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***Interactive comment on* “Changes in particulate matter physical properties during Saharan advections over Rome (Italy): a four-year study, 2001–2004” by G. P. Gobbi et al.**

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We thank Dr. Kishcha for taking the time to revise our work. Our detailed replies to the referee’s comments follow (in black italics and in blue in the enclosed PDF supplement).

Ref. The present study deals with the analysis of the contribution of Saharan desert dust to PM₁₀ surface aerosol concentrations in Rome, Italy. This is an experimental study based on a relatively large number of lidar measurements (703 days) in Rome and daily PM₁₀ measurements in three monitoring sites during the four-year period 2001–2004. In addition, the authors analyzed the capability of the BSC-DREAM8b

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regional dust model to predict dust events having the presence of dust near the surface. This was carried out by comparing modelled dust concentrations with lidar measurements in Rome. The impact of desert dust on PM₁₀ records was estimated as the exceedance of PM₁₀ measurements on dusty days over PM₁₀ measurements on non-dusty days. The paper is clearly presented. The obtained results are interesting. Specifically, the current study has shown that the combined use of modeled dust forecasts with lidar measurements is important to effectively monitor desert dust presence and to estimate its contribution to PM levels. The authors have suggested an improved approach for estimating background PM₁₀ concentrations. I recommend the manuscript for publication.

The authors may consider the following critical aspects: 1. With respect to the percentage of dusty days and dust ground contacts, the correspondence between modeled dust forecasts and lidar observations was noticeably better during the first three individual years 2001/2002/2003 than in the last year 2004 (Table 2). It is worth discussing possible causal factors for the large discrepancy in 2004.

Answer: We checked on a yearly basis both Lidar and DREAM8b results without finding any anomaly in the dataset. The number of Lidar observations in 2004 is exactly on average. The only explanation we can endorse is linked to the anomalously high intensity of Saharan advections occurring in the western and central Mediterranean in 2004, as reported in Section 3.5 of Pey et al. (Atmos. Chem. Phys., p.1395, 2013). As shown in our paper, these are associated to precipitation events. In fact, the number of days with precipitation in 2004 (122) is above one sigma of the four-year average (98). As remarked in the paper (a further point has now been included in the conclusions), precipitation can alter model forecasts of dust events.

Ref. 2. The authors studied seasonal variations of dust contribution to PM₁₀ concentration (Fig. 3). Did they find any seasonal variation in the discrepancy between modeled dust forecasts and lidar observations, with respect to the percentage of dusty days and dust ground contacts?

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Answer: A sentence illustrating such seasonal comparison has been inserted at the beginning of section 3.1.

Ref. 3. According to Fig. 3, one can see that the number of dust events in summer is higher than in winter. It is worth discussing possible reasons why the average dust contribution to PM₁₀ in summer is lower than in other seasons?

Answer: This is expected to be a consequence of dilution in the boundary layer: in the warmest months PM is dispersed over larger mixing heights, leading to lower concentrations. This concept has now been addressed in Section 3.2 (4th paragraph).

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/13/C2717/2013/acpd-13-C2717-2013-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 4963, 2013.

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