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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol nucleation over oceans and the role of galactic cosmic rays" *by* J. Kazil et al.

Anonymous Referee #2

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General comments: In this work, the authors investigate aerosol formation via neutral and charged binary nucleation of H2SO4 and H2O. They use global model covering the oceans. The authors have made interesting and important conclusions about the role of ion-induced nucleation and galactic cosmic ray ionization in global marine atmosphere. The subject is appropriate for ACP and substantial conclusions are reached. Global character is the most important merit of the study, because we lack global-scale simulations on atmospheric aerosol formation so far. As authors say, this work is only a step towards an accurate description of the phenomena. However, this is already valuable contribution and valuable tool for future research. I therefore recommend the manuscript for publication in ACP after minor revisions, mostly considering uncertainties in connection with presumptions in simulation of aerosol formation.

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Specific comments: i) Previous studies have shown that surface area of preexisting aerosol particles is important factor influencing the formation processes of new aerosol particles. In present study, the authors start their model with no preexisting aerosol, which certainly leads away from real conditions and wrong conclusions can be made easily. The authors have aimed to obtain an upper limit of effects. However, the authors should investigate the sensitivity of model results to preexisting aerosol and add some discussion what happens by adding this parameter into model. Of course, this is not easy, as concentration of aerosol particles can vary several orders of magnitude at different locations.

ii) In the paper we can see plots for global OH and SO2 concentrations. The production rate of sulfuric acid is calculated using parameterization of SO2 and OH. I think that readers would be interested to see model results about gas phase concentration of H2SO4. The authors should consider adding such figure for H2SO4 like Figures 1 and 2.

iii) The model computes the aerosol size distribution at given times from SO2 concentration, the concentration of the hydroxyl radical OH, ionization rate, relative humidity, temperature, and pressure. In what size range we get the size distribution? I recommend adding quantitative values about the size of calculated aerosol particle, and also estimations about charging efficiencies or charged fraction of the freshly nucleated particles. What is the size limit for the supercritical aerosol particles which concentrations we can see in Figure 5?

Technical corrections: Figures 1, 2, 4, 5 and 6 would be better readable if they are ordered so that plots (a) and (b) are located in the upper row, and plots (c) and (d) in the lower row, like in Figure 8. In page 5561 line 14, there is one extra “not” in expression: “we cannot not rule out...”

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 5543, 2006.

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