Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-354-RC1, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ozone formation under low solar radiation in eastern China" *by* Xuexi Tie et al.

Anonymous Referee #1

Received and published: 6 June 2019

This study could be a very meaningful work. The paper addressed the relevant scientific questions within the scope of ACP. This manuscript studied the possible reasons enhancing the ozone formation under high PM2.5 concentrations. It is not a very novel concept since some previous studies already reported the positive correlation between PM2.5 and ozone, and analyzed the underestimated HONO sources in China and other areas in the world. However, better understanding the mechanisms in different locations is scientifically significant in modeling studies. In addition, as the authors mentioned, the results bring important insights for control strategy of air pollution, because both PM2.5 and ozone are significant air pollutants in China.

There sever major concerns as follows:

(1) Both cloud and aerosol can affect the solar radiation. In order to separate these

Printer-friendly version

Discussion paper

two factors, especially for case studies, people usually will analyze the meteorological conditions during the measurement period, or only analyze the data under the cloud-free conditions. However, the authors of this manuscript never mentioned the cloud factor.

(2) Several important previous studies should be mentioned so that some conclusions from this manuscript can be more solid. For example (but not limited to), Zhang et al. (2016) already parameterized up-to-date HONO sources into WRF-Chem model such as the heterogeneous reactions on ground and aerosol surfaces, direct vehicle and vessel emissions, conversion of NO2 at the ocean surface, and emissions from soil bacteria. The modified WRF-Chem substantially reproduced the observed HONO levels, and greatly improved the ozone simulations. However, in this manuscript, the calculated HONO level was still very low in Fig. 6. More information about the WRF-Chem setup is needed. In addition, some other studies (e.g., Shi et al., 2015) already reported the positive correlation between aerosol and ozone. The ozone formation is also strongly dependent on the aerosol size and composition. The process might be a complex interaction between aerosols and photochemical reactions. For example, the scattering aerosol could considerably diffuse the solar radiation and enhance the flux density inside the boundary layer (He and Carmichael, 1999). Thus, the scattering aerosols may favor the ozone formation through increasing solar flux in the boundary layer (Shi et al., 2015). More discussions are needed in the manuscript.

Zhang, L., Wang, T., Zhang, Q., Zheng, J., Xu, Z., & Lv, M. (2016). Potential sources of nitrous acid (HONO) and their impacts on ozone: A WRFâĂŘChem study in a polluted subtropical region. Journal of Geophysical Research: Atmospheres, 121(7), 3645-3662.

Shi, C., Wang, S., Liu, R., Zhou, R., Li, D., Wang, W., ... & Zhou, B. (2015). A study of aerosol optical properties during ozone pollution episodes in 2013 over Shanghai, China. Atmospheric Research, 153, 235-249.

He, S., & Carmichael, G. R. (1999). Sensitivity of photolysis rates and ozone production in the troposphere to aerosol properties. Journal of Geophysical Research: Atmospheres, 104(D21), 26307-26324.

Generally, this manuscript presents a significant study; however, the analysis should be in more depth. The authors should give proper credit to related work, and clearly indicate this manuscript's original contribution. I would not recommend using a vague word (such as "low solar radiation") in the title.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-354, 2019.

Printer-friendly version

Discussion paper