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“Effects of dust deposition on iron cycle in the surface Mediterranean Sea: results from a mesocosm seeding experiment Author(s): T. Wagener, C. Guieu, and N. Leblond MS No.: bg-2010-97

General Comments:

This manuscript presents valuable data on the effect of dust deposition on iron cycle in surface waters of the Mediterranean Sea. The unexpected results of a dust event resulting in a decrease of dissolved Fe, rather than an increase, due to abiotic scavenging are very interesting. The experiments were well executed and the data analysis and calculations are sound. I found the discussion very insightful and focused. In general the manuscript is well written. There are a few sections that need further clarification (see comments below), especially how certain calculations were made and some of the methodologies.

Specific comments:

Introduction

- Page 2801, line 29. A reference is needed after ‘dissolution processes’.

Materials and methods

- Page 2802, line 15 to 20. It would be helpful to indicate the depth of the mesocosm here (12.53 m, correct?). This number is necessary to calculate the biological demand of Fe in the mesocosms (page 2811).
- Page 2803, line 4. The dust addition should be normalized to the volume of the mesocosms, so that the dust addition in the mesocosms and the batch experiments can be compared. According to my calculations, the addition to the mesocosms was 0.789 mg/L [41.5 g / (52m³ × 1000 L/m³)].
- Page 2803, line 7. Please include more information about how the aging of the dust particles was accomplished. Adding something like “The protocol for aging the dust particles reproduced the photochemistry and the pH gradients & ionic strength normally observed during cloud processing of dust.” would be useful to the reader.
- Page 2804, line 9. Please include the porosity of the cellulose acetate filters.
- Page 2805, line 5-15. It would be helpful to have some additional details here. For example, was the dust added to the ‘bottle’ experiments also diluted in Milli-Q water, as done for the mesocosms (see page 2803, line 6)? Why was the dust addition in the bottle experiments 5mg L⁻¹, while that in the mesocosms was 0.798 mg L⁻¹? The authors should justify their chosen additions of dust, 5mg L⁻¹ in the ‘bottles’ vs. 0.798 mg L⁻¹ in the mesocosms. I am surprised that the difference between the two is almost an order of magnitude. Is it possible that this difference might have somehow affected the outcome of both experiments regarding the solubility of Fe?
- Page 2805, line 14. It would be helpful to have estimates of surface area to volume ratio for the ‘bottles’ vs. the mesocosm experiments. This may be handy in the discussion.

Results

- Page 2806, line 17-18. What do the authors mean by “Variability among the replicates was more important in [pFe] than in [dFe].” ? Do they mean variability was higher?
- Page 2806, line 23. There is a typo here. It reads “The mass of particulate iron [dFe] per sample...” It should be “[pFe]” instead of “[dFe]”.
- Page 2807, line 16-17. The authors should justify discarding samples with high [pAl]. Why is it ok to discard samples with high Al content?
- Page 2807, line 22-25. I found this paragraph very hard to understand. The legend in Figure 4 is better. Please modify this paragraph to make it clearer. Maybe the authors should include a little equation. There are too many ‘between’ in the sentence, so it is hard to see what they are exactly comparing or dividing. For example, in line 25, after reading it a couple of times, I realized that

“...measured before the addition of dust particles to the batch reactor” refers to the filtered seawater. Why not make the sentence more concise and precise?

Discussion

- Page 2809, line 2. Replace “submitted” with “subject”
- Page 2809, line 6-8. The quoted, highest Fe:C ratio for phytoplankton was originally presented in Brand 1991 manuscript. This manuscript thus should be cited after the number.
- Page 2809, line 23 & 25. Please indicate units in parenthesis.
- Page 2811, line 19. I calculated the phytoplankton Fe demand based on their reported Fe:C ratio (400 $\mu\text{mol Fe per mol C}$), a C/chla ratio of 100 g/g (typical of Fe-limited phytoplankton), and a depth of the mesocosm of 12.53 m. According to my calculations, the phytoplankton demand is in the order of $\sim 3100 \text{ nmol Fe d}^{-1} \text{ m}^{-2}$. It would be helpful for the authors to be more explicit about their calculation. They could simply put the calculation in brackets at the end of the sentence. Again, I am not sure that citing Veldhuis et al 2005 is the most appropriate, given that the title of the Veldhuis manuscript is on picophytoplankton. What kind of phytoplankton community composition did they have in the mesocosm? A sentence with this info would be helpful. The authors can then justify using a Fe:C typical of diatoms, or picoeukaryotes, cyanobacteria....
- Page 2811, line 21. I also calculated the heterotrophic bacteria Fe demand using a Fe:C of 9.1 $\mu\text{mol Fe per mol C}$, and a C quota of 2.6 fmol per cell. My calculation is close to that presented here (mine 77 vs. the authors' 55 $\text{nmol m}^{-2} \text{ d}^{-1}$).
- Page 2812, line 13-15. This information should also be placed in the legend of the pertaining figure.
- Page 2814, line 9-13. It is not clear to me how “scavenging of colloidal Fe on dust particles or the re-precipitation of soluble Fe favored by the presence of an important amount solid particle after the dust seeding” can increase Fe solubility. Shouldn't this decrease Fe solubility? Please clarify.

Figures

- Figure 5. I am confused about the t_0 loss in panel B. How are they calculating the loss term at t_0 , this calculated loss is relative to what? Are they just reporting the values of $[\text{dFe}]$ and $[\text{pFe}]$ before the dust addition? This should be clarified in the legend and the graph itself. Also, the font in the figure symbols of all the graphs is too small and hard to read.

END OF REVIEW