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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of convective transport and lightning NO_x production over North America: dependence on cumulus parameterizations" *by* C. Zhao et al.

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We thank the reviewer for a detailed review. Both text and figures will be revised as the reviewer suggested and a detailed response to all the comments will be provided later. Here we want to give some quick feedback to the main issues in the comments.

(1) We set the physical and dynamical configurations of MM5 and WRF to be as close as possible. In the model evaluation, the large differences between the two models are attributable to convective parameterization difference. We will clarify in the revision.

(2) We agree that the lightning NOx parameterization is not described clearly and we will revise that section.

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(3) We did not show the comparisons for C3H8 and HNO3 because the difference for them between the two models is within the variation of the measurements. We will include the comparison in the response, so they are available to readers who are interested in the results. Lightning HNO3 is not scavenged because it takes time to oxidize lightning NOx to HNO3. In our model (as in most models), we assume that the conversion to HNO3 takes place in the outflow of convection, away from the convective scavenging region.

(4) The IC/CG ratio is one parameter that determines the total amount of lightning NOx production. The reviewer is correct that IC/CG ratio is higher in MM5 than WRF and we will describe the ratios in the revision. Both the NOx production rate per flash and the ratio of the lightning NOx from IC and CG flashes are "tunable" parameters for the lightning NOx source in model simulations. What we try to show in this work is that the more critical factor in 3-D model simulations is the vertical distribution of lightning NOx. As we show in Figures 5 and 7, in situ observations during INTEX-A at 8-12 km do not provide critical constraints needed for the simulated lightning NOx profiles.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 2289, 2009.