

Atmos. Chem. Phys. Discuss., referee comment RC3
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Comment on acp-2021-624

Anonymous Referee #2

Referee comment on "Wet deposition in the remote western and central Mediterranean as a source of trace metals to surface seawater" by Karine Desboeufs et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-624-RC3>, 2021

This is an interesting study that examined the wet deposition fluxes of trace metals with co-located measurements in surface seawater and marine stocks in the Mediterranean Sea prior to and after the rain events. The study showed that wet deposition contributed to trace metals in surface seawater and marine stocks. However, there are some scientific questions that have not been addressed in the paper. The role of dry deposition of particles is undermined considering that dry deposition of trace metals is often equivalent to or greater than that of wet deposition based on a literature review of worldwide measurements (Cheng et al. 2021). The duration of the wet deposition monitoring is too short and limited to two rain events. The paper reported one event representing regional wet deposition and another event representing wet deposition from a dust episode. One question is whether these single event wet deposition fluxes can be extrapolated to seasonal or annual fluxes, which is typically what is measured in other wet deposition monitoring studies. Indeed, wet deposition does contribute to trace metals in surface seawater and marine stocks, but it is highly uncertain to what degree when compared with post deposition processes, effluent discharge to the sea, shipping pollution, etc. To better understand the relative importance of these processes, a mass balance analysis on the water chemistry is something to consider. Another important question is that based on the trace metals deposited to the Mediterranean Sea, would this result in negative effects on aquatic organisms.

Specific comments

Line 59: The sentences emphasized wet deposition, but the importance of dry deposition of metal-containing aerosols was not discussed.

Line 110: Rainwater was collected during the period between 11 May and 10 June 2017. How many samples were collected?

Line 290: The subheading can be more detailed. E.g. Atmospheric conditions prior to rain events.

Line 303: "in the night between June 28 and 29," Why are these dates different from those in Table 1?

Section 3.1: The low sample size seems to be an issue. There was only one rain event representative of regional background conditions and one rain event representing wet deposition from a dust episode.

Lines 378-379: It is unclear if this is the dissolved or total concentrations of Fe and Zn in rain.

Section 3.2: There should more discussion on how the chemical composition between the two rain events differ, e.g. are there different sources contributing to the scavenging of metals for the ION and FAST events? Are the sources of TMs in dust natural or anthropogenic? The dissolved concentrations for metals are not very different between the ION and FAST rain events. Are they statistically different? It appears that the total concentrations were much higher for the FAST event than the ION event. Any possible explanations as to why the dissolved concentrations are much more comparable between the two events than total concentrations?

Lines 474-475: It was mentioned that the rainwater chemistry from this study cannot be compared to those from previous studies because emissions levels were much higher back then. Is it valid to compare the enrichment factors from this study with those from earlier studies? Why is the enrichment factor for Zn in this study higher than that of previous studies despite regulations on toxic trace metal emissions?

Line 535: What causes the lower solubility of TMs in high dust events?

Line 556: Is this the deposition flux over the course of the rain event? Can you quantify the time period associated with this deposition flux, e.g. mg/m²/day? Given the rain events last up to a few days, can the deposition fluxes be extrapolated to seasonal or annual fluxes?

Lines 591-592: How many intense deposition events occur in a typical year?

Section 4.2.2: Have you compared the trace metals profile in wet deposition and in seawater and in marine stocks? Are they comparable? Based on the trace metals deposited to the Mediterranean Sea, would this result in negative effects on aquatic ecosystems? Although the authors qualitatively discussed the role of post deposition processes on seawater concentrations, some data are needed to elucidate the importance of atmospheric deposition relative to the post deposition processes.

Lines 745-747: "we suggest to use the chemical composition of PEACETIME rains as a new reference for the studies TMs on wet deposition in Med Sea". I suggest rewording this statement. This is only one wet deposition monitoring study in the Mediterranean region, and the paper presented the findings from two rain events. Other studies have been conducted to capture background and dust episodes in this region. The results on the trace metals composition and their solubility in wet deposition are not particularly new compared with previous studies.

Lines 750-753: HNLC has not been defined.