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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Saharan dust aerosol over the central Mediterranean Sea: optical columnar measurements vs. aerosol load, chemical composition and marker solubility at ground level" *by* M. Marconi et al.

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Review of "Saharan dust aerosol over the central Mediterranean Sea: optical columnar measurements vs. aerosol load, chemical composition and marker solubility at ground level", by M.Marconi et al.

Preliminary remarks: I am writing the following report on the basis of the manuscript initially submitted for discussion to ACP, of the remarks already posted by F. Dulac, and of the answers made to him by the authors.

General comments: The objectives of the authors are to 1) assess the contribution

of the “Saharan dust” to the ground level PM10 in the central Mediterranean Sea, 2) to compare its seasonal evolution to the one of the spectrally-resolved aerosol optical depth used as an indicator of the columnar aerosol burden, and 3) discuss the solubility of different markers having a possible impact on the ocean biological activity. Seven years of almost uninterrupted measurements of the PM10 chemical composition and of the aerosol optical depth measured on the island of Lampedusa (35.5_ N, 12.6_ E) are available, which is assumedly amply enough for achieving the first two objectives. Conversely, the body of data used for determining the solubility of specific “markers” contained in different size classes of the aerosol is too limited (see the remarks already made on this point by F. Dulac) for achieving the third announced objective. Before making more specific comments on the methods and results, I would like to express my regret that the authors did not consider necessary to compare their results with those already available in the literature. In addition to the references on the solubility studies already quoted by F. Dulac, some papers have been dedicated to the analysis of sunphotometer measurements performed in Tunisia (see the works of Masmoudi) and in the eastern basin of the Mediterranean (see the works of El Metwally). Comparing the situation of Lampedusa to the one of these not so distant areas would have been interesting.

More specific questions or comments:

1) Contribution of the “Saharan dust” to the PM10 burden: a. Is it possible to speak of “Saharan dust” in general, which would mean that the dust comes from a unique source and has undergone the same modifications during transport? b. Ca was already used by Favez et al. (Atmospheric Environment 42, 2008, 1503–1516) as a proxy for estimating the share of desert dust in the Cairo aerosol. c. Because North African dust sources are known to be richer in Ca than the Sahelian ones, it would have been interesting to give the order of magnitude of the aerosol Ca/Al ratio and to look at a possible variability which could indicate different origins for the dust collected at Lampedusa (see remark above). d. The dust concentration levels at Lampedusa

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are relatively “moderate” (which could have been seen, had the results been compared with other studies). Is this due to the fact that the dust events are of short duration (which, after averaging over the 1-day duration of the collection would lead to small values) or are there other reasons for this? In particular, what is the cut-off size of the sampling head? Is it possible to rule out the possibility that the largest “dust” particles are not collected efficiently, and therefore not analyzed? 2) Comparison of the columnar and ground-level burdens: I agree that if the dust is transported above the marine layer, the AOD can be large when the ground-level PM10 remains small. I have more difficulty imagining the contrary. If the PM10 is large close to the surface, how can this not be reflected by an enhancement of the AOD? 3) Size distribution of the aerosol retrieved from the OPC measurements: In their answer to F. Dulac, the authors provide a new table (Table 4) comparing the results of a deconvolution procedure applied to ‘non-dust” and “dust” cases. a. There is little difference between the two cases. Even more puzzling is the fact that the proportion of particles in the first super-micron mode (mode 2) seems to be larger in the “non-dust” case than in the “dust” case. This is in contradiction with the result of all studies showing a general enhancement of the proportion of the coarse modes in presence of desert dust. b. In Table 4, the geometric standard deviations (gsd) of modes 1 and 2 are unrealistically low. This is particularly the case for mode 3 in the non dust case. Note that a gsd =1.007$\pm$1 has no physical sense for a lognormal distribution (in this case, the gsd cannot be smaller than 1) 4) Solubility of the different aerosol fractions: I will not repeat here the remarks made by F. dulac. I fully agree with these comments.

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