Supplement of Atmos. Chem. Phys., 20, 4105–4132, 2020
https://doi.org/10.5194/acp-20-4105-2020-supplement

Atmospheric Chemistry and Physics
Open Access
EGU

Supplement of

Bromine from short-lived source gases in the extratropical northern hemispheric upper troposphere and lower stratosphere (UTLS)

Timo Keber et al.

Correspondence to: Timo Keber (keber@iau.uni-frankfurt.de) and Andreas Engel (an.engel@iau.uni-frankfurt.de)

1. Observations from TACTS and WISE for major Br VSLS separately (as Fig 4)

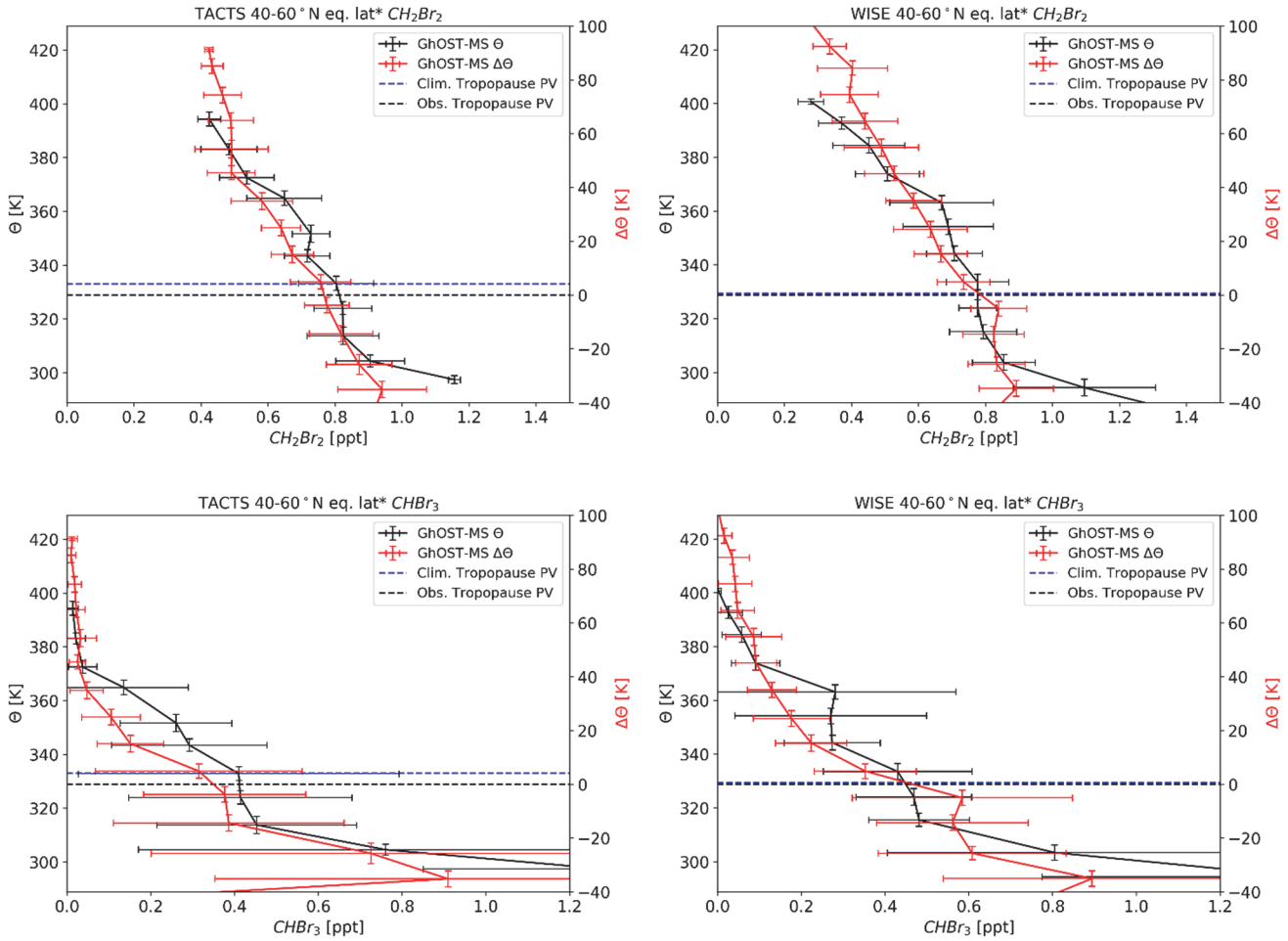

Figure S1: Vertical profiles of CH_2Br_2 (top) and $CHBr_3$ (bottom) averaged over 40-60° of equivalent latitude* and all flights during the TACTS (left) and WISE (right) campaigns. The data are displayed as function of potential temperature and potential temperature above the tropopause. The dashed blue line shows the zonal mean dynamical tropopause derived from ERA Interim during September and October of the respective years in the Northern Hemisphere between 40 and 60° latitude, while the black dashed line is the average dynamical tropopause derived for the times and locations of our observations. Both vertical and horizontal error bars denote 1 σ variability.

2. vertical profiles of minor VSLS and total Br for PGS and the combined data set from WISE TACTS (as Fig 4)

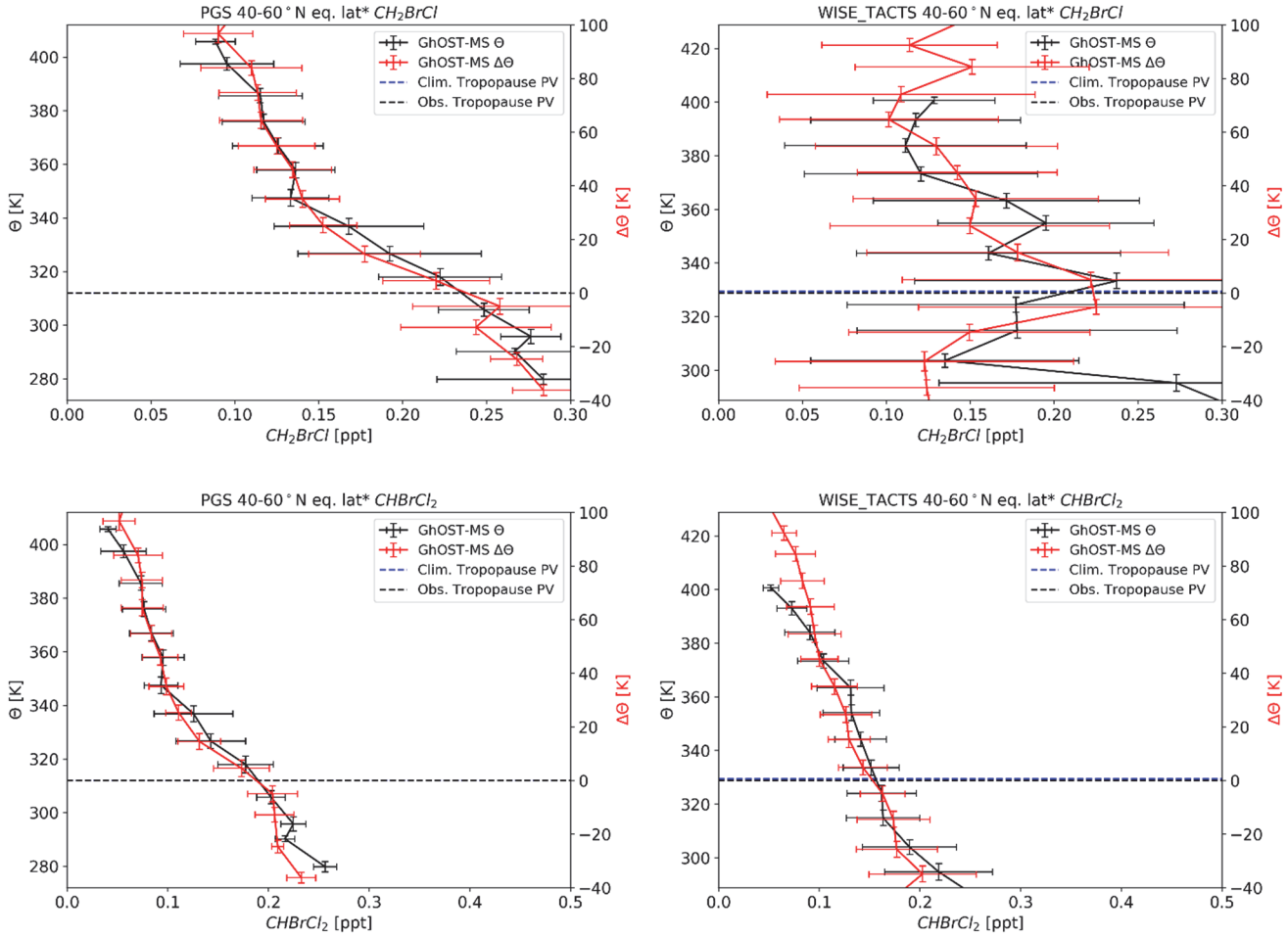

Figure S2: As Fig S1 for minor VSLS CH_2BrCl (top) and $CHBr_2Cl$ (bottom) for all flights during the PGS campaign (left, late December 2015 to March 2016) and from the merged data set from the TACTS and WISE campaigns (right, representative of late summer to fall).

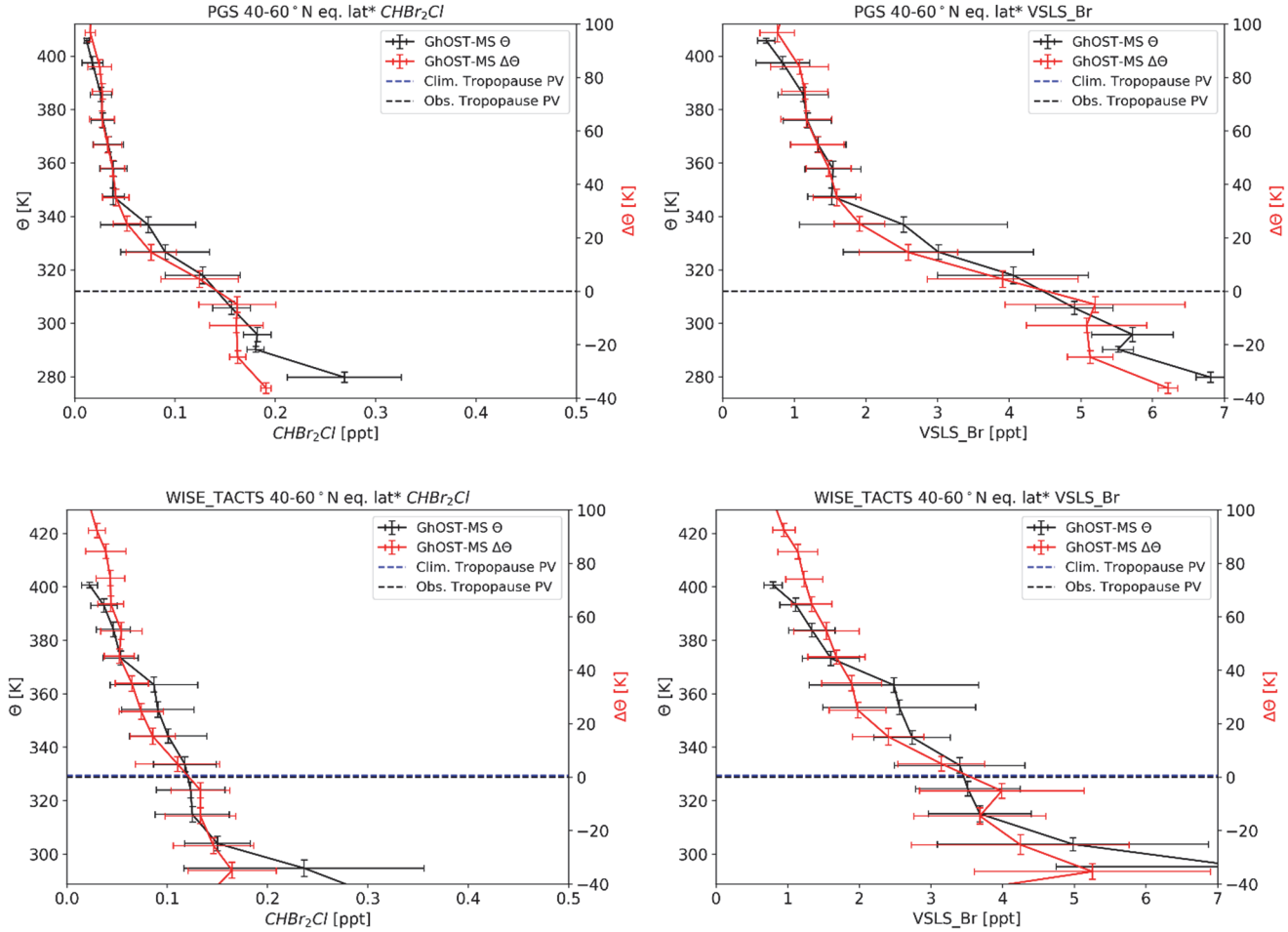

Figure S3: As Fig S2 for $CHBr_2Cl$ (top) and total VSLS organic bromine (bottom).

3. Model comparisons of minor VSLS and total Br for PGS and the combined data set from WISE TACTS (as Fig. 7)

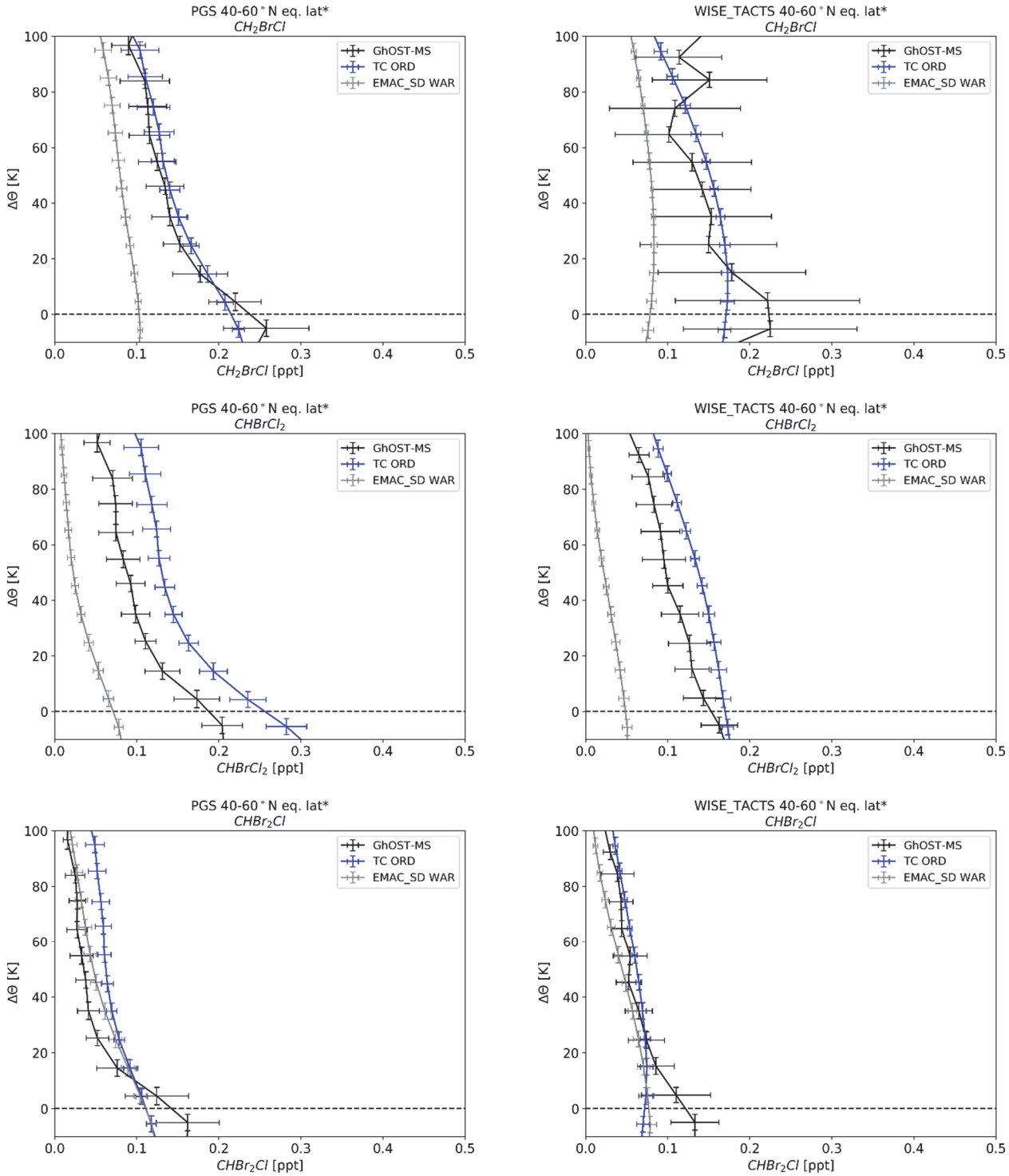

Figure S4: Vertical profiles of CH_2BrCl (top), $CHBrCl_2$ (middle) and $CHBr_2Cl$ (bottom) averaged over 40-60° of equivalent latitude* and all flights during the PGS campaign from late December 2015 to March 2016 (left hand side) and from the combined WISE_TACTS data set, representative of late summer to fall conditions. Also shown are model results from the TOMCAT and EMAC model using different emission scenarios (see text for details). Note that data emission data for the minor VSLS are not available for all scenarios. The data are displayed as function of potential temperature above the dynamical tropopause. In case no model information on the tropopause altitude was available (TOMCAT), climatological tropopause values have been used (see text for details).

4. Br_y sensitivity study for WISE_TACTS (as Fig 15)

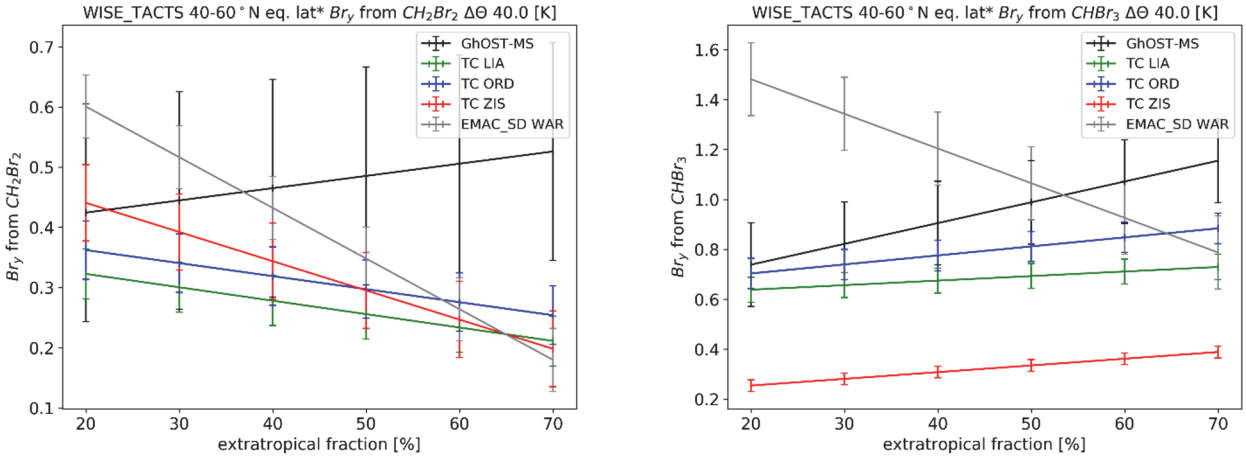

Figure S5: Sensitivity of Br_y from CH_2Br_2 and $CHBr_3$ at $\Delta\theta$ = 40 K as a function of the fraction of extratropical air for the WISE_TACTS merged data set campaign for observations in comparison to the different model calculation.