

Interactive comment on “Effects of dust deposition on iron cycle in the surface Mediterranean Sea: results from a mesocosm seeding experiment” by T. Wagener et al.

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General Comments In this paper, the authors report the effects of dust deposition on iron cycle in the Mediterranean Sea in the frame of the interesting DUNE project. It appears that the authors obtained a very interesting dataset which is not easy given the complexity to develop such mesocosms in clean conditions. Furthermore, the paper is very well written. The abstract is clear and provides a major summary of the study. The introduction is well structured and the goal and the relevance of the paper are well presented. The results/discussion is very interesting and improves our knowledge on the complex Fe cycle in seawater. This new kind of experiments (mesocosms) points

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out that the effects of dust deposition are more complex than previously thought and shows that there is still work to do to understand the impact of this important source of Fe in surface waters. I think that this paper clearly merits publication. I just have very few detailed comments to address.

RESPONSE: We thank Referee #1 for his encouraging and constructive comments and criticisms on the manuscript.

Specific Comments The explanation of the Fig. 5 should arrive earlier in the text. Explanations are given at the p. 2812 whereas some data are discussed p. 2811 (the net sink of up to $4 \mu\text{mol m}^{-2}$). To make the reading easier, and to understand how is calculated the value of $4 \mu\text{mol m}^{-2}$, I think that some information should be given at the beginning of the subsection p. 2811, l.10.

RESPONSE: We agree with this comment and we have added the explanation of fig 5 earlier in the text as suggested. Moreover, following a suggestion by referee #2, a part of the explanation of figure 5 has been added to the the legend of this figure.

- p. 2817, l.3-9: The opposite effect between, in one hand the transport time and processes occurring in the atmospheric compartment which increases the dissolution and thus the impact in surface waters and in the other hand the fact that in areas receiving large dust deposition scavenging processes are enhanced is not clear enough. . . maybe this sentence should be rephrased.

RESPONSE:This part of the manuscript has been rephrased as following: “It has been argued that, because of the enhanced solubility of atmospheric dust particulate iron that has been transported over long distances [e.g. Baker and Jickels, 2006, Chi et al., 2009], in areas far from from dust sources, the flux of atmospheric dissolved iron could be high in comparison to the total deposition flux [Fan et al., 2006]. this study present evidences of the opposite effect: in areas receiving large dust deposition, dFe scavenging onto the atmospheric particles may be promoted and thus, thus large fluxes of total iron may lead to relatively small fluxes of dissolved iron. Moreover, in areas with

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high seawater dissolved iron and high dust deposition (i.e. oligotrophic areas P- or N-limited such as the Mediterranean Sea or the Tropical Atlantic), a strong dust event could even induce a sink for dissolved iron. This implies that atmospheric dissolved iron inputs to the surface ocean are not linearly linked to dust deposition: low dust areas are relatively favored in comparison to high dust deposition areas.”

Technical Corrections

-p.2801 : l.17-23 : Sentence difficult to read, too long. Should be divided in two distinct sentences.

RESPONSE:This sentence has been divided in two distinct sentences as suggested.

-p.2804 : l.6: Mistake between [pFe] and [dFe]. This same mistake occurs several times in the text (p. 2804, l. 23; p. 2806, l.23; p.2812, l. 21).

RESPONSE:These mistakes have been corrected in the text.

-p.2806: “values up to 40 to 60 $\mu\text{g L}^{-1}$ ”. The maximum value of 60 $\mu\text{g L}^{-1}$ can't be observed on the Fig. 2 because of the scale which stops at 40. Furthermore, such high values (60 $\mu\text{g L}^{-1}$) are not found in the supplementary database.

RESPONSE:This was an error in the manuscript which has been corrected by the following sentence “ [pFe] increased to values up to 36 $\mu\text{g.L}^{-1}$ ”.

-p.2812, l.14: dFe_stock_loss in $\mu\text{mol m}^{-2}$ instead of $\mu\text{m m}^{-2}$

RESPONSE:This has been corrected in the revised manuscript.

-p.2812, l. 27: Fig. 5.b not 5.c

RESPONSE:This has been corrected in the revised manuscript.

-p. 2814, l. 20: “this hypothesis is consistent with the decrease in dFe. . .” not clear

RESPONSE:This sentence has been rephrased as following: “The [dfe] decrease and the appearance of a new source of non available iron that followed the dust seeding

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could have enhanced the bacterial production of siderophores. “

-Figure 5, figure caption: “The definition . . .can be found in the text (Sect. 4.2), not (Sect.4.3.2).

RESPONSE:This has been corrected in the revised manuscript.

-Figure 6, idem Sect.4.2 not Sect.4.3.2

RESPONSE:This has been corrected in the revised manuscript.

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