Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
https://doi.org/10.5194/acp-2021-202-RC1, 2021

Comment on acp-2021-202

Anonymous Referee #1

Referee comment on "Organic and inorganic bromine measurements around the extratropical tropopause and lowermost stratosphere: insights into the transport pathways and total bromine" by Meike K. Rotermund et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-202-RC1, 2021

In this paper, airborne measurements of upper tropospheric and lower stratospheric total bromine performed over North Atlantic, Norwegian Sea and north-western Europe regions in fall 2017 are reported. Total bromine is estimated from measured total organic bromine added to inorganic bromine derived from measured BrO and photochemical modelling. Combined with transport tracers observations, these bromine measurements suggest that total bromine enriched air masses persistently protruded into the lower stratosphere created a high total bromine region (HBrR) over the North Atlantic in fall 2017. Simulations using the CLaMS Lagrangian transport model show that the main sources of this high bromine region are former tropical upper tropospheric air transported by the Asian monsoon and hurricanes from Central America, and to a lesser extent transport across the extratropical tropopause. The impact of this total bromine content on lower stratospheric ozone is also evaluated based on simulations from the TOMCAT global 3-D model.

This paper is well written and clearly structured and presents very interesting results on the atmospheric bromine topic which fit well with the scope of ACP. I recommend the final publication of the manuscript after addressing the following specific comments:

Page 5, lines 146-147: Why only the limb viewing mode of the mini-DOAS instrument is used in this study? The nadir mode could also provide valuable information about the BrO column density above the varying altitude of the aircraft.

Page 6, lines 179-181: How is initialised the McArtim RT model for the calculation of NO2 and O3-vis reference SCDs? In a similar way as for the radiative transfer simulations of the limb measurement (see lines 186-190)? This information should be added.

Page 7, lines 201-202: Does the scaling method fully compensate for any cloud effect? Did you make any selection of the mini-DOAS limb measurements regarding the cloud conditions by removing the more problematic cloudy scenes in terms of RT modelling?

Page 9, lines 269-270: You should provide the list of Aura-MLS and ACE-FTS trace gases/tracers which are used to initialize the CLaMS simulations or at least a reference

where this list can be found.

Pages 13-14, lines 400-427: the discussion is a bit difficult to follow here. Maybe the different bromine contributions (CH3Br, halons, VSLS, inorganic) corresponding to the selected typical delta_theta values (+/-5K, 78-88K) could be included in a table?

Section 4.3.1, Pages 17-19: the fractions of air values for various domains of the atmosphere are presented and discussed. Would it be possible to give an estimate of the uncertainties corresponding to these values? For instance, in the investigated high bromine region, the fraction of air from the tropical troposphere is 51.2% while the corresponding value in the lower stratosphere below and above the HBrR is 42.6%. How significant is this difference?

Page 24, line 770: Could simulations using the CLaMS model give indication about the seasonality of the bromine content in the high bromine region investigated in this study?

Technical corrections:

Page 6, line 176: ‘asent’ -> ‘ascent’

Page 10, line 292: ‘distince’ -> ‘distinct’