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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Negatively charged nanoparticles produced by splashing of water" *by* H. Tammet et al.

H. Tammet et al.

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We would like to thank the editor and the referee for their interest in the article and for their valuable comments. We are pleased to consider the comments and suggestions in the revised manuscript. The critical comments and responses are listed below.

Referee: It would be important to mention in the review part the number of experimental works of H.R. Carlon (H.R Carlon, J. Appl. Phys., 1981, 52, 311; J. Appl. Phys., 1980, 51, 171 etc.) who revealed the ion-pair concentrations in a highly humid air resulting, as reported, from the thermal dissociation of neutral water clusters.

Authors: We thank the referee for pointing out the interesting papers by H.R. Carlon. Unfortunately, in these papers, we did not find any relevant discussions of the ballo-electric effect. The effect of water vapour on the air conductivity and production of

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small ions was considered by Carlon without treating the charged particles of the size of above 1.5 nm. Thus we have no sufficient reason for including above references into the manuscript.

Referee: It is reported in MS that the splashing-generated balloelectric ions can be considered as singly charged water nanodroplets. However the estimation of the evaporation time was made for only neutral droplets. What is the reason?

Authors: The evaporation time of the balloelectric ions exceeds by a number of magnitudes the evaporation time of the liquid water calculated according to the traditional kinetic theory. The effect of the electric charge on the evaporation time does not exceed some tens of per cent, see Caleman, C. and Spoel, D.: Evaporation from water droplets containing singly charged ions, Phys. Chem. Chem. Phys., 9, 5105-5111, 2007. Thus a rough approximation of the calculations is sufficient. A brief explanation and a corresponding reference are included into the revised manuscript.

Referee: It is not clear from the MS the history of the measured charged nanodroplets formation: for example, (i) the direct production of these charged nanodroplets during the laboratory bulk-water splashing and rain or (ii) at first the formation of larger and widely distributed in size charged water droplets (e.g. 10-100 nm) which then all evaporate to the observed size range.

Authors: The direct mechanical production of the nanodroplets is doubtful due to the shortage of the kinetic energy. The actual mechanism of producing the nanoparticles is unknown.

Referee: It is not clear from the MS: the formation of charged water nanodroplets at rain is the result of droplet-droplet collisions by analogy with laboratory collision of the water jet onto a solid surface or the one droplet dissociates on charged fragments due to some reasons.

Authors: Unfortunately, the mechanism of producing the nanoparticles still remains

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unknown and we do not know the answers to the last two comments of the referee. Corresponding explanations have been added into the revised manuscript. We thank the referee for pointing out the important problem and we will consider the comments in the future research.

Editor: The authors should slightly sharpen the very initial part of the introduction to this paper. Especially, the first sentence "Physics and chemistry ... climate change mechanisms" does not fit into historical overview, in addition to which it should be backed up with relevant studies published in scientific literature. I suggest that the authors will write a short paragraph into the very beginning of Introduction (before section 1.1), in which they put the importance of aerosol nucleation into broader atmospheric context.

Authors: We agree with the comment. The first sentence is replaced by a newly written text and the background of the problem is better explained.

Editor: There are a few terms and concepts used in the paper that could be explained more explicitly. For example, can we call nanometer size aerosols as "water droplets". What does "balloelectric" mean, and so on.

Authors: The term "nanodroplets" is often used in the literature including the titles of some cited papers. However, it is true that the water nanoparticles cannot be considered as liquid droplets. We have replaced the term "droplets" in the revised manuscript with a more general term "particles" when the diameter of the particles does not exceed few nanometers. Another improvement in the revised manuscript is an explicit explanation of the origin and etymology of the term "balloelectricity".

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 16609, 2008.

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