

**Review of ‘Seasonal impact of biogenic VSL bromine on the evolution of mid-latitude lowermost stratospheric ozone during the 21st century’ by Javier A. Barrera et al.**

The manuscript presents a modelling study of the impact of very short-lived halogenated compounds (VSL<sup>Br</sup>) on stratospheric ozone under current and future conditions. In particular, seasonal changes of the impact VSL<sup>Br</sup> on midlatitude ozone and their link to heterogeneous chlorine reactivation are discussed. While many findings of this study are known from existing publications, the seasonality of the changes presented here is a unique and new result. The manuscript is well written, and the study is of interest to the readership of ACP. I recommend publication after addressing the following comments.

General comments

- 1) The CAM-Chem version used here does not include the full stratosphere and has a relatively low lid when compared with state-of-the-art chemistry climate models. Therefore, the full Brewer-Dobson circulation path is not included in the model domain. It is not clear how modelled future changes of the circulation and stratospheric temperatures are impacted by the low model lid and a discussion of these facts should be included in the manuscript.
- 2) A critical discussion of the how the projected changes of lowermost stratospheric temperatures impact the role of VSL<sup>Br</sup> driven ozone loss is needed. Both points (1 and 2) should be used to demonstrate that the model version used here offers an appropriate model set up.
- 3) The discussion of the VSL<sup>Br</sup> emission parametrization should make clear that the seasonality of the emissions is not well known due to missing process understanding and sparse observational data.
- 4) Why are chlorinated very short-lived substances not included in the halogen budget? Their current and potential future emissions could play an important role and it would be interesting to see how this impacts the relative role of VSL<sup>Br</sup>.
- 5) Please explain why the polar latitudes are not analysed.

Specific comments

- 1) Page 5, line 6-7. Does this refer to ocean dynamics or also to ocean biogeochemistry?
- 2) Figure 1. Legend is too small, and therefore it was very hard to read the figure.
- 3) Page 6, line 32-33. It is not clear why not including the short-lived chlorinated species would cause an offset to the observed Cly only in the tropics. Once they contributed to the inorganic chlorine budget, they should play a role at all latitudes.
- 4) Page 8, line 13. Here and in several other places, a consistency between different values is cited that is not necessarily clear to the reader. Why is the number of the VSL<sup>Br</sup> impact being 50% at the end of the century consistent with projected delta TOC changes of 10 to 15%?

- 5) Page 8, line 19. Why is the minimum TOC shifted to 5 years earlier when including a constant  $VSL^{Br}$  term?
- 6) Page 8, line 34 and other places. What is the term  $VSL^{Br}$  driven ozone loss efficiency referring to? Is this describing the total impact of  $VSL^{Br}$  on ozone or some relative terms (% ozone loss)?
- 7) Page 9, line 1. Something is missing in the sentence.
- 8) Page 11, line 20 and 21. This is not clear and might need some more explanation. First of all, Figure 8 (which has again a way too small legend) seems to suggest that the Ox and NOx terms also increase. Is this increase maybe similar to the one of the HOx term relative to the total contribution? If not, it would be worthwhile explaining why the VSL impact gets compensated by the HOx term alone.