

## Scientific comments

I. 15: What do you mean by 'absence of precursors'? Do you mean 'the fact that precursors of intermediate-volatility and semi-volatile organic compounds (I/SVOCs) are not included in models...'?

I. 74: Please rewrite this sentence. 'Large gaps' should be clarified. I guess you refer to the underprediction of SOA concentrations by models.

I. 79: Are indeed the volatility bins shifted? To my understanding, in the VBS, the volatility bins are fixed but compounds are sorted into the different bins depending on their volatility. Please clarify.

I. 80ff: "Previous studies have successively configured the VBS scheme from one dimensional (1-D) to 1.5-/2-dimensions (1.5-/2-D), which can better describe the evolution of OA in the 2-D space of oxidation and volatility in the model, and coupled the simplified emission inventory of SOA precursors estimated from POA to improve the model performance on SOA simulation."

The sentence is overall too long and confusing. Please split it into two.

1) What is the parameter of the second dimension in the 2-dimensional VBS? The first parameter is volatility, but 'Oxidation' is a process; how can this be accounted for in the scheme. Do you mean 'oxidation state'?

2) The second part of the sentence ('...and coupled...') is not clear either. What is a simplified emission inventory? Why was it simplified and compared to what? Are you implying that POA are SOA precursors?

I. 89: Do you mean 'limitation' rather than 'constraint'?

I. 133/4: What is a 'full volatility organic emission inventory'? It might be clearer to reword it as 'emission inventory that takes into account ....'

I. 136: Can you quantify 'gaps'? Underprediction by 'x' percent?

I. 252: Doesn't the sentence 'It is worth noting...' contradict the preceding one? In the sentence starting in line 249, you mention 'multi-generation oxidation' whereas in the second sentence you state only one generation was considered. Please clarify.

I. 259: '...and input as semivolatile accordingly' – is not clear. Do you mean 'considered as semivolatile species accordingly'?

I. 271: The semivolatile emissions that were particle phase'.... – could you simply say 'Emissions of semivolatile POA..' – if not, please clarify.

I. 450ff: "The modeled IVOCs was higher in summer while lower in winter, not to mention the diurnal patterns and spatial distributions also remained unknown. This may be due to the difference in monthly profiles of I/SVOC emissions, which has not been considered in this study."

1) As also mentioned by the last reviewer, some more discussion would be useful here. Even though you do not have the exact monthly emission profiles, can you be a bit more explicit on they qualitatively may vary with season or month and how this could play out for the IVOC profiles?

The explanation that the chemical mechanism might be responsible for not being able to reproducing the trends is not convincing.

2) “not to mention the diurnal patterns and spatial distributions also remained unknown” is not clear. Please reword.

I. 495: What do you mean by ‘better meteorological conditions’?

I. 522 -524: “Note that uncertainty exist when directly compare the modeled OA factors with those resolved by AMS-PMF analysis since a clear split of POA and SOA from a measurement point of view can hardly be achieved.”

Please clarify this sentence. What do you mean by ‘modeled OA factors’? POA and SOA or the various SVOC, I/SVOC etc categories? I understand that the PMF of AMS results gives different factors – but can’t some of them be ascribed to POA and SOA?

I. 554: “For example, an increasing body of experimental and observational evidence suggest that heterogeneous and multiphase reactions also played important roles in SOA formation especially during pollution episodes” reads as if you imply that heterogeneous and multiphase reactions are ‘other factors’, i.e. different from the photochemical oxidation in the summer. However, also heterogeneous and multiphase reactions in the summer can be oxidation reactions, initiated by photochemistry. Please clarify.

I. 562: What do you mean by ‘condensable organic aerosols’?

#### **Technical comments**

I. 102: replace ‘a same’ by ‘the same’

I. 219: The link to MOZART does not work. Please update.

I. 254: replace ‘were treated’ by ‘was treated’

I. 257: ‘that quantified with the metric’ can be simply replaced by ‘with’

I. 467: replace ‘was’ by ‘were’

I. 549: ‘the model is still hard to capture the diurnal patterns’ is not correct English. Replace by ‘The model cannot fully capture the diurnal patterns...’ or something similar.