We thank the editors and reviewers for the effort to review the manuscript and to provide good comments and suggestions to improve our manuscript. Our replies to the comments and our actions taken to revise the paper (in blue) are given below (the original comments are copied here).

The modifications are marked in red color and highlighted.

Comments:

The authors have comprehensively and convincingly replied to all reviewer comments and provided a much improved revised manuscript. There are only 2 minor revisions required. These relate to clarifications of the two revisions inserted at lines 278-281 and 285-287 respectively. I cannot quite understand either sentence.

Does the first sentence mean: "A single oxidation step would be unable to sufficiently reduce carbon number for the oxidation products of POA and IVOC to be one order of magnitude higher in volatility"? (noting that a reduction in carbon number increases the volatility)

and the sentence second mean: "To account for the insufficient reduction in carbon number of the IVOC product, reduction in SOA mass yields from IVOC are assumed..."?

Reply: Yes, a reduction in carbon number increases the volatility when other factors are not taken into account. The sentence in our manuscript caused misunderstanding. In the 2-D VBS space, the reaction trajectory of POA aging initially follows the carbon-number isopleths (oxygenation) but then transitions to fragmentation of more highly-oxygenated products (Donahue et al., 2012). In the 1.5-D VBS, reduction in carbon number indicates that fragmentation is implicitly accounted for. Considering that a single oxidation step would be unable to sufficiently transfer OA from HOA basis to OOA basis, the concept of “partial conversion” is used in 1.5-D VBS; that is, the oxidation products are a mixture of POA and oxidized POA (OPOA) in the adjacent lower volatility bins (Koo et al., 2014). In the oxidation process, although the averaged carbon number of the organic mixture can be reduced by fragmentation, the oxygen is added and the volatility of major oxidation products is decreased.

To make the meaning more clear, the sentence in line 278-281 is changed to

"Considering a single oxidation step would not be able to move the oxidation products of POA into the oxidized OA basis in the volatility bin that is one magnitude lower" (seen in line 278-280).

The sentence "To consider insufficient carbon number reduction of IVOC product, a lower SOA mass yields from IVOC are assumed" is changed to "To account for the insufficient reduction in carbon number and volatility decrease of the IVOC product, the SOA mass yields from IVOC are assumed to be lower than that of POA" (seen in line 285-287).