

Interactive comment on “Size resolved mass concentration and elemental composition of atmospheric aerosols over the eastern Mediterranean area” by J. Smolik et al.

Anonymous Referee #1

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The authors present and discuss results from size-resolved aerosol collections during summer and winter sampling campaigns at and near the island of Crete. The samples were analyzed for the particulate mass (PM) and up to 17 elements. The data set is certainly valuable. However, the analysis and discussion of the data is fairly standard and too simplistic. It should be improved. The language and grammar of the manuscript should also be improved.

Specific comments

1. A major comment is that no size distributions (neither raw nor inverted) are presented in the paper (except for the one in Fig. 1, which applies to Athens). Also, the discussion of the mode diameters and other parameters (i.e., mode intensities and

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standard deviations) which are obtained from the MICRON inversions is much too meager or is simply not given (sections 3.1 and 3.2). The authors used the inverted size distribution data essentially only to derive PM1 and PM10 mass and elemental concentrations. What is the point of utilizing a 10-stage cascade impactor (and doing all the analyses) for this purpose? PM1 and PM10 data could much easier be obtained with PM1 and PM10 samplers or with a dichotomous sampler (or perhaps even a stacked filter unit). There is a lot of information in the detailed size distributions, which deserves to be used and interpreted. For example, with regard to the multimodal distributions that were obtained for Cu, Cr, Zn, and Pb (page 2556, lines 12-13), were the distributions similar for these 4 elements and over all samples? The size distributions may help in assessing the sources, source processes or even the state of mixing of the various elements.

2. Page 2548, lines 10-11, and later in the paper (e.g., page 2560, lines 8-11): To attribute fine K to forest fires and coarse K to soil dust is incomplete. Besides forest fires, various other forms of biomass burning are emitters of fine K. In industrialized countries also waste burning and municipal incinerators are important sources of fine K. As to coarse K, besides soil dust (and other crustal matter), also sea salt may be an important source, in particular at coastal locations and above the sea. The same applies to coarse Ca. Comparing concentration ratios in the aerosol with these in crustal rock (or soil) and in sea water can assist in estimating the relative contributions of soil dust and sea salt to the coarse K and Ca. Using the data of Table 1, and Cl as sea water reference element, I estimate that about 30% of the coarse (PM10 - PM1) K in winter comes from sea salt.

3. Page 2556, last paragraph, continuing on 2557: Although the results from the principal component analysis seem to make sense, 21 samples is not sufficient in order for the solution to be robust. According to specialists in the field the number of samples minus the number of variables should be at least 30. See more on this in e.g., Ito et al., 1986, and Henry, 1991 [Ito, K., Kneip, T.J. and Lioy, P.J., 1986. The effects of number

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of samples and random error on the factor-analysis multiple-regression (FA MR) receptor modeling technique. *Atmospheric Environment*, 20(7), 1433-1440; Henry, R.C., 1991. Multivariate receptor models. In: P.K. Hopke (Editor), *Receptor modeling for air quality management*. Elsevier, New York, pp. 117-147.]. Furthermore, concluding from the variance that is explained by the natural sources that these have a greater influence is vague. A greater influence on what? Actually, one can only conclude from this that the natural sources explain the largest fraction of the total variance in the data set, and, for example, not that they contribute most to the PM. The loadings of the PM on the 4 components (Table 3) give some clues on the contribution of the components to the PM. It is clear that the third component will provide a larger contribution to the PM than the second component. To actually assess the contribution of the 4 components to the PM, the authors should have gone one step further and have performed an absolute principal component analysis (APCA). Incidentally, besides APCA, there are other approaches that allow one to estimate the source contributions. For example, the authors could have used a chemical mass balance (CMB) approach, which can be applied on a sample by sample basis. More on receptor modelling can, for example, be found in the following classical review paper: Henry, R.C., Lewis, C.W., Hopke, P.K. and Williamson, H.J., 1984. Review of receptor model fundamentals. *Atmospheric Environment*, 18, 1507-1515.

4. With regard to the language and grammar: These should be significantly improved in some paragraphs, in particular in section 2.4. Also, on a number of occasions, a definite article is used where an indefinite article would be appropriate.

Technical corrections

- page 2554, line 24: Bergametti et al., 1992 is not in the list of References.
- page 2558, line 18, and page 2559, line 7: "Bardouki et al., 2002" should be replaced by "Bardouki et al., 2003".
- page 2561, line 7: "The limpact of" should be replaced by "The Impact of".

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- page 2563, line 24: "Kaupinnen" should be replaced by "Kauppinen".

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