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Interactive comment on "Impact of nitrous acid chemistry on air quality modeling results over the Pearl River Delta region" *by* R. Zhang et al.

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In this manuscript, the authors incorporated various HONO formation mechanisms into the CMAQ model for the Pearl River Delta in China. Significant improvement in HONO prediction compared to the observed was achieved. The addition of HONO formation mechanisms showed only relatively small effects on the predicted air quality in the region, i.e., O3 and PM2.5. While this manuscript is a good attempt to model atmospheric HONO behavior and its potential impact on urban air chemistry, I have several major concerns and comments as listed below.

1. When calculating relative contributions from different HONO sources (e.g., Section 3.4, Figures 6, 7 and 8), the term of HONO production rate (i.e., source strength) would be more appropriate than HONO concentration, and should be used. Although the nighttime HONO concentration is higher than that during the day, the HONO production

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rate is actually much higher during the day. The plots in Figures 6, 7 and 8 will look quite different, and conclusions may also be quite different, if the production rate term is used. For example, the surface photolysis mechanism would become much more important than heterogeneous mechanism and direct emission (figure 6). It is also suggested that HONO formation rate is used in Figure 7 so that the actual source strength from each mechanism can be easily seen as a function of time of the day.

2. The mean daytime HONO concentration of 4 ppb in this manuscript was probably the highest value reported in literature. The photolysis HONO, in the order of 15-20 ppb/hr, probably contributed a major fraction of new daytime HOx production. So it is quite surprising to see no significant effects on the modeling O3 and PM2.5 productions from the HONO formation mechanism additions.

3. It is not quite sufficient to validate the model through the comparison between the predicted and the observed using just daytime and nighttime averages in Figure 4. A time-series plot of the observed and the predicted (incorporating different mechanisms) would be more desirable. The detailed time profiles will help the authors and the readers to evaluate relative importance of different mechanisms as well as the overall performance of the model.

4. Even with all the mechanisms incorporated into the model, there are still large discrepancies (by a factor of 2-3, Figure 4) in the observed and the best predicted concentrations of HONO. While models may be “re-tuned” to get better agreement, it is important to make sure that the measured HONO values are correct and accurate, especially when such a high daytime mean HONO concentration (4 ppb) is reported.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 15075, 2011.