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Interactive comment on "Improvement from the satellite-derived NO$_x$ emissions on air quality modeling and its effect on ozone and secondary inorganic aerosol formation in Yangtze River Delta, China" *by* Yang Yang et al.

Anonymous Referee #1

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The authors developed a "top-down" methodology based on the inversed chemistry-transport modeling and satellite data to estimate the NOx emissions for four seasons in YRD region in 2016. The results show that the improved NO2, O3, and SNA simulation results can be achieved with top-down estimates comparing to current bottom-up estimates. Further sensitivity study of O3 formation indicates the effectiveness of controlling VOCs emissions on O3 pollution abatement for PRD region and reducing NH3 emissions was crucial to alleviate SNA pollution of YRD in winter. The manuscript was generally well written, the research presented is innovative and the results can

guide the policymaking. I recommend this paper to be published in ACP after some comments have been addressed. My general comments: 1. Please revised the introduction part thoroughly to improve the narrative logic, the current version is a little hard to follow and some statements need to be summarized. 2. Line 259-265: The description of Table S3 does not agree with Table S3 shown in the Supplement file. And please clarify the meaning of "-" in Table S3, preferably with a footnote. 3. Line 386-389: Why did the authors only perform an extra simulation of exploring the influence of BVOCs emissions with top-down estimate instead of with both top-down and bottom-up estimates to prove that a better O3 simulation can be achieved based on top-down NOx estimates? Please clarify it. 4. Line 409-413: Please add references after these two statements. 5. Line 423-426: Please explain more to support the inference and can authors replot figure S2? The current one is blurring. 6. Line 427: I think changing SIA to SNA would be better to keep the consistency of the full text. 7. Line 451-453: Sha et al. (2019) reported that SO2 heterogeneous oxidation can largely improve the sulfate simulation results in Nanjing. Authors may incorporate the related mechanisms to perform the simulation, if possible, or at least mention this potential reason when discussing the factors influencing the accuracy of SNA simulation. References: Sha T, Ma X, Jia H, Tian R, Chang Y, Cao F, Zhang Y. Aerosol chemical component: Simulations with WRF-Chem and comparison with observations in Nanjing. Atmospheric Environment. 2019 Dec 1;218:116982.