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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Lidar and in situ observations of continental and Saharan aerosol: closure analysis of particles optical and physical properties" *by* G. P. Gobbi et al.

G. P. Gobbi et al.

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Manuscript: "Lidar and in situ observations of continental and Saharan aerosol: closure analysis of particles optical and Physical properties", by G. P. Gobbi et al., Atmos. Chem. Phys. Discuss., 3, S200-S203, 2003.

Compared to the first version of the manuscript, a major change (not requested by the reviewers) concerned the correction of the in-situ (DMA and OPC) data. In fact, these data were provided without indication they referred to STP conditions. So, we originally used them assuming they referred to local pressure and temperature conditions (as lidar data necessarily are) at Mt. Cimone Station (2167 m asl). The introduced correction for local conditions (approximately a 20% decrease in volume concentrations of the DMA and OPC data) led to a better agreement between the lidar and the in-situ ob-

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servations. All relevant changes have been marked in yellow in the revised manuscript. We apologize about this misunderstanding.

Suggestions of reviewer #2 were very useful (and challenging). The proposed changes resulted into 3 additional figures, two tables and interesting related comments. We believe the final manuscript really benefitted by this review process.

Answers to Reviewer #2 comments:

All suggestions of Steps 1 to 5 have been implemented in section 2.1 and changes are yellow-marked in the new text. The new paragraph now provides a much more detailed description of the lidar signal analysis procedure and of the relevant indetermination.

The reference to Gobbi et al. 2002 was intended to say that "Benefits of the spherical versus non-spherical model are discussed in (Gobbi et al., 2002)". Such a sentence has been added.

Section 3:. The sentence has been rephrased: "In the presence of non-spherical aerosols, the latter is well evidenced by the depolarization record of Fig. 1b."

Section 4.1a. The sentence "Impactor filters were collected at the same location as the other in situ measurements" has been added.

Section 4.1b. It has been specified that relative humidity RH was "measured at the Station".

Section 4.1c. A table containing the a and b coefficients has been added (Table 1). The hygroscopic correction is not a function of altitude since only measurements at the Station level are compared.

Section 4.2a. As a matter of fact, "absolute" values are defined (at least in our method) as the square-root of squared differences. So, dBETAa/BETAa is a statistical average, representing the mean combined variability of the two measurements. I do not understand to which parameterŠs variance is pointing the referee since we are comparing

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two observations.

Section 4.2b. A new Figure 3, addressing the "cost function" of the corrected and uncorrected datasets plus discussion about the minimization of dBETAa/BETAa with respect to refractive index has been introduced. Of course this is just an average index for the whole campaign, therefore it is not expected to be statistically significant. Here it is used to describe the effects of the hygroscopicity correction and of the minimization technique which will be used later (see also answers in Section 4.3 concerning the new Figure 6 on "cost function" introduced there).

Section 4.2c. The continental aerosol model considers a wide range of RH values. Therefore, the refractive index variability ranges from 1.35 (RH=80%) and 1.53 (RH=0%). At 65% RH (average RH for the whole campaign) the model expects m of the order of 1.43, i.e. very close to the "average" refractive index of the whole campaign m=1.45. The new Figure 6 on "cost function" for homogeneous airmasses introduced in Section 4.3 shows very well this behavior.

Section 4.3. Two new figures (5 and 6) have been added to make the discussion more clear:

Figure 5 (and relevant discussion) has been introduced to show the dependence of aerosol depolarization on relative humidity for various aerosol categories. Coefficients a and b vary as a function of the airmass origin, as indicated in the new Table 1.

Figure 6 (and relevant discussion) has been introduced to describe the dependence on refractive index of dBETAa/BETAa for the five aerosol categories. This figure provides a good way to evaluate the statistical significance of the approach and of the retrieved refractive index. Ample discussion of these figures has been given in Section 4.3 (yellow-marked). Triangles have been evidenced in the new figure 4b.

Section 4.4a. This section is now entitled: "Closure Analysis". It has been made shorter and clearer as shown by the yellow marked changes. The last part describing

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the effect of non-sphericity on continental aerosol models has been deleted since rather qualitative and already addressed a few lines above.

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