Review on “Contribution of HONO to the atmospheric oxidation capacity in an industrial zone in the Yangtze River Delta region of China” by Zheng et al.

General Comments:

The authors present a measurement-based study to report high wintertime HONO concentrations in Nanjing in the YRD area in China, and investigate the contribution of HONO to the atmospheric oxidation capacity in terms of its contribution to the OH formation using a box model. They attribute the high HONO level to the NO_2 heterogeneous reactions on surfaces (particles and ground). Although some results are surprising (for example, photolysis of HONO is the dominant daytime OH source in this area), the methods are overall sound, the paper is well structured and well written in general. The manuscript can be accepted for publication after addressing the following minor issues.

One of the major concerns is that the authors rely considerably on the correlation analysis to reach conclusions, but some of the correlation information may not be valid (a good correlation between two variables does not necessarily mean a cause-and-effect relationship between them). For example, the authors use “The observed similarity between HONO/NO_2 and HONO in diurnal profiles” to “strongly suggests that HONO in the study area was likely originated from NO_2 heterogeneous reactions”. The similarity between HONO/NO_2 and HONO merely suggests that NO_2 does not importantly affect the HONO diurnal variation or NO_2 concentrations are relatively time-invariant (which is indeed the case as shown in Fig. 3). This similarity does not provide any connections between the HONO formation and the NO_2 heterogeneous reaction. Another questionable example is that the authors use “concurred elevated HONO and PM2.5 levels” to “strongly suggest that high HONO may increase the atmospheric oxidation capacity.” Although there is no doubt that high HONO would enhance the atmospheric oxidation capacity and therefore SOA formation, but one could also argue that elevated PM2.5 levels lead to elevated HONO due to the heterogeneous reactions and elevated PM2.5 levels could be due to emissions. Therefore, the only information of concurrence of elevated HONO and PM2.5 levels may not necessarily suggest enhanced oxidation capacity.

Specific comments:

(1) In Eqn 9, the authors appear to attribute the term of $P_{unknown}$ to the heterogeneous NOx reactions (including photosensitized and non-photosensitized). In fact, this term should also include HONO emissions and transport (advection). This may partially explain the moderate correlation coefficients (~0.5) between this term and $(NO_2).NO_2.RH$ or $J(NO_2).\ NO_2.\ S/V.\ RH$. Although the authors claim that HONO emissions are negligible, the OH production results from two industrial plumes in Fig 6 could also suggest the importance of HONO emissions (besides NO and VOC emissions) to HONO and OH.
(2) In the box model, how is the time variation of the PBL height considered? How it is represented may affect the agreements between observed and simulated HONO concentrations in Fig 10. The authors may also discuss how other limitations or assumptions in the box model affect the simulation results.

Technical corrections:

(1) When several numbers in the same units stand site by site, it is better to just use unit once (e.g., L240, 266, 297-298, 515-517).

(2) In eqn 9, should $\frac{\partial[HONO]}{\partial t}$ be $\frac{d[HONO]}{dt}$?

(3) Fig 9, $P_{photolysis}$ should be $L_{photolysis}$.