

Comments by Referees are in blue. Our replies are in black. Changes to the manuscript are highlighted in red both in here and in the revised manuscript.

Reply to Ref #4

The authors summarized heterogeneous reactions of mineral aerosols and emphasized its implications for oxidation capacity in the troposphere on the basis of substantial publications. Generally, this is an interesting topic although a lot of review articles in this field have been published, followed by the first work reported by Usher et al. (2003). Especially, the authors tried to compare heterogeneous uptake lifetime of oxidative species (O₃, H₂O₂, HONO, HCHO, and N₂O₅) to ones by other loss pathways in the atmosphere, which is the valuable information to the researchers. Finally, the authors supposed mineralogy of dusts, RH, temperature could play the important roles in the heterogeneous process, and recommended that simulated experiments should be performed under more actual conditions.

Reply: We would like to thank ref #4 very much for recommending our manuscript for publication. His/her comments, which largely helped us improve our manuscript, have been properly addressed in our revised manuscript, as detailed below.

Specifically, the manuscript suffered from some small flaws: (1) As a review-type article, it's better if the authors supply time span of the literatures, since many review paper have been published in this field.

Reply: That is a good point. In the revised manuscript (line 235-236) we have clarified the literature covered in this review paper: "Following this in Section 3, we review previous laboratory studies of heterogeneous reactions of mineral dust particles with these eight reactive trace gases, and we have tried our best to cover all the journal articles (limited to those in English) published in this field."

(2) In the fraction of "1.1 Mineral dust in the atmosphere", I found it is little relationship to oxidation capitation in the troposphere.

Reply: The topic of our manuscript is heterogeneous reactions of mineral dust and its implications for tropospheric oxidation capacity; therefore, it is necessary to give an introduction to tropospheric mineral dust aerosol and its environmental and climatic impacts. Nevertheless, we can understand that ref #4 found it not very relevant to tropospheric oxidation capacity, and this is largely because in the original manuscript the impact of mineral dust on

tropospheric oxidation capacity was not emphasized. In the revised manuscript (line 98-101) we have highlighted it by referring to the pioneering work by Dentener et al. (1996): “According to this study, heterogeneous reactions with mineral dust could largely impact tropospheric photochemical oxidation cycles, resulting in up to 10% decreases in O₃ concentrations in dust source regions and nearby.”

(3) The authors should list a total table to compare the loss lifetime of the key species by the heterogeneous process and gas-phase process.

Reply: We agree with ref #4 that it could be very informative to provide a table which summarizes lifetimes of key species with respect to gas phase and heterogeneous reactions. Such information has been provided in relevant sections/subsections in our manuscript. However, lifetimes of these species due to gas phase and heterogeneous loss processes are highly spatially and temporally variable, depends on the concentrations of other species they react with; therefore, it is very difficult to use a table to summarize such information in a comprehensive way. If such as a table is not comprehensive, it may cause overs-simplification and thus can be misleading. As a result, we prefer not to provide such a table at this moment, though we entirely agree that such a table, if presented in a comprehensive manner, would be very useful.

(4) Although the paper was well organized and written, I still found some English errors, such as: Line 41 “in the atmospheres”, line 80 “and etc”, line 222 “. . .in reporting and interpreting kinetic data”, line 247 “. . .the first major primary source”, line 1742 “the roles these heterogeneous reactions play in. . .”.

Reply: We thank ref #4 for carefully reading our manuscript. All the typos have been corrected in our revised manuscript.