Reply to Referee 2

(REFEREE)

This paper presents a sound dataset concerning the dry and wet deposition fluxes of dissolved organic matter sampled for 2 years and a half at the island of Lampedusa (Italy). This site, in the central Mediterranean, is appropriately taken to represent the interaction atmosphere-sea surface in a remote marine environment. It is a well written paper which addresses a topic of interest: the role of DOM (and its components DON and DOP) deposition in the western Mediterranean. It explores the role of the frequent Saharan intrusions, a very interesting point since few studies have dealt with the interactions between organic carbon and Saharan dust. Finally, it specifically addresses the role of this atmospheric deposition for marine productivity.

The quantification of N and P atmospheric deposition to the Mediterranean has been previously addressed in many papers, the most relevant of them are adequately cited by the authors. However, I'd like to bring to the authors attention the work of Izquierdo et al. 2012 in Atmospheric Environment. Atmospheric phosphorus deposition in a near-coastal rural site in the NE Iberian Peninsula and its role in marine productivity, since it will provide more data for comparison, discussion and understanding of the role of African sources in marine biogeochemistry, and the relative contribution of dry and wet deposition.

The layout of the paper and data treatment are OK, and I have only a few suggestions, which I list below.

(AUTHORS)

We really thank the reviewer for his/her appreciation of our manuscript. In the revised version, all the comments and suggestions will be taken into consideration. In the revised manuscript, the work of Izquierdo et al. (2012) will be cited and discussed as suggested by the reviewer.

Introduction

Lines 34-35. Industrial pollution can also be originated from North Africa as has been shown in the work of Rodríguez et al (2011). Transport of desert dust mixed with North African industrial pollutants in the subtropical Saharan Air Layer. Atmospheric Chemistry and Physics 11, 6663–6685. I think it is worth considering.

In the introduction of the revised manuscript, we will add this reference and a sentence about the possible contribution of pollution from North Africa.

Line 40. The work of Izquierdo et al 2012 could be included in this list of references, since it deals with how P dep influences the marine biogeochemical cycle in the western Med Sea.

In the introduction of the revised manuscript, we will add this reference.

Line 45. This sentence should be revised as it is not true that atmospheric deposition affects radiative forcing and human health. Aerosols in the atmosphere do, but not deposition.

We agree with the reviewer that the sentence was not clear. In the revised manuscript, we propose to change it as follows: "*Atmospheric deposition of organic carbon can therefore affect regional C cycling (Yan and Kim, 2012; Decina et al., 2018).*"

Material and methods

I recommend to make some reorganization of the text, since some paragraphs in this section in fact correspond better to the Introduction. E.g. the paragraph dealing with the explanation of the Mediterranean seawater DOM stoichiometry compared to the world oceans (lines 70-75) should be moved to the Introduction.

We apologize for this inaccuracy, in the revised manuscript, this sentences will be moved to the Introduction.

Same thing with the paragraph justifying the appropriateness of Lampedusa as representing an unpolluted site in the central Med.

In agreement with this comment, in the revised manuscript we will add a subsection at the end of the introduction explaining why we choose Lampedusa Island for this work.

Line 78. Revise the notation of units of mean dust deposition

OK.

Line 95. polycarbonate, not in capital letter Paragraph

OK.

104-108. Please list in this text the ions and metals analyzed

We will list the ions and metals in section 2.5 and we will deleted this part since it is also reported at lines 135-140, as noted by the reviewer.

Line 105 and 136. blank levels, instead of blanks level

OK.

Lines 135-140. This has been already exposed in lines 104-108.

As above reported, we will delete the lines 104-108 and we will add here the list of metals and ions.

Line 144. I see that the particulates retained in the filters (after wet and dry deposition filtration) was analysed. But the procedure of digestion and analysis is not reported. Same thing for particulates from the PM10 samples (line157). This should be described in the M&M.

In agreement with this comment, in the revised manuscript, the description of the procedure will be added in the Material and Methods section.

Results

Line 202. Here there is an error, since the upper limit of TDP is 5*10 exp-3 (as deduced from Table 2).

We apologize for the inaccuracy. The mistake will be corrected in the revised manuscript.

Line 244. Error in unit: 8.8 ug m-3

We apologize for the inaccuracy. The mistake will be corrected in the revised manuscript.

Discussion

In this section I'd like a more in deep discussion of dry versus wet deposition and its relation to meteorology.

In agreement with this comment, in the revised manuscript, we will add some information on dry versus wet deposition and its relation to meteorology. In particular, in the results we will report the annual rainfall during 2016 and we will add the following sentence: "*Precipitation shows a significant interannual variability and is concentrated in autumn and winter, with a maximum in October. Intense precipitation events, which are relatively infrequent, are generally associated with frontal passages and winds from the Northern sectors. Very dry conditions characterize late spring and summer*." In the discussion (paragraph 4.2), we will add the following sentence : "*All of the analyzed samples, except few cases in summer 2016, are relative to dry+wet conditions. Although the DON and DOP recorded during the dry samplings are generally on the low end side of the measured range (see Table 2), no information on the role played by wet and dry deposition processes may be drawn at this stage, due to the limited number of dry samples.*" Regarding DOC input, in the discussion (paragraph 4.1) we reported that "*It should also be stressed that the DOC dynamics and its annual fluxes are not only influenced by dust deposition events. The wet deposition is also relevant, and the correlation between monthly precipitation rates and DOC fluxes confirms the high efficiency in DOC atmospheric deposition via rain events in the Med Sea, as recently proposed by Djaoudi et al. (2018).*"

In the literature, the wet atmospheric deposition is considered the main pathway for the removal of organic carbon from the atmosphere. Our data show that dry deposition is also important and we have reported a detailed discussion of this point in the paragraph 4.3:" *Some models have estimated that wet deposition represents up to 75-95% of total deposition (Iavorivska et al., 2016). Our data confirm the importance of wet deposition, but similarly dry deposition also plays a crucial role. Our results stress the relevance of dry deposition (32% of the total deposition during the entire sampling period) that, in the remote site of Lampedusa, appears to be main contributor of DOC and of other chemical species, as suggested in the past by Morales-Baquero et al. (2013).*"

In the revised manuscript, a sentence about the need of further studies aimed at clarifying the relationship between atmospheric deposition and meteorology will be added in the conclusions.

High DOC deposition was recorded in Lmp25 (May 2016) and also in Lmp1 (end of March 2015) and Lmp 4 (May2015) coinciding with Saharan dust but low DOC was found in Saharan events during autumn and winter. In view of this clear seasonal differentiation, one could hypothesize that there is a role of pollen attached to desert particles in these spring events (end March-May) and this pollen would contribute DOC. This process would not occur in the other seasons (winter and autumn of no pollen production). This is a possible explanation that needs further attention. However, there are some reports in the literature of joint pollen and dust transport: for example, Van Campo and Quet (1982) identified pollen types transported from North Africa to south France together with mineral desert dust, Franzen et al. 1994 documented the arrival of pollen from the Mediterranean to Fennoscandia during a dust event. Pollen originating in Morocco was detected South Spain (Cabezudo et al. 1997) and various pollen types (Cannabis, Cupressus, Pinus, Platanus and Sambucus) were observed in Cordoba (South Spain) exclusively during dust African events (Cariñanos et al. 2004).

We really thank the reviewer for this interesting suggestion. The contribution of pollen to atmospheric DOC in spring is an interesting hypothesis to test. In the revised manuscript, the following sentence will be added in the discussion (paragraph 4.3): "*In addition Lmp01 (end of March 2015), Lmp04 (May 2015) and Lmp25 (May 2016) show a seasonality that could be linked to the transport of pollen attached to desert particles in the spring events, and this pollen would contribute to atmospheric DOC input in spring (end of March- May). Pollen originating in Morocco was detected in South Spain (Cabezudo et al., 1997) and various pollen types (Cannabis, Cupressus, Pinus, Platanus and Sambucus) were observed in*

Cordoba (South Spain) exclusively during dust African events (Cariñanos et al., 2004). This process would not occur in the other seasons (winter and autumn), when no pollen production occurs.“ A sentence about the need of further studies will be also added in the conclusions.

Figures In fig 2, 3 and 4, include a legend to indicate the color of wet and dry deposition.

In the revised manuscript, a legend will be included in figures 2, 3 and 4.