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Comment on acp-2021-1048

Anonymous Referee #2

Referee comment on "Hemispheric asymmetries in recent changes in the stratospheric circulation" by Felix Ploeger and Hella Garny, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-1048-RC2, 2022

This paper examines changes in the stratospheric circulation via CLaMS simulations forced by different reanalysis products, free running model output from CCMI runs and satellite observations of N2O. This wealth of information is used to elucidate the hemispheric asymmetry in the stratospheric circulation variability over recent decades and put these changes in context of the long-term changes expected due to ozone recovery and climate change. The results are generally consistent with previous studies but this study brings more detail and explanation of the circulation asymmetry than has been done before. The methods of analysis are clearly explained, the figures show the features well and the conclusions are fully justified. I recommend publication of this paper in its current form with consideration of the minor comments listed below.

Specific comments:

Lines 1-3: The first sentence of the abstract is a bit awkward. Perhaps, 'The stratospheric Brewer-Dobson circulation (BDC) has been found to have weakened in the NH relative to the SH in recent decades, despite ozone recovery over this period that would be expected to cause the opposite trend, inducing substantial effects on chemical composition'.

Line 37: maybe add ‘increasing’ before ‘ozone depletion’ here since ozone depletion has been ongoing after 2000. It might be helpful to come up with a term to describe the ozone depletion before 2000 since you refer to it again later.

Line 63: I think you meant ‘BDC decrease’ rather than ‘increase’.

Line 84: The ‘e.g.’ seems oddly placed after the reference.

Line 157: It looks like both ERA-Interim and ERA5 have mostly positive trends in the SH.

Line 162: ‘extent’ instead of ‘extend’

Line 164: ‘of’ instead of ‘for’

Lines 216-7: This sentence could use a bit more explanation. When you say a ‘strengthening deep BDC branch’ and ‘weakening meridional circulation’ I assume you’re referring to just the NH circulation but it’s not entirely clear. And the consistency with the age of air trends is maybe not straightforward since there are positive age trends in ERA5 in the NH at all levels above 100 hPa. Positive age trends (plus negative N2O trends) and a stronger circulation above 10 hPa don’t immediately follow so it would helpful to at least

make reference to the later discussion in Section 4.2.