Supporting Information for "Investigating zonal asymmetries in stratospheric ozone trends from satellite limb observations and a chemical transport model"

C. Arosio[1], M. P. Chipperfield[2,3], S. Dhomse[2,3], W. Feng[2], A. Rozanov[1], M. Weber[1], X. Zhou[2,4] and J. P. Burrows[1]

[1]Institute of Environmental Physics, University of Bremen, Bremen, Germany

[2]School of Earth and Environment, University of Leeds, Leeds, UK

[3]National Centre for Earth Observation (NCEO), University of Leeds, Leeds, UK

[4]School of Atmospheric Sciences, Chengdu University of Information Technology, Chengdu, China

Contents of this file

1. Comparison trends including/excluding the 2020 cold winter;
2. Comparison of ozone trends with M2-GMI;
3. Definition of sectors for polar vortex occupancy.

Introduction This document provides further analysis and figures that were not possible to report in the paper.

Comparison trends including/excluding the 2020 cold winter

To further rule out the possible influence of the cold winter 2020 on the identified zonal asymmetric pattern in trends, we show here ozone long-term changes for February-March (FM) computed using the TOMCAT dataset (to have a complete latitude coverage) over the periods 2004-2022, but excluding in panel (b) FM 2020. Ozone trends for these two time series at 35 km are shown in Fig. S1.

The trends including/excluding the cold 2019/2020 winter are very similar, pointing out the negligible influence of this event on the zonal asymmetry in the middle stratosphere. We also checked the trends at 21 km, here not shown, and found larger changes between the two considered periods, but retaining the same overall pattern.

Comparison of ozone trends with M2-GMI

Figure S2 shows longitudinally resolved ozone trends from M2-GMI and TOMCAT simulations, at 35 km over the period 2005-2019, which corresponds to the M2-GMI available data span. Despite overall larger positive values in M2-GMI, the pattern at northern high latitudes is very similar in both panels. In addition, seasonal trends from M2-GMI, especially for March-April (MA), as displayed in the bottom panels, show a very high degree of similarity with the results from TOMCAT.

Definition of sectors for polar vortex occupancy

Figure S3 shows on a polar map the Siberian and North American sectors used to calculate the relative occupancy of the polar vortex shown in Fig. 11 of the manuscript.

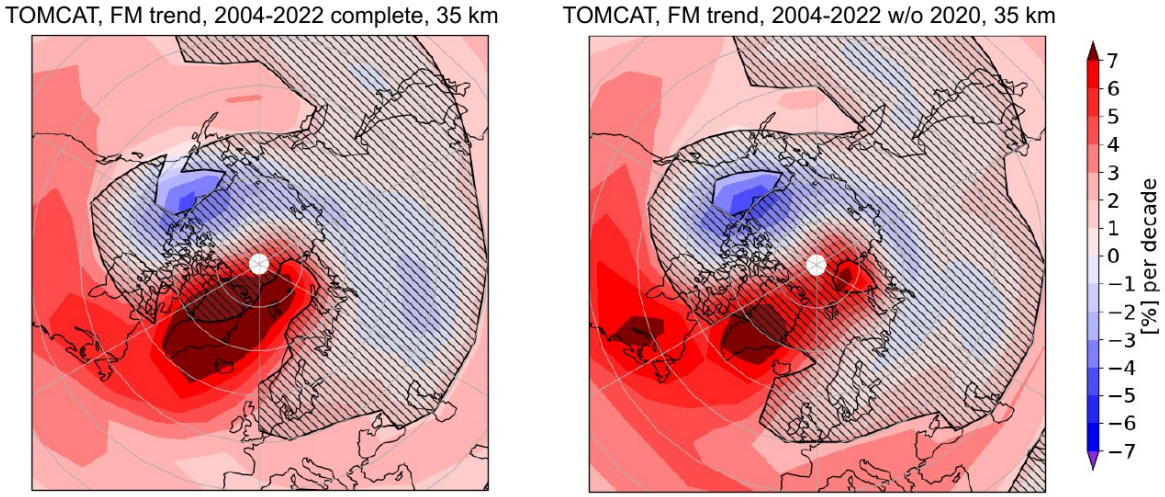

Figure S1. Ozone trends at 35 km for the TOMCAT time series; on the left for the complete period 2004-2022, on the right excluding 2020.

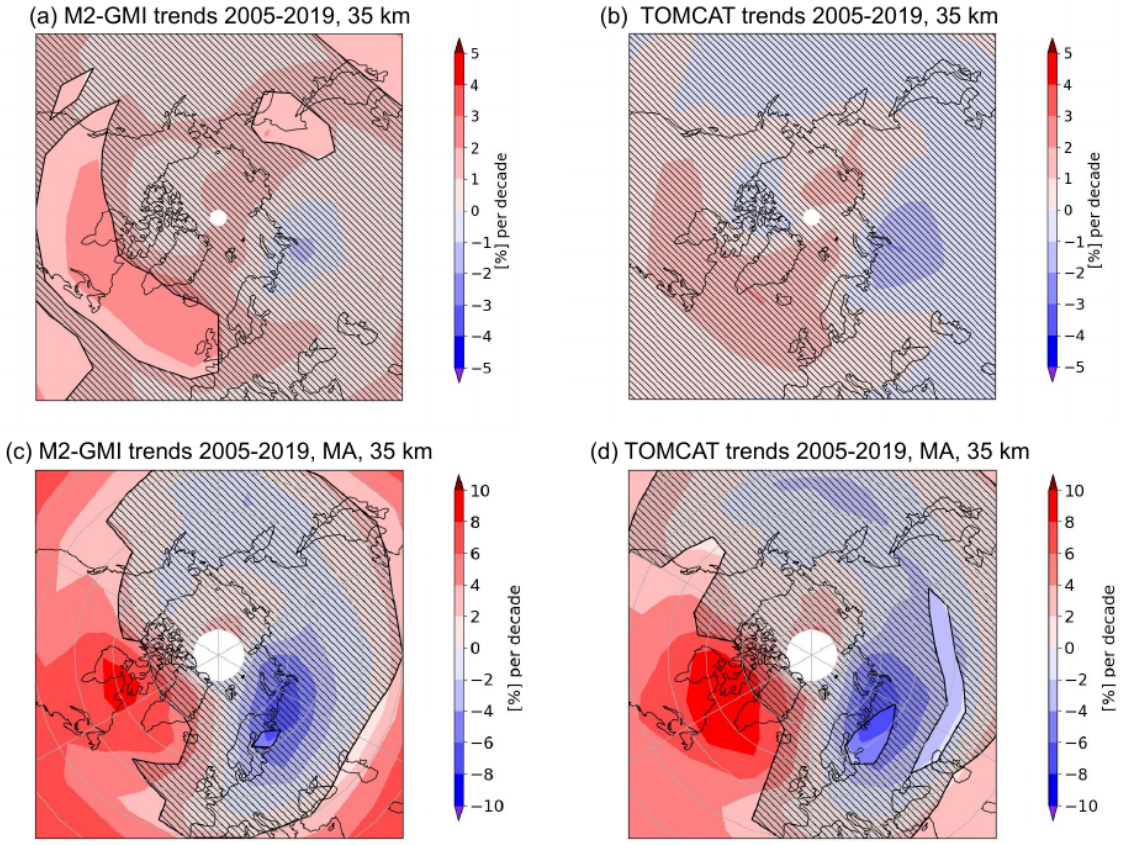

Figure S2. Top row: the left panel shows ozone trends for the M2-GMI time series over 2005-2019 at 35 km, the right panel the same for TOMCAT. Bottom row, MA ozone trends for the same period.

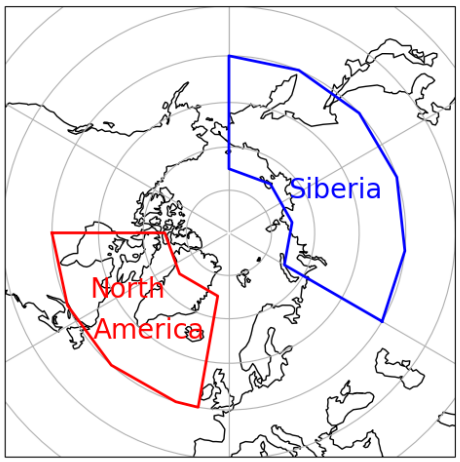

Figure S3. Definition of the Siberian and North American sectors.