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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling of daytime HONO vertical gradients during SHARP 2009" *by* K. W. Wong et al.

Anonymous Referee #1

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Wong et al. used a 1-D chemistry and transport model to model vertical gradients of HONO during daytime, which have been previously measured by the same group (Wong et al., 2012). As major pathways of HONO formation during daytime are still under debate the comparison of modeled and measured vertical profiles of HONO provides unique information for understanding the relative importance of proposed sources. The authors identified light induced conversion of NO2 at the ground surface as a major source of HONO. Furthermore, they highlighted vertical transport as an important source aloft and as a main sink close to the surface. This has important consequences for considering HONO budgets and for the interpretation of vertical gradients. Wong et al. introduced an photolytic aerosol source to improve the fit of measured and modeled profiles. This aerosol source contributes roughly 10 % of HONO formation within the lowest 300 m. The combination of a unique set of field

measurements, with interpretation by a modeling approach is of great importance for the research on the OH radical precursor HONO. Therefore, I recommend publishing in ACP after addressing some minor comments.

P27779 L3 et seqq.: Kleffmann et al. (2003) did not measure daytime profiles. Sörgel et al. (2011) did observe gradients, but they were overcome by extensive vertical mixing (by coherent structures) around noon. Häseler et al. (2008) report negative gradients for the autumn campaign, but were not able to detect gradients in July (convective BL?). As the profiles reported by Zhang et al. (2009) were also influenced by atmospheric stability these studies (Häseler et al., 2009; Zhang et al., 2009) should be also included in the discussion on modeled vertical profiles.

P27782 L22: If heterogeneous reactions are considered, the reactive surface area available is important. How do the authors account for this? I found a statement in the conclusions (P27800 L7-L14) "...the true atmospheric surface area available for chemistry is likely one or two orders of magnitude larger than the geometric surface area used in the model, and thus the uptake coefficient is of the correct magnitude...". Maybe this important issue should be discussed prior to the conclusions.

P22789 L21: "...followed by it gas-phase..." => followed by the gas-phase...

P27792 L26: It should be clear that even with the rate constant given by Lee et al. (2008) the model underestimated the HONO values and that the cited studies (Carr et al. 2009; and Amedro et al., 2011) confirmed a rate constant about an order of magnitude lower, which was proposed by the original work of Crowley and Carl (1997). Please clarify.

P27796 L6: Fig.8 or Fig.9?

P27796 L17 and Fig. 9: I suggest that only the important processes should appear in Fig.9., as most terms in the figure legend, like Pground; P ground photolytic, P aerosol, E (Emission), L ground, L aerosol, do not appear in Fig.9 or are invisible as they fall

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12, C10728–C10731, 2012

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on one line at the bottom. Furthermore, d[HONO]//dt and LHONO+OH fall on one vertical line (close to zero). The figure might be improved by using thinner lines and a log profile for the height, or by only showing Lphotolysis, PNO+OH, Paerosol and the vertical transport term. Furthermore, it should be mentioned in the figure caption that the vertical transport term combines all surface processes.

P27817 (Fig.8): It would be useful to have the information about the model run "photolytic ground and aerosol source" also in the figure caption (not only in the text).

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