

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-535

Anonymous Referee #2

Referee comment on "The Michelson Interferometer for Passive Atmospheric Sounding global climatology of BrONO₂ 2002–2012: a test for stratospheric bromine chemistry" by Michael Höpfner et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-535-RC1>, 2021

Review of "The MIPAS global climatology of BrONO₂ 2002–2012: a test for stratospheric bromine chemistry"

by Hoepfner and colleagues.

This is a very nice paper describing a well-executed study capitalizing on a valuable new dataset. I am very happy to recommend this manuscript for publication in ACP, and have a few minor suggestions for improvements detailed below.

My only broad comment relates to the discussion of uncertainty in the MIPAS BrONO₂ observations as it relates to model discrepancies. This is just a suggestion, but presumably the approach used to quantify uncertainty in MIPAS BrONO₂ measurements has been similarly applied to other MIPAS products, for which a larger set of validation/correlative observations exist. For example, if the MIPAS ozone, N₂O, CH₄, etc. observations are shown to agree with other observations to a degree consistent with the estimated uncertainty in the MIPAS products, does that not speak to the robustness of the uncertainty budget approach? I recognize that, to coin the authors' phrasing, such an argument does not constitute an "unambiguous" assessment, but it could be an additional point to bolster the authors' arguments that the discrepancies are unlikely to be dominated by measurement uncertainties.

Specific comments. Most of these are simply wording suggestions.

Line 5: "... into sunlight *observations* and observations in the dark..."

Line 15: insert "upper stratospheric" before "BrONO₂"?

Line 18: "...the lower stratosphere, a simulated production of BrONO₂ that is too low during day as well as strongly..."

Line 19: "additionally" -> "in addition"

Line 24: wonder if "smallest" might be better than "lowest" here.

Line 34 and others: The reactions have the molecules in italics, but Equation 1 (page 24) has them in upright font. It would be nice to be consistent (probably more of an issue for the copy editor/typesetter). Similarly, would be good to be consistent on whether the y in Br_y is in italics or not.

Line 36: Not being a kineticist, I was unclear whether some of the numbers quoted on this page for reaction rate uncertainties should have units. From the discussion later in the paper, it is clear that these numbers are indeed "factors". Might it be good to say something like "(i.e. 20% uncertainty)" or something like that for this first one, to make that clearer. Again, feel free to ignore this if what you have is the widely accepted practice.

Line 49: I think "Finally" might be better than "At last"

Line 64: "contributing" -> "contribute"

Line 66: comma needed after "changes" I think.

Line 68: Put commas before and after "in consequence"

Line 81: "years" -> "year"

Line 95: "retrieval" -> "retrievals". Also, "has" -> "have"

Line 99: "shortly" -> "briefly"

Line 103: comma needed after averaging.

Figure 1 caption: I suggest "...from four 3-day periods, two during P1 (top) and two during P2 (bottom), for both dark (left) and sunlit (right) conditions"

Line 182: "following" -> "subsequent years". Also, "until" -> "through"

Line 183-184: I suggest: "The coverage at lower altitudes is determined by the lower limit of 15 km, chosen to confine the retrievals to the stratosphere, and by the presence of high-altitude clouds and the scan pattern of MIPAS (which is mainly a factor in the tropics)." Or something like that (move the parenthetical point at the end earlier if it only applies to the clouds).

Line 189: Insert "a" between "as" and "supply"

Line 190: "at PSC particles" -> "on PSC surfaces"? (unless the reactions take place inside the PSC particles, in which case "in PSCs" might be simpler)

Line 237: insert "of BrONO₂" before "might". Also "... might be the emission scenario used for organic bromine species, taken from Warwick..."

Line 242: "at" -> "on"? (see above though)

Line 266/267: move "quite well" to the end of the sentence.

Line 273: Perhaps change "those altitudes" to "the 30 km region" to be that bit clearer. Also, comma needed after "errors"

Line 274: Comma needed after "negative"

Line 278/279: Suggest you move "still" from the start of the sentence to before "appeared"

Line 280: Suggest comma after "simulations"

Line 285: Suggest: "The test the sensitivity of modeled BrONO₂ to the production..."

Line 286: "which" -> "that"

Line 304: "extend" -> "extent"

Line 368: "are" -> "is"

Line 373/374: Suggest "a too efficient" -> "an overly efficient".

Line 374: Also, comma needed after "model"

Line 399: Suggest "In case" be changed to "If it is the case that". Also "they" -> "these inconsistencies".

Line 481: Funny spacing in NO_y

Line 561: Funny spacing in Br_y

(Note, I didn't do a comprehensive check of the references, it's just that those two caught my eye).