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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Using cloud ice flux to parametrise large-scale lightning" *by* D. L. Finney et al.

Anonymous Referee #3

Received and published: 30 July 2014

This study proposes a new parameterization method to calculate the lightning flash density based on upward cloud ice flux, which in turn can improve chemistry-climate simulations. The authors calculate the lightning flash distributions using their proposed method and compare them with the ones obtained using the observations by the Lightning Imaging Sensor (LIS) satellite and results obtained from several existing parameterization methods; they conclude that the proposed method yields better estimates of flash frequency distributions than the other methods. The manuscript is very well written. I have only identified few minor issues with the manuscript, as other referees have already identified the major ones. I recommend that this manuscript be accepted for publication after minor revisions.

Major comments:

As investigated by referee #2, it is important to consider the meteorological fields, such as precipitation and cloud top height that are used as input for the parameterization methods because errors in these inputs can influence the performance of these methods during their evaluation; the results could be biased because of differences in error magnitudes/characteristics of the input variables. At very least, more discussions on error characteristics of ERA-Interim, for instance, the ones based on ERA-Interim evaluation reports, are required to clarify whether the proposed approach overcomes the limitations of other existing approaches.

Minor comments:

p.17825 L5: Please clarify if the annual global total flash rate is adjusted to 44 flashes/s, and the seasonal variation and the global distribution are simulated using each parameterization.

p.17827 L9: Please describe whether you applied any length limitation for “nearest”.

p. 17831 L7-8: It is not clear from this study whether reduced errors in input data change the correlation between the upward ice flux and the lightning density. Consider adding more discussions or removing the sentence “Given the errors in input data the correlation over land is better than might be expected.”

p. 17832 L11-13: No evidence is presented to support this statement. To support the validity of this statement some evidence is required, for instance, comparisons of OLR between the ERA-Interim and any satellite observation.

p. 17833 L16-18: It is not clear whether there exists no significant trend (with which significance level?) for the global total flash rate or the flash rate at every grid point. Please clarify this point.

p. 17833 L25-27: There is a possibility that all parameterization methods cannot be applied to simulate the realistic flash density for this region, even if the meteorological data is not affected by any source of error. Please provide a clarification.

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Section 6: It would be useful to add discussions about the use of output from cloud-resolving models (CRMs) with regard to more explicit representations of cloud parameters.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 17817, 2014.

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