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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The role of atmospheric ions in aerosol nucleation – a review" *by* M. B. Enghoff and H. Svensmark

Anonymous Referee #2

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In this manuscript, the authors gave an overview of the state of observations, theory, and experiments with regard to ion-induced nucleation. This review paper deals with an important subject and covers a wide range of relevant publications. My main complain is that this paper doesn't provide substantial new insights or critical discussions. I recommend the publication of this manuscript in ACP after the following issues are properly addressed.

Main comments:

The summary is too brief. It is important and necessary to have a more detailed summary to describe the main insights obtained from the review of various publications relevant to the topics of ion-induced nucleation. More specifically, the authors should

address the following questions in the summary section:

(1) What is current knowledge about the role of ions in aerosol formation? Do all the papers agree with the importance of ion nucleation? If not, what are the different opinions and how to resolve the difference?

(2) What are the evidences supporting or against the importance of ion-induced nucleation in the atmosphere? The authors mentioned in summary and abstract that "Evidence for the importance of ions in aerosol nucleation is accumulating". What is this "evidence"? Please be more specific and list the evidence in the summary. Based on some papers reviewed in the manuscript, it appears that ion nucleation is very small at least in the lower troposphere where most of nucleation events are observed. So is the evidence against ion-nucleation also accumulating?

(3) The authors pointed out both in the abstract and summary that "the exact mechanism for the nucleation is not known". What does the statement refer to? Different explanations of nucleation phenomena observed both in laboratory and in the atmosphere? What are the uncertainties in different existing nucleation mechanisms? What should be done in the future to identify "the exact mechanism"?

Minor Comments:

(1) Page 7482, lines 9-10. It has been pointed out in Horrak et al. (ACP, 8, 655, 2008) that "an extra ion loss term of the same magnitude as the ion loss onto aerosol particles is needed for a quantitative explanation of the observations. This term is presumably due to the small ion deposition on coniferous forest." The work of Horrak et al. should be discussed here. (2) Page 7483, lines 3-4. As I understand, "26%" and "22%" refer to the percentage of total analyzed days (including event, undefined, non-event days). It will be more useful to give the percentage of EVENT days that were associated with positive and negative ions.

(3) Page 7489, line 14. Should add another item "(4) scavenging by pre-existing parti-

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