

RC2: 'Comment on egusphere-2023-184', Anonymous Referee #2, 28 Apr 2023

We thank you for your useful comments that helped us improving the paper. Our response is organised as follows. After each of your comments in quoted italics you will find the authors' s response to each comment in bold text colored on blue. Where more substantial changes were made to the manuscript, we have quoted these in bold red below. We also have made some small corrections to spelling and wording as your suggestion in the final publication of our paper and we hope that our response to these comment helps reader.

“Page 2, last sentence of abstract : I don't know all the results of previous volcanic halogen modeling but the statement that the results are consistent with all previous ones seems a bit strange.”

This statement is unclear and has been replaced by :

“All the results of this modelling study, in particular the rapid formation of BrO, which leads to a significant loss of tropospheric ozone, are consistent with previous studies carried out on the modelling of volcanic halogens.”

“Page 2, line 31: "in the form of SO₂" (there are different sulfur species but no different SO₂ species)”

Done

“Page 2, line 35: “magmatic gases” instead of “magmatic air” pp”

Done

“Page 11, line 255: Which other cycles are meant here ?”

We agree that this sentence is not clear enough. We have added some clarification that ozone destruction in the R12 and R13 cycles is mediated by the BrO + BrO self-reaction. The other destruction reactions involve the BrO + BrO, BrO + ClO, and BrO + O₃P reactions. The ozone reforming reactions include pre-cursor reforming (BrO + OH, BrO + NO, BrO + CH₃O₂) and direct ozone reforming (BrO + hv). We propose the following changes to the text:

“The ozone destruction in the R12 and R13 chemical cycles is mediated by the BrO + BrO self-reaction that leads to the formation of Br₂ and molecular oxygen. Other variations of these ozone destroying cycles are mediated by BrO + ClO and BrO + O₃P. Conversely, other reactions of BrO can lead to ozone reformation (BrO + hv) and the formation of ozone precursors (BrO + OH, BrO + NO, BrO + CH₃O₂).”

“Page 11, line 268: “...and are thus individually represented as diagnostic species” ??”

This sentence is not clear and has been replaced by:

“One of the limitations of the work done with the 1D vertical profile version of MOCAGE and presented in Marécal et al. (2023) was that OH was a diagnostic species. In the standard version of MOCAGE used by Marécal et al. (2023), a chemical family approach is used meaning that HO_x (H+OH+HO₂) is the variable explicitly represented and the OH concentration is then diagnosed from HO_x assuming a photochemical equilibrium.”

“Page 13, line 335: Certainly not important and just a detail: In an earlier part of the manuscript the height of Mt Etna is given as 3330 m – 50 m above would mean 3380m.”

Done

“Page 20, line 439: I would not use abbreviations in the main text => molecules cm⁻² s⁻¹”

Done

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