

Reply to the referee on the paper: “Variability of mineral dust deposition in the western Mediterranean basin and South-East of France” by J. Vincent et al.
The modifications in the manuscript are indicated in red.

Interactive comments on “Variability of mineral dust deposition in the western Mediterranean basin and South-East of France” by J. Vincent et al.

Anonymous Referee #1

The paper by Vincent et al summarizes the results of a monitoring study on atmospheric deposition in the Western Mediterranean, covering a south to north transect from Lampedusa to continental France.

General comment:

The authors measured weekly deposition samples by using a new automatic device (CARAGA) able to collect and filter atmospheric deposition onto filters. They performed the study at 5 different locations (4 islands and one continental site, all regional background), during almost three years but with several gaps, and they focused only in the insoluble fraction (mostly attributed to mineral dust). In their study the authors display a North to South increasing deposition gradient related to the higher impact of Saharan dust towards the South, as expected from airborne measurements. Furthermore, they investigated when (in seasonal terms) deposition amounts are more intense at each location, and from where the dust is dominant (in terms of source regions). The study of atmospheric deposition is essential to know the transfer of nutrients and pollutants to waters, sediments and ecosystems, and therefore a study of these characteristics is necessary.

We agree with these general comments but we would like to also underline that the measurements and study of dust deposition are also of high interest for the validation of dust transport models which simulate, besides the AOD and the dust concentration, the deposited mass of dust. This will allow us to provide additional information on the dust mass budget in the models, which is presently only poorly constrained.

Specific comments:

-The authors only considered the insoluble fraction, which is not a criticism by itself, but given the effort realized in setting up the network it would be desirable also to measure the soluble fraction, especially concerning the N deposition.

As mentioned above, the goal of this paper is mainly to study over a quite long period of time and at different stations the deposited mass of Saharan dust events. Obviously, it would be very interesting to be able to also measure the soluble fraction and its content in nutrients and/or pollutants. However, deposition samplers allowing collecting both insoluble and soluble fractions are not automatized and not autonomous for long periods. This constitutes for us a strong limitation. By focusing only on the total insoluble mass of deposited dust, the sampling device could be significantly simplified (especially concerning the procedure to change and store of the samples). As mentioned in Laurent et al. (AMT, 2015), in order to estimate the deposited mass, collecting only the insoluble part of the Saharan dust deposition is justified by the very large fraction

that the insoluble matter represents in the Saharan dust deposition over the Mediterranean basin.

-They did not perform any chemical speciation study, and consequently the transfer of specific nutrients contained in mineral dust such as Fe and P is unknown. The availability of this desirable information would add an enormous value to this work.

We again agree with the added value that chemical speciation in deposition could provide. However, as mentioned above, the whole procedure (especially the only collection of the insoluble material) was thought to allow us to collect dust deposition over a long period of time and at different stations as simultaneously as possible. The soluble fraction of the deposition being not collected, the information on the chemical composition will not allow to directly and simply discuss the transfer of specific nutrients such as Fe and P.

-The design of the experimental network is adequate in terms of geographical distribution but one of the sites (Frioul) is really close to a big populated region (Marseille city and its industrial surroundings). Actually, it seems that a constant mineral dust input (most probably reflecting the influence of that urban area) occurs (see Fig. 3), which makes that place not fully comparable with the others (but at the same time interesting).

The Frioul and Le Casset sites are the sites the farthest from the African coasts and thus the Saharan dust deposition can be quite low and not so higher than the mineral particulate background. This is one of the reasons for which we decided to focus our study on the highest dust deposition events for which we assumed that the local contribution and/or background remain low compared to the long range transported material. We also selected a measurement procedure based on calcination which allows to destroy almost all the organic particulate matter that can be significant at a site like Frioul not so far from urban and industrial areas. Thus we add in the text the following sentences: “We cannot exclude that local mineral contribution, especially during high wind speed periods at the station, may affect some samples, in particular those for which the deposition due to long-range transported dust is the lower. Moreover, for the station located the farthest from the African coasts such as Frioul or Le Casset, the anthropogenic background in refractive material may also contribute for a limited part to the mineral deposition”.

-It would be nice to find (even in the supplement) a comparison between airborne measurements (dust in PM10 or TSP, as in some works cited in the paper) and deposition fluxes where both measurements are available (namely Lampedusa, Mallorca, Corsica).

It is well known that the link between PM10 concentration at the surface and dust deposition is far to be direct, especially because:

- **PM10 concentrations included other species than mineral dust. For example, Marconi et al. (2014) underline that sea salt can contribute significantly to the PM10 concentration measured at Lampedusa.**
- **wet and dry deposition have not the same efficiency and dust transport over the Mediterranean basin can occur frequently above the surface layer making difficult to link dust deposition and surface PM10 concentrations (for example Marconi et al., 2014).**

Nevertheless, we tried to look at the link between PM₁₀ and dust deposition at Le Casset and Lampedusa but, as expected, no significant correlation was found between dust deposition and PM₁₀ concentrations.

-Data coverage is good (over 77%) but important gaps are evident at specific locations, putting in risk some of the conclusions, especially those concerning seasonal patterns and source regions of dust. I encourage the authors to discuss deeper on this when appropriate.

The data recovery rate of our data set varies between 77% and 91% depending on the station. Moreover, at least 1-yr of continuous measurements is available for each station. Obviously, the results and our conclusions correspond to the situation observed for the investigated time period at the locations where the samplings were performed.

Nevertheless, our results support the fact that a strong temporal variability is observed: the deposition fluxes measured at a station can vary over two orders of magnitude. The deposition fluxes measured at the different sites illustrate clearly the spatial variability of the dust deposition in the Western Mediterranean basin.

Concerning the seasonality of the MIDD occurrence, because each month of the years has not been sampled with the same frequency at each station, we weighted the number of weeks for each month and for each station as mentioned in section 4.3. The seasonal patterns of dust deposition we found are in agreement with previous studies performed in the north-western Mediterranean basin.

Part of the conclusion was rephrased: **“A South to North decrease of the intensity of the deposition fluxes is noticed. Moreover, during the investigated period, different source regions contribute to the dust deposition in different locations of the central and western Mediterranean in relation with different dust transport pathways. Our results also suggest the seasonal pattern of the Saharan dust deposition within the Western Mediterranean basin which could be refined with longer time series of deposition measurements”**.
