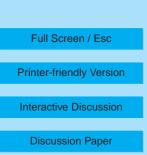**Atmospheric Chemistry and Physics Discussions**

Interactive comment on "Lightning and convection parameterisations – uncertainties inglobal modelling" *by* H. Tost et al.

Anonymous Referee #3

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This manuscript addresses uncertainties in the combination of convective and lightning parameterizations in a global model. Four lightning parameterizations are tested in association with 5 convective parameterizations, for a total of 20 combinations. The authors are correct in evaluating the combination of both types of parameterization. However, I would like to see more evaluation in the paper which separates the effects of errors in the convective versus the lightning parameterization. For example, if there is an incorrect placement of a lightning maximum in the model, is it due to a deficiency in the convective scheme or due to a problem with the lightning scheme? Within the results for one convective parameterization, the authors could look for biases in the predicted lightning which are common to all lightning schemes. These biases would like be due to problems with the convection. Simulated convection was analyzed in

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detail in the Tost et al. (2006) paper. More of the findings from this paper should be incorporated into the current manuscript in this regard.

The analysis contained in this paper will be useful information for global modelers. However, the improvements mentioned above, plus those changes listed below, should be implemented before the manuscript can be accepted for publication. These items will result in significant changes to the manuscript.

Specific Comments:

p. 6769, line 5: most likely ranging from 2 to 8 TgN/yr based on Schumann and Huntrieser (2007)

p. 6771, Section 2.2: How were the cloud top heights determined from the model?

p. 6772, line7: start new paragraph for the Grewe et al. (2001) parameterization.

p. 6772. line 18: start new paragraph for the Allen and Pickering (2002) parameterization.

Pages 6775-6778: In this discussion the authors need to indicate where an incorrect prediction of lightning may be due to incorrect location or seasonality of parameterized convection in the model. Some references to the results of Tost et al. (2006) could be used.

p. 6778, lines 7-8: Please make it clear that the correlations discussed here are spatial correlations, not correlations over time.

p. 6779, Section 4.2: Delete this section. Using monthly mean cloud top height and precipitation in the lightning parameterizations is meaningless. The parameterizations were not designed to be used in this manner. The use of the TRMM radar echo top is not the same as the cloud top. The cloud top can extend well above the top altitude of the precipitation-sized hydrometeors. Therefore, this results in a cloud top significantly different from those from the model.

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p. 6781, starting at line 14: The Allen and Pickering parameterizations (A_updr and A_prec) do much better with the annual cycle of lightning when using the GEOS DAS data. This is the meteorological data set from which these parameterizations were developed. At the end of the sentence in line16, add the following: "Ě.as implemented with the five convection schemes in ECHAM5/MESSy". At the end of the sentence in line 21, refer to Allen and Pickering (2002) who did get the correct annual cycle of lightning with this parameterization with the RAS convective scheme in the GEOS-DAS.

p. 6784, lines 5-6 and 12: Please include an explanation of why the emission is different for the different parameterizations even after the rescaling to the observed number of flashes.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 6767, 2007.

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