

I suggest that ACP publish this paper with three minor modifications/clarifications.

- (1) Missing heterogenous chemistry of SO₂ is listed as the main reason for model underestimate of sulfate. But the model result of adding SO₂ heterogenous chemistry is only briefly mentioned and the figure is in the supplementary section S17. I suggest incorporating it in the main part.
- (2) In the abstract, the shallow nighttime PBL height, or rapid collapse of mixing layer, is listed as one of main reasons for model bias in nighttime chemistry. But based on Figure 9, the run with rising PBL (to the observation level) shows no improvement in model performance, i.e. the red line and blue line are almost the same for most species. Please clarify.
- (3) Figure 6, where is 5x dry deposition run results in (b), (c), and (d)? No impact on other species? NO₂ deposition is under-estimated? Increasing or decreasing dry deposition look more like tuning model toward observations.

One more suggestion: the “No local emissions” run can be a very useful model simulation to quantify the relative contribution from the local emissions vs long range transport. It is not showed in most analyses (figures), right?

The line number in the draft is only partially labelled and mismatched to the number mentioned in the response to reviewer. We have to use search function to locate the content mentioned in ‘ResponsetoReviewers’.