

Interactive comment on “Significant contribution of HONO to secondary pollutants during a severe winter pollution event in southern China” by Xiao Fu et al.

Anonymous Referee #1

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General comments The authors applied the CMAQ model to simulate HONO over PRD region in China for a winter episode. The standard CMAQ model underestimates observed HONO data. They incorporated several additional HONO pathways in the model which substantially increased HONO production. HONO produces OH via photolysis; thus, it increases OH, HO₂, and enhances secondary pollutants. Model performance improves with additional HONO sources. The article is well written and merits publication. Several issues need to be addressed before publication.

Specific comments

Line 49-51 The sentence appears to indicate that NO_x, SO₂, and VOC is oxidized by

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OH, O₃, and H₂O₂. The sentence needs revision since VOC or NO_x is not oxidized by H₂O₂.

Line 107-132 and results The spin-up period was only 3 days. If the model simulation is performed for a longer time, then deposited HNO₃/nitrate amount will increase with time which in turn will enhance HONO production from the photolysis of deposited material. For a long-term simulation, HONO over-estimation is likely to be worse than those shown in the article. Some discussions are needed.

Line 124-128 The simulations were done for 2017. However, 2010 and 2103 emissions were used for PRD and other region of China. Were any adjustments made to account for simulation for 2017? Some discussions are needed.

Line 129-132 Zhang et al. (2016) is not the proper reference for HONO/NO_x emissions ratios. Need to cite the proper reference.

Line 202-212 Need measurement accuracy for HONO, HNO₃, sulfate, nitrate, ammonium, and PM_{2.5}.

Line 247-249 Overestimation of nighttime HONO may not be related to uncertainties of emission inventory and meteorological simulation. Emissions inventory appears to be reasonable since Figure S1 suggests that model NO₂ is similar to observed data. Meteorological performance shown in Table S1 is reasonable. Thus, meteorology is not the problem either.

Line 308-309 Do the authors mean that fast conversion occurs between OH and HO₂?

Line 306-382 The HONO chemistry increased daytime average HO₂ by 336% which means it also likely increased H₂O₂ substantially. Some discussion is needed.

Figure 8 Difficult to read the figure. A better plot is needed.