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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Model of optical response of marine aerosols to Forbush decreases" *by* T. Bondo et al.

Anonymous Referee #3

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The paper discusses the effect of galactic cosmic rays on aerosol formation by ion-induced nucleation and progresses from nucleation to larger, optically observable particle sizes. If ion-induced nucleation plays an important role in aerosol formation then the role of ionization by GCR may be significant over marine areas far from the continents and thus from sources of radon, the most significant source of ionization over continents.

The effects predicted by the modeling may or may not be true but the good thing in the paper is that it gives a hypothesis that can be tested by measurements. It is true that the left panel of Figure 6 shows some qualitative agreement between observations and the model. However, the AERONET measurements that the model was compared against were made on land where all other sources of aerosol dominate and such AE

variations, from 1.3 to 1.15, are not uncommon also in other times. The comparison made using MODIS data from over the oceans is not really supporting the model, like the authors also note. What the comparison with the MODIS data tells me is that the FD-related modification of AE is not a very significant process - which is not a bad result for the whole work and should be presented. This is also in agreement with a recent paper by Kulmala et al. (ACPD, 9, 21525–21560, 2009) that I suggest the authors cite in the revised version of the paper.

Detailed comments:

22840, L2. The formula for AOD (Eq. 2) is wrong. AOD is unitless. The unit for extinction coefficient is 1/m and the integral as it is there, yields meters as units so they cancel out. Multiplied with Nsap the unit on the right side is 1/mˆ3. Correct the formula. I hope the calculations of AOD have been done with a correct one.

22842, L11-15. Reviewer #1 mentioned cloud processing that you have not taken into account. The other cloud-related process is below-cloud scavenging. You discuss the precipitation scavenging of particles and write "On smaller scales rain is a discrete and abrupt process that basically cleans out an area for particles." Below-cloud scavenging is a strongly size-dependent process and there is plenty of literature on this. Being size-dependent it will have a clear effect on the Angstrom exponent. Over the ocean this process alone may potentially lead to larger AE variations than the process predicted by the model here. So, I suggest you also add size-dependent below-cloud scavenging into your model and discuss also its effects on AE in the revised work.

22843, L13. Define the factor alpha in Eq. 6. And actually, use some other symbol if you are using alpha for angstrom exponent as presented earlier in Eq. 4. And also define the factor beta in line 20. And go through the whole text to give explanations to all symbols.

I wish you presented the full general dynamic equation that you have used. For example it would make it easier to follow your "Figure" 3 - I suggest you rename it as a Table

- and all associated text.

Add legends to figures so that the reader does not have to guess what line presents what.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 22833, 2009.