Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-471-RC2, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The changing role of organic nitrates in the removal and transport of NO_x" *by* P. S. Romer Present et al.

Anonymous Referee #2

Received and published: 11 June 2019

This paper evaluated the relative importance of two NOx removal pathways, forming HNO3 and RONO2. The fraction of NOx loss via RONO2 chemistry was approximated the contribution of VOC to the total OH reactivity with additional consideration of RONO2 yield. The comparison of such simple calculation and 13 field campaigns results show consistent trend, which give confidence to conduct long-term prediction. The impact on the ozone production is discussed based on the growing importance of RONO2 chemistry to NOx loss. Finally, the spatial distribution of NOx lifetime is evaluated using WRF-Chem model for the 2013 summer United States. This paper presents an interesting result on the fate of NOx using a simplified but insightful approach. The paper is well written and the method to evaluate the fate the NOx is helpful to diagnose the non-linearity of the atmospheric chemistry. I recommend publication after

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Discussion paper

the following comments are addressed. Comments: (1) The uncertainty in the radical budget calculation. In the appendix, the production of OH, HO2 and RO2 are not complete. The HONO photolysis, alkene ozonolysis are missing. How much does the result rely on this budget analysis? Some results showed that HONO photolysis, as an OH source, is more important than ozone photolysis in polluted environments (Mao et al., 2010;Tan et al., 2019). Ozonolysis of alkenes, isoprene, and monoterpenes could be important radical source in forest areas (Griffith et al., 2013). A discussion on this missing radical source and its impact would be helpful. Also, I assume these radical concentrations are used to calculate the P(HNO3) and P(RONO2) separately for each 13 campaigns but it's not clear in the context. The authors should make this point clearer. (2) The detail description of alpha. The organic nitrate yield is determined for different VOCs and explained in the appendix. However, I would suggest adding a table to describe the range of organic nitrate yield. As I found in Figure 2, the least-squares fit is y=(1+125xˆ1.06)ˆ{-1} and 125 should be equal to 1/(alpha*fNO*YRO2), the alpha would be 0.008 if fNO and YRO2 are unity. In this case, a comparison with least-squares fit to Eq. 4 and discussion on the parameters would be helpful to the reader to understand what the meaning of such fit function is. (3) Some argumentation are too general or without explanation. Page 4 Line 23, please define low-NOx Page 9 Line 1-2, according to Fig. 3, this statement relies on an assumption that many regions are located in the transition regime (e.g. NO2R/VOCR ranges from 2e-2 to 1e-3). The authors should provide relevant information to support this argument. Page 9 Line12, please define comprehensive metric. Technical corrections: Page 5 Line 1, 'NO2R' 2 should be subscripted. Page 5 Line 2, please provide the reaction rate constant for OH+NO2 reaction and the literature. Page 9 Line 10, 'P(O3)' 3 should be subscripted. Page 13 Line 14, (A3) 2jHCHO*[HCHO] Page 13 Line 19, (A8) L(OH) should be (VOCR+NO2R)*[OH]

References: Griffith, S. M., Hansen, R. F., Dusanter, S., Stevens, P. S., Alaghmand, M., Bertman, S. B., Carroll, M. A., Erickson, M., Galloway, M., Grossberg, N., Hottle, J., Hou, J., Jobson, B. T., Kammrath, A., Keutsch, F. N., Lefer, B. L., Mielke,

L. H., O'Brien, A., Shepson, P. B., Thurlow, M., Wallace, W., Zhang, N., and Zhou, X. L.: OH and HO2 radical chemistry during PROPHET 2008 and CABINEX 2009-Part 1: Measurements and model comparison, Atmos. Chem. Phys., 13, 5403-5423, https://doi.org/10.5194/acp-13-5403-2013, 2013. Mao, J., Ren, X., Chen, S., Brune, W. H., Chen, Z., Martinez, M., Harder, H., Lefer, B., Rappenglueck, B., Flynn, J., and Leuchner, M.: Atmospheric oxidation capacity in the summer of Houston 2006: Comparison with summer measurements in other metropolitan studies, Atmos. Environ., 44, 4107-4115, 10.1016/j.atmosenv.2009.01.013, 2010. Tan, Z., Lu, K., Jiang, M., Su, R., Wang, H., Lou, S., Fu, Q., Zhai, C., Tan, Q., Yue, D., Chen, D., Wang, Z., Xie, S., Zeng, L., and Zhang, Y.: Daytime atmospheric oxidation capacity in four Chinese megacities during the photochemically polluted season: a case study based on box model simulation, Atmos. Chem. Phys., 19, 3493-3513, 10.5194/acp-19-3493-2019, 2019.

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