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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling nitrous acid and its impact on ozone and hydroxyl radical during the Texas Air Quality Study 2006" *by* B. H. Czader et al.

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Thank you for reviewing the manuscript. Please find below our reply to your comments.

(1) Vertical mixing/transport is one of the most important processes controlling HONO mixing ratio in the boundary layer, as demonstrated by Wong et al. (2011) and by Figure 9 in this manuscript. I suggest that the authors examine the effect of this process in more details, e.g., on HONO mixing ratio and vertical gradient.

(Reply) Figure 9 already presents the contribution of vertical transport along with other processes on the HONO mixing ratio in the first model layer. Our results support the findings by Wong et al. (2011) that upward vertical transport is the most important

process removing HONO from the surface. Based on three analyzed days (as presented in Figure 9) vertical transport contributes 74 % to the removal of HONO during daytime, dry deposition contributes 11% and chemistry 15 %. Chemistry, in particular photolysis on surfaces, controls HONO production in the first model layer. The analysis at the elevated level, corresponding to the second model layer, shows that the upward vertical transport continue to be a major process controlling HONO at this level.

(2) In this model, almost all the HONO is produced on the ground (i.e., except gas-phase sources). Therefore, one should expect that HONO/NO2 ratio should decrease with altitude during the daytime, as a result of the HONO photolysis and the oxidation of freshly emitted NO to NO2 during the vertical transport. I am very interested in seeing some simulated daytime HONO/ NO2 profiles, versus the observed. I remember that the observed HONO/ NO2 ratio did not decrease but rather increased with height sometimes during the day.

(Reply) Please see supplementary graphs of observed and modeled HONO/NO2. In general measured as well as modeled HONO/NO2 decreases with height; however, indeed there are cases when the HONO/NO2 ratio increases with height. When looking at those cases the model predicts them correctly for morning hours for Sep. 5, 8 and 13, but does not capture them on Sep. 7, 16, and 17. There are several cases when the measured HONO/NO2 ratio increases with height for the afternoon hours (e.g. Sep. 2, 8, and 19), the model captures this trend correctly for low and middle DOAS levels but it predicts lower than measured ratio for upper level.

Specific comments: (1) Page 5862, 1st and 2nd paragraph: citations of Figures 7 and 8 appear before Figure 6. Figure numbering should follow the order of citation in the text. (2) Figure 6: need Y-axis labels. (3) Simulation or measurement heights need to be specified in the figure captions in Figures 2, 5, 6, 8 and 9.

(Reply) All specific comments have been addressed in the revised manuscript.

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Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/12/C2350/2012/acpd-12-C2350-2012-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 5851, 2012.

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Interactive Comment