

Interactive comment on “Measurements of electric charge separated during the formation of rime by the accretion of supercooled droplets” by R. A. Lighezzolo et al.

Anonymous Referee #3

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2) The reviewer agrees with the author's response and logic for the idea that even if comparable charge densities were found in the lower negative charge region of inverted polarity storms, that this would not preclude the splintering hypothesis presented in the paper from operating in the lower positive charge region of positive polarity storms as originally presented by the reviewer. The current suspicions in the literature are that inverted polarity storms may be associated with unusually high liquid water contents in the main updraft as the authors state, resulting in a different region of EW-T parameter space being in operation during Relative Growth Rate mechanism charging to give rise to the observed inverted charging structure. The reviewer now agrees with the author's comment that a discussion of this is not warranted in the paper on grounds of lack of

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observational evidence.

There is one further comment that the reviewer would appreciate discussing here on the forum. If it were found that the magnitude of the lower negative and positive charge regions in inverted/normal polarity storms were comparable, and given that the Relative Growth Rate mechanism would likely be operating in both cases to produce a comparable charge transfer as seen in laboratory studies*, then by a reverse analysis, would it be reasonable to conclude that the contribution to the lower positive charge region from the splintering hypothesis would be relatively negligible? In other words, if we accept that the splintering mechanism may not operate in inverted polarity storms due to high LWC, and given that the Relative Growth Rate mechanism is likely charging the lower region of the storm comparably in both storm polarity situations*, then for the splintering mechanism to be in the running for having a significant contribution, the lower positive charge region would have to be greater in magnitude than the lower negative charge region, typically.

(*Away from a reversal line (or anomalous zones), positive and negative graupel charging is comparable in magnitude except at both higher EW and temperature where positive graupel charging is stronger typically, which allows for the suggestion above that the lower positive and negative charge regions charge to comparable values from the Relative Growth Rate mechanism.)

Just to be clear, the reviewer is not against the splintering hypothesis, but is simply subjecting it to standard scientific skepticism and test. It's very intriguing in fact.

This reviewer has asked other informed peers and colleagues around the world for any evidence of the charge densities observed/modelled etc. in the lower charge region of both storm polarities, and will post further feedback comments here if any worthwhile responses are received for the benefit of the authors.

3) The reviewer accepts the original point was not presented very effectively, and also accepts the response from the authors. This point originally stemmed from discussions

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with peripheral readers of this subject area around the world who have explained to the reviewer that following this area is difficult as there are lots of competing theories and little apparent cohesion between them in the literature. Explaining in a straight forward way what a hypothesised mechanism can't do in addition to what it can in relation to the most supported alternatives was a suggestion for the authors to consider, to alleviate possible difficulties in appreciation of advances in this field by such readers, but is at the authors' discretion.

4) The reviewer retracts the original point 4 owing to confusion between the contents of two different published papers. Criticism was wrongly attributed to Avila et al. 2003, which this reviewer actually feels is a solid piece of careful research and is in full support of. This was careless and this reviewer apologises. This also means that this reviewer no longer feels it is necessary to remove the Avila et al. 2003 reference from this paper (even after considering its only loose relevance), and leaves this decision to the authors.

5) The reviewer very much appreciates this decision and hopes such considerations could apply to future papers, and that the authors could consider helping to address any future appearances of the term by others.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 23349, 2009.