the cases would correspond to coarse-mode aerosol dominance over this arid environment. However, despite the fact that desert dust is the dominant aerosol type over the study location any discussion about desert dust, exposure, transport, etc is missing. The authors can see the recently published article by Badarinath et al. (2010,

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Global Planetary Change) regarding dust exposure over Middle East and its transport over Arabian sea. Moreover, the seasonal averages of the aerosol number size distribution (Fig. 8), i.e. more coarse particles in spring and summer, is similar to the results regarding the AOD and alpha seasonal variability over regions close to the study one, e.g. Solar village (Kaskaoutis et al., 2007, ACPD) and Bahrain (Smirnov et al., 2002, J. Atmospheric Science).

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 2367, 2010.