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Comment

Interactive comment on "Impacts of dust deposition on dissolved trace metal concentrations (Mn, Al and Fe) during a mesocosm experiment" *by* K. Wuttig et al.

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Anonymous Referee #1 By preparing the submission of the revised manuscript, we have discovered an error in our answer to reviewer #1. Concerning the calculation of the fractional solubility, the former submitted answer was not the latest version which

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corresponds to the revised manuscript. Please find here a short revised response to the following two comment of reviewer #1: P13874: why calculate the solubility from the difference between the control and dust mesocosm inventories. An alternative option would be to use the inventory of the dust mesocosm just prior to dust addition.

RESPONSE: We partially agree with this comment of the reviewer, as we note that a key assumption, which appears validated here, is that the control and dust mesoscoms had the same inventories prior to the dust additions. The reason why we made the choice of calculating the solubility based on the difference between dust seeded and control mesocosms instead of the difference between values prior to the dust addition and after the dust addition in the dust seeded mesocosms comes from the "philosophy" used to design the experiment. Due to presence of organisms in the mesocosms, biogeochemical changes are observed within the mesocosm even if no dust is added. For this reason three control mesocosms were deployed. The observations in the dust seeded mesocosms can be "corrected" from the changes observed in the control mesocosms in order to estimate the changes due to the dust addition only. Based on this "philosophy", we decided to calculate the solubility from the difference of inventories between the dust seeded and the control mesocosms.

That being said, the choice of a fractional solubility calculation method was more complex for the second dust addition. Using the method used for the first dust addition (Difference between control and dust), would not take into account the changes induced by the first dust addition. We have decided to use the stock in the DUST mesocosms just before the second addition of dust (144 hours after the first dust addition) to calculate the fractional solubility induced by the second dust addition only. This aspect of the fractionnal solubility calculations will be developed in the revised manuscript as mentioned in the next comment.

P 13874: the description of the calculation of the solubility is awkward, if not wrong.

RESPONSE: We agree with the reviewer that the description of the solubility calcu-

lation was unclear, however it was not incorrect. This description has been rewritten as following: "The fractional solubility of an element from dust particles in seawater is commonly expressed as a percentage. For a given element at a given time, the fractional solubility is the ratio between the amount of an element dissolved from dust in seawater and the total amount of this element introduced with the dust particles. Here, the solubility of each element from the added dust is estimated at the time point when the inventory of this dissolved element in the mesocosms is at its maximum after the dust addition. The total amount of the element introduced by dust is estimated from the amount of dust introduced to the mesocosm and the elemental composition of the dust used (Guieu et al 2010). The amount of the dissolved element introduced by dust can be estimated in the particular case of this experiment by two different approaches: (1) by using the difference between the inventories in the dust seeded and the control mesocosms or (2) by using the difference between the inventories in the dust mesocosms before the addition of dust and after.It is important to note that in the case of this experiment, using the difference of the inventories between dust seeded and the control mesocosms to estimate the dissolved amount, allows us to avoid taking the changes in dissolved concentration observed in the control mesocosms during the experiment into account. The dissolved concentration changes in the control mesocosms are independent from the added dust and must therefore not be taken into account in the solubility calculation. For this reason, we have used the first method to estimate the fractional solubility after the first addition of dust. However, for the second addition of dust, using this method would somehow integrate both dust addition in the calculation of the fractional solubility. For this reason, in order to just estimate the solubility of the second addition the second method has been used for the second dust addition." We assume that the reviewers are familiar with the concept of fractional solubility (we refer the reviewers to Baker and Croot (2010) for more details if this is not the case). The difference in fractional solubilities calculations for both dust additions can be resumed with the two following equations which will be added in the revised manuscript. In this work the fractional solubility is calculated from the dissolved inventories as follows:

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$$FracSol(\%) = \frac{\max\left\{A\left(\left|\int_{z}^{0}[M]_{DM}\,\partial z\right| - \left|\int_{z}^{0}[M]_{CM}\,\partial z\right|_{t_0}\right)\right\}}{\Sigma M_{Dust}}$$

Case 1: 1st addition

$$FracSol(\%) = \frac{\max\left\{A\left(\left|\int_{z}^{0}[M]_{DM}\,\partial z\right|_{t} - \left|\int_{z}^{0}[M]_{DM}\,\partial z\right|_{t143}\right)\right\}}{\Sigma M_{Dust}}$$

Case 2: 2nd addition

Where A is the surface area of the mesocosm and assuming it is a perfect cylinder, t represents the time since the last dust addition.

Fig. 1.