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Atmospheric Chemistry and Physics Discussions

Interactive comment on "African biomass burning plumes over the Atlantic: aircraft based measurements and implications for H_2SO_4 and HNO_3 mediated smoke particle activation" *by* V. Fiedler et al.

Anonymous Referee #1

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This paper describes smoke particle activation via H2SO4 and HNO3 of two biomass burning plumes from Africa, using measurements made aboard the DLR Falcon during African Monsoon Multidisciplinary Analyses experiment in 2006. Overall I found the manuscript informative and a useful piece of work showing how local airborne and satellite measurements can be combined with theory to describe the evolution of a biomass burning plume as it transits the Atlantic.

There are a few areas that need to be clarified or expounded upon. As the primary thrust of the work is the activation potential of smoke particles via H2SO4 and HNO3,

I find the overall description and interpretation rather weak in detail.

There is a statement that measurements made during August 13th in the MT-plume showed that at least 45% of the initial SO2 was still present. Using calculations the authors state that a H2SO4 concentration of 2.8x10e10 cm-3 is implied. This statement needs to be clarified as such a concentration is far beyond that for homogeneous particle formation at ambient humidities. To my knowledge the largest ambient concentrations observed are in the 10e8 cm-3 range and these occurred only in areas close to local SO2 sources. I believe the authors are trying to show that the conversion of that much SO2 would lead to an approximate mass fraction of sulfate coating the particles. The theory is sound, but the description is confusing and needs to be clarified.

How would heterogeneous processes affect these conclusions? It appears to be assumed that NH4NO3 and (NH4)2SO4 remain intact on the smoke surface, however (as the authors state) these components along with H2SO4 and HNO3 have associated H2O with them. It is possible for the NH4NO3 to interact with H2SO4 resulting in a HNO3 and a neutralized NH4HSO$ or (NH4)2SO4. The combined equilibria of the system needs to be considered for rigorous calculations. While quantitatively this might not be possible, a qualitative explanation should be included.

On a lesser note, the paper should be revised by a native English speaker. While not being great at English grammar myself, there are many grammatical errors that I noticed.

Also in my opinion the work is too figure rich. Many of the figures could be combined and still present the points made. Specifically, is figure 1a necessary? A larger version of 1b would show the relevant point. Overlay figure 3 onto figure 1 or figure 2. The photos in figure 4 do not add to the text. Combine figures 5 and 6. Eliminate 7a. Put the pieces of figure 8 onto one plot to give better resolution. Eliminate figure 8a. Figure 13 seems redundant with figure 8. Combine a nd b on figures 15. and 16.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 7699, 2010.