Atmos. Chem. Phys. Discuss., 11, C3315–C3317, 2011
www.atmos-chem-phys-discuss.net/11/C3315/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The fate of Saharan dust across the Atlantic and implications for a Central American dust barrier" *by* E. Nowottnick et al.

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Received and published: 13 May 2011

Review of Nowottnick et al. "the fate of Saharan dust. . ."

This is a solid paper looking at an important problem. It should be published with minor revisions.

By Natalie Mahowald.

"Additionally, insoluble iron in dust aerosols can be converted into a soluble form via photochemistry and cloud processing (Hand et al., 2004; Kieber et al., 2003; Desbouefs et al., 2001; Zhu et al., 1997), which when de- posited at the Earth's surface can serve as a nutrient source for aquatic and terrestrial ecosystems (Mahowald et al., 2005; Jickells et al., 2005; Falkowski et al., 2003)." Some iron starts out soluble: see

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those papers.

2nd paragraph of the introduction. Winckler et al., 2008 shows that there is an incorrect gradient in many of the gcm simulations of the dust deposition to the pacific ocean: too much north African dust is coming across. You can see this in the source apportionment studies of Luo et al., 2003; Tanaka and Chiba, 2005; Mahowald, 2007; North African dust is sneaking through in the tropics. Notice this include reanalysis and gcm wind based models. Thus, the issue of how much dust gets through central america is an important one.

“To evaluate Saharan dust transport to the Caribbean and understand the Central Amer- ican dust barrier we performed a baseline GEOS-5 replay simulation using the MERRA analyses”: "replay": this is usually called hindcasting in the world of meteorology (although replay does sound more fun, like a video!).

4.1 is really a methods section and should be put into the above methods section, not in the results. Separate out the results and keep them in 4.1: this will make the paper flow better.

“Our analysis of Eq. (2) uses monthly mean components that have been computed from instantaneous model output at every 3 h; thus, the fields examined include both the mean flow and the contribution from transient eddies.” I hope you are doing this analysis on the 3 hourly instantaneous output and then plotting up the monthly means. If you are, then please clarify that by saying: ““Our calculation of Eq. (2) use 3 hourly instantaneous model output to determine monthly mean dust mass fluxes; thus, the fields examined include both the mean flow and the contribution from transient eddies.”

“The best agreement between our model and the observations was obtained when dust wet removal was treated as we treat the removal of hydrophilic aerosol species.” This is completely consistent with the observations that dust readily attracts water when unprocessed Koretsky et al., 1999, and that dust readily acts as a CCN (Nenes et al., 2009? New articles from Thanos Nenes’ group). I’m not sure where the idea came

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up that because dust is insoluble it does not readily attract water (except the Fan et al paper, and we did not need that to capture the correct Pacific trend in our model, so we know it was model dependent), but it's completely inconsistent with the literature or our understanding of minerals, and should be eliminated from the literature as much as possible. Your paper should help do that.

"The implication of appealing to an increase in dust wet removal efficiency is that perhaps processing of dust during transport results in a more hydrophilic aerosol. Such an aerosol would likely be more bioavailable to oceanic organisms once it is eventually deposited." There is absolutely no need for atmospheric processing of dust for this to occur, as indicated above, and for North african dust coming across the north atlantic there probably really isn't time or sulfate: you can see this in the processing times of Hand et al., 2004. And wet deposition being more efficient for dust than previously thought has no implications for bioavailability, even if it required atmospheric processing, so please remove these two sentences in the conclusions and anywhere else they appear.

Figures: I think figure 2 and the repeat (figure 14) are excellent ways to show what you are doing.

Figure 9 should clarify that these are the dust production and loss terms (figures should be stand alone), and indicate where in the text the calculations is derived.

Figure 10 is my favorite. I like this way of looking at things, and find it much more interesting than figure 11 or 12: I would prefer to see a horizontal plot of figure 10, with different colors represent different strengths of different processes across the whole north atlantic region.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 8337, 2011.