

Interactive comment on “The GESAMP atmospheric iron deposition model intercomparison study” by Stelios Myriokefalitakis et al.

Anonymous Referee #1

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Biogeosciences Title: The GESAMP atmospheric iron deposition model intercomparison study Author(s): Stelios Myriokefalitakis et al. MS No.: bg-2018-285 MS Type: Reviews and syntheses

This is clearly interesting and worthwhile work, given the importance of iron in ocean nutrition, but I think there is an immediate question about why it is needed. The authors state that this kind of modelling is the only way to estimate iron deposition (page 4 lines 11ff). But is it really impossible to utilise the large number of observations of Fe concentrations (listed in the SI) to estimate fluxes? I would like to see a better justification for this claim.

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The third aim of the work (page 7, top) seems circular – why would future modelling studies find the fluxes calculated in this modelling study useful, other than as comparative measures? I also miss an indication that the work described here is potentially useful in permitting prediction of changes in Fe deposition rates, for example due to anthropogenic activities.

Page 21, line 10 states “The TFe loading, Fe solubility, and LFe loading from the models are compared with the measurements and presented in Fig. 4.” This confuses me, since I would use the term loading to mean a flux over time (mass per unit area). The axis labels refer to concentrations, with units of mass per volume, but the text and the Figure caption use loading. Please clarify.

And also with reference to Figure 4, if I understand correctly (and if I don't then please clarify the text) the MNB values indicate the overall bias of the predictions compared to the data, which would mean that the ensemble model overestimates LFe concentrations by a factor of five. Does it then follow that loadings to the ocean are overestimated by this factor? If so, then the proposed further work doesn't seem to address the issue – Section 5 reads more like a series of minor tweaks than addressing a major quantification problem.

Evaluating the importance of atmospherically deposited Fe depends greatly upon assessing the fate of the metal in ocean water. According to the authors “Upon deposition to the surface ocean, this fraction of Fe from the atmosphere can either enter the dissolved Fe pool, or precipitate-out as large oxy-hydroxide particles (Meskhidze et al., 2017)”. I am surprised that the cited study, which worked with high Fe concentrations and did not explore the influence of light on iron chemistry, is considered to represent the state of knowledge in this area. I am also surprised that neither this reference nor the paper under review cites the book by Turner and Hudson “The Biogeochemistry of Iron in Seawater” (Wiley 2001).

Is there any prospect of using the Fe loadings reported here to simulate Fe concentra-

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tions in the ocean? I realise that this may be outside the scope of the present paper, but some indication of possibilities would be welcome.

It is not clear to me whether FeD deposited to the ocean is considered “inert” or whether it can yield significant dissolved Fe. Maybe this could be explained. If it is not considered to be a source, then it is not so important to get the global fluxes correct, and the focus should be on the LFe.

As I understand it, a similar loading (to LFe) of dissolved Fe to the oceans comes from rivers. Could the authors briefly explain why this is not considered as important as the atmospherically-deposited form?

Section 2.1.2 introduces the presence of oxalate in aerosols, without explanation of its sources and why other carboxylic acids are not considered. I am not at all expert in this area, it appears as though oxalate is assumed or known to be dominant – if so then its strong solubilising properties are clearly important. I would appreciate some references to justify the assumption that oxalate is truly dominant in governing aerosol Fe solubility.

The right hand maps in Figure S4 are not informative. Is it possible – or do the authors consider it worthwhile? – to show primary sources of LFe?

TECHNICAL CORRECTIONS (just the ones I noted, this is not comprehensive!) Page 5 line 15 This sentence needs improvement. Table S3. What does “NaN” mean? (not analysed I guess, but please say). Figure S7 should have “continuous” not “continues” Page 21 line 19. I assume that SH = southern hemisphere? Is this so very well known? Page 21 line 22. Should it read 0.50-0.56?

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