

Response to reviews

Reviewer comments are in **bold**. Author responses are in plain text labeled with [R]. Line numbers in the responses correspond to those in the revised manuscript (the version with all changes accepted). Modifications to the manuscript are in *italics*.

Reviewer #2

The work improves SOA simulations by both of process-based and observation-constrained schemes. The authors clarify all updates in revised model simulations and highlight an important model modification, namely the addition of nitrous acid sources. The model shows a good correlation with the observations in different regions and seasons, giving confidence that there is value in the technique. The paper not only presents a reasonable way of improving SOA simulations, but also uses it to interpret air quality sources and phenomena in China. The authors then go on to make source analysis and provide insights into haze mitigation. The paper is good that it offers further evidence that the importance of controlling residential emissions in winter in polluted areas in China. Overall, the quality of English is good. As such, I think this MS can be accepted.

[R0] We thank the reviewer for the valuable feedback. To further improve the paper, we have clarified the scientific points including the budget and sources of OA in China as well the sensitivity of SOA formation to OH levels and downweighted the technical sound by various changes in the Abstract, Introduction, Section 3, and Conclusions in the revised version.