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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.

Anonymous Referee #1

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As stated in a previous review the data set presented in this paper is of high interest, with more that seven years on PM10 chemical composition in an island site in the central Mediterranean basin, next to the coast of Tunisia. A number of revisions were suggested in order to improve interpretations. However, only a few changes / suggestions have been addressed in the revised version. The paper provides information on three topics of interest: transport of Saharan dust (surface and altitude); solubility of elements and size distribution. The specific aims are separated in two major objectives : 1. to quantify the Saharan dust contribution to PM10 at surface level; investigate sea-

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sonal variation and compare surface with columnar measurements, and 2. Investigate solubility of PM components as a function of size distribution, in order to quantity able to interact with the biological system. The first objectives are based in the interpretation of a large set of data. The last are based on short and intensive campaigns. This high amount of objectives result in a major limitation: authors provide a high amount of information but a deeper interpretation is needed to give answer to all the objectives raised. As recommended by F. Dulac, and referee 2, I suggest removing the section on solubility. I agree this section is the weakest; interpretation can be improved and presented in a different paper (following the recommendations regarding literature, methodology and interpretation by F. Dulac). The present paper should focus in the first objectives: to quantity the contribution of African dust on PM10 levels, based on the interpretation of a large data set of PM10 composition, variation in time, and comparison between surface and column concentration. But, a more detailed interpretation is needed. There is a need of a better interpretation as a function of the origin of the air masses. Results on levels and composition of PM10 should be interpreted as a function of changes in the source area (mainly for dust events). Crustal contribution to PM10 during Saharan dust seems to be quite low (50% during severe episodes, see abstract). What is the origin of the remaining 50%? Please, provide a Table with mean concentrations of PM components (mineral and not mineral) for dust and non-dust events? It would be very helpful to have the average composition as a function of major source areas. Results must be compared with those obtained in other areas in the Mediterranean; please, revised the literature on PM10 composition in the Mediterranean basin. This will help to evidence or not the specificities of the study area. As depicted, in Figure 1, it seems there is an increase on PM10 concentrations during 2007-2009. Is this related to an increase on African dust contribution? Given the long time series presented it would be of high interest to interpret the time variation of PM10 levels, mainly concerning dust contribution. Non soluble Ca is not a good indicator for Saharan dust given that its relative contribution to dust may vary depending on source area (see comments by F. Dulac). Also a local/anthropogenic source cannot be ignored for Ca. Therefore,

ACPD
13, C8647–C8650, 2013

the use of nssCa may difficult the quantification of the dust contribution but also the identification of dust events. In this sense, I agree with F. Dulac that a deeper study is needed to check the consistency of the single nssCa criterion for identifying dust events. Relation between columnar and surface measurements if of great interest (this could be in a specific section (together with current 3.2). I recommend describing first the seasonal evolution of surface episodes; then the seasonal evolution of columnar and finally to compare the seasonal evolution of both type of episodes. Description of the different transport patterns (in altitude and in surface) should be improved. Is there any relation between the two kind of episodes and specific meteorological scenarios? As indicated by referee 2, a number of references are missed.

Other questions: Page 21266: Was Ca not determined by ICP AES in the acidified extraction? Why not? Page 21268 – 20-25: it is not clear how you did estimate the sea spray fractions. In order to estimate the nssNa you need to know nssCa; but for estimating nssCa you need to know ssNa; and fo calculating ssNa you need to know nssCa. Please, could you clarify? Have you tester if there is a correlation between Na and Cl?. Page 21269: The average Na/ca) crust ratio used is too high. This ratio may be quite different depending on the geology of the source area. applying the equations showed you need to know Application of EF may be limited by variations of the composition of dust depending on the source area-. Differences do not necessarily imply an anthropogenic contribution. Page 21270: please give background concentrations for the PM10 components. Compare with other sites in the Mediterranean basin. Page 21273 (3-13). Why events with high nssCa surface concentrations do not coincide with high concentrations in the column? If there is an African dust event in the surface this should be registered by the columnar measurements. Page 22173: Do you have information about seasonal variation of the height of the boundary layer? Page 21278: Sr is usually associated with Ca (in carbonates), and Rb and La with Al (in aluminiun-silicates) what is the cause of the different size distribution determined for these elements.

ACPD
13, C8647–C8650, 2013

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 21259, 2013.

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13, C8647–C8650, 2013