

Supplement of Atmos. Chem. Phys., 18, 8409–8438, 2018
<https://doi.org/10.5194/acp-18-8409-2018-supplement>
© Author(s) 2018. This work is distributed under
the Creative Commons Attribution 4.0 License.



Atmospheric
Chemistry
and Physics
Open Access
EGU

Supplement of

Estimates of ozone return dates from Chemistry-Climate Model Initiative simulations

Sandip S. Dhomse et al.

Correspondence to: Sandip S. Dhomse (s.s.dhomse@leeds.ac.uk), Douglas Kinnison (dkin@ucar.edu), and Martyn P. Chipperfield (m.chipperfield@leeds.ac.uk)

The copyright of individual parts of the supplement might differ from the CC BY 4.0 License.

This document contains additional figures to support those presented in the main document. For discussion of the figures and references see the main text.

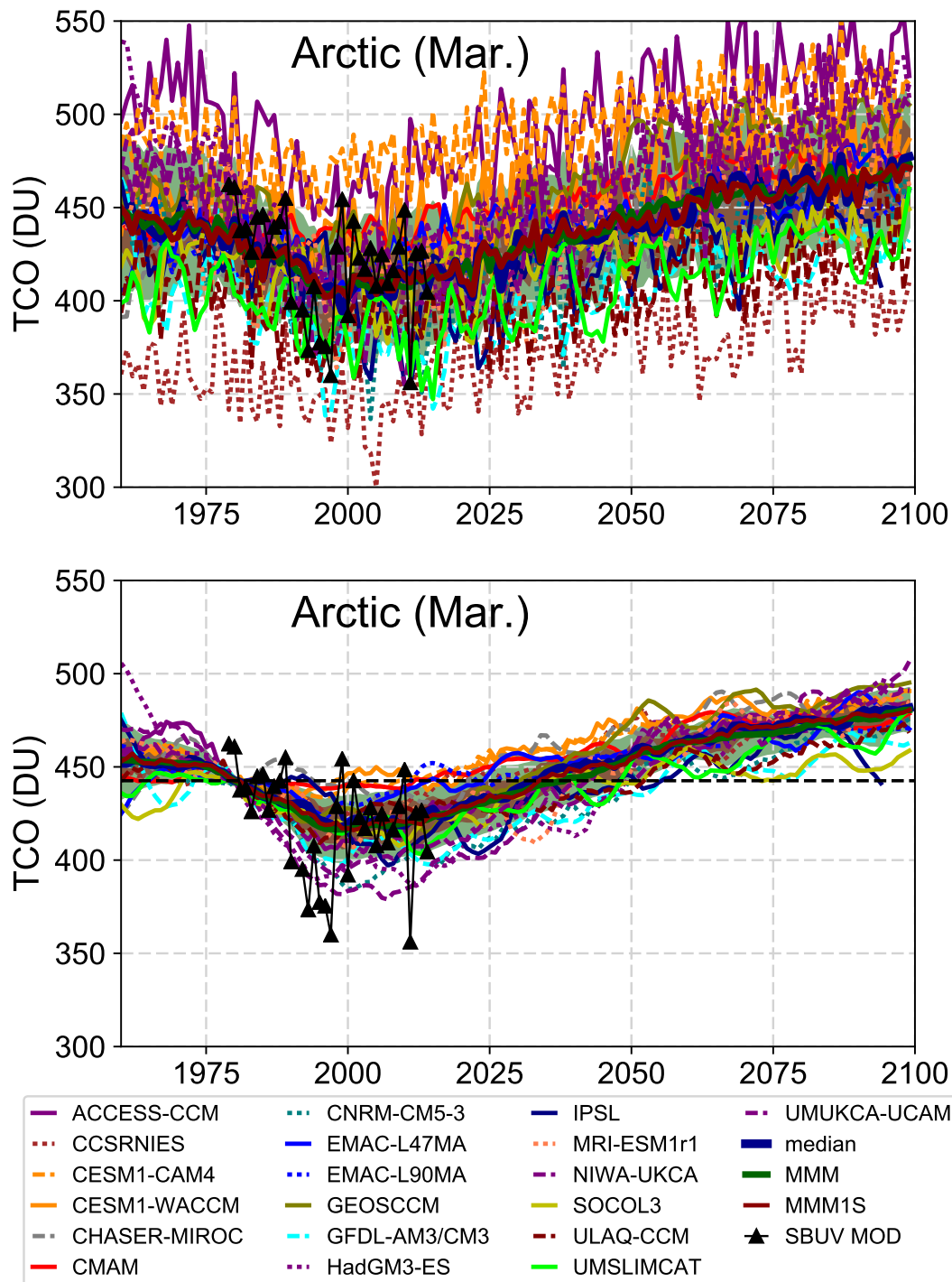


Figure S1. (a) Total column ozone time series (DU) for Arctic ($60^{\circ}\text{N} - 90^{\circ}\text{N}$) in March from 19 individual CCMs for March for the REF-C2 simulations along with observations from the SBUV merged ozone dataset. The MMM, median (MedM) and MMM1S are shown with thick green, blue and red lines, respectively. Light blue shaded region indicates 10th and 90th percentile range. Light green and red regions show $1-\sigma$ variability w.r.t. MMM and MMM1S mean lines. (b) Same as (a) but adjusted total ozone time series w.r.t. mean 1980-1984 observations. The dashed black line indicates 1980 reference value.

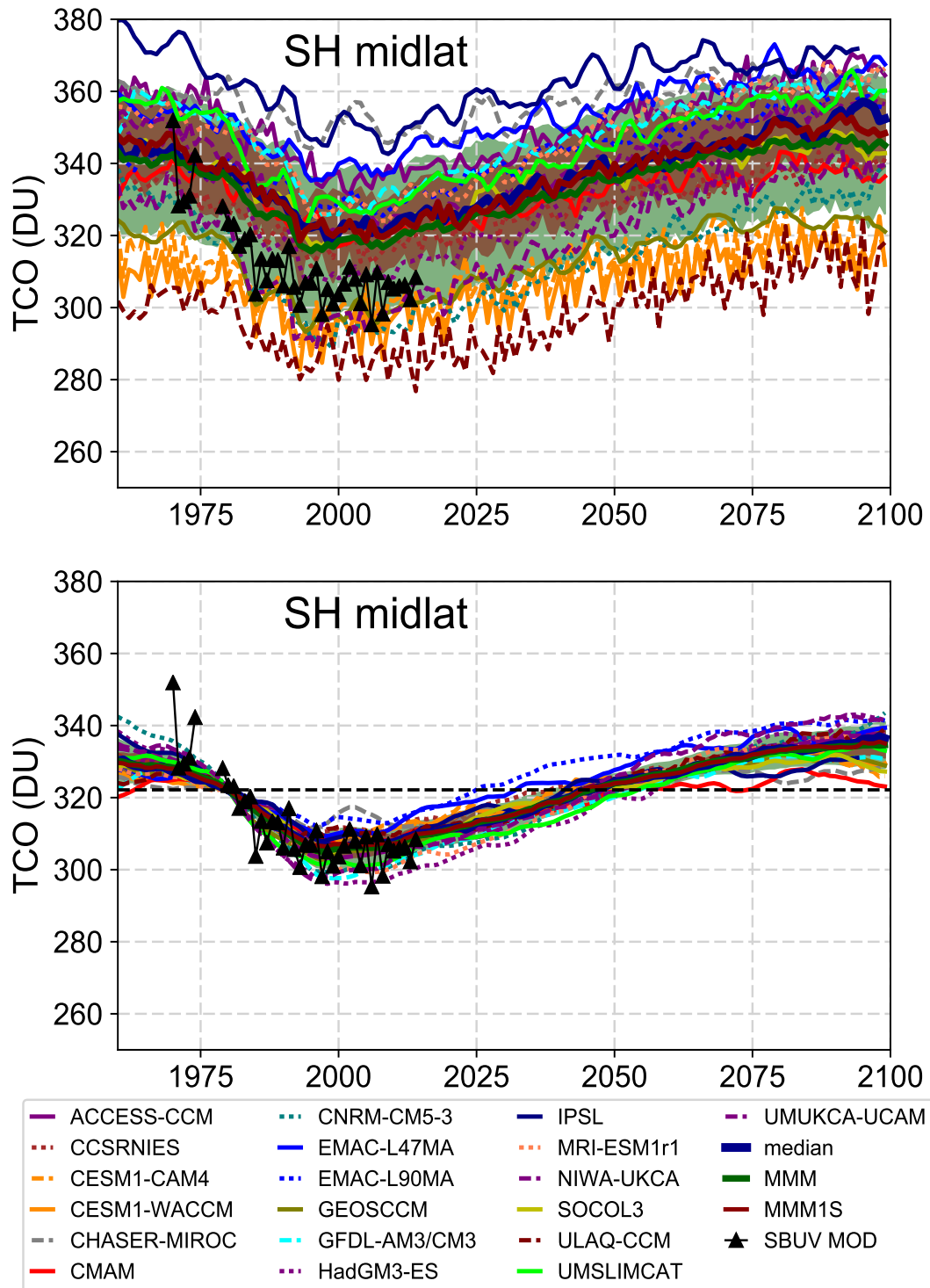


Figure S2. As Figure S1 but for annual mean total column ozone for SH mid-latitudes (60°S – 35°S).

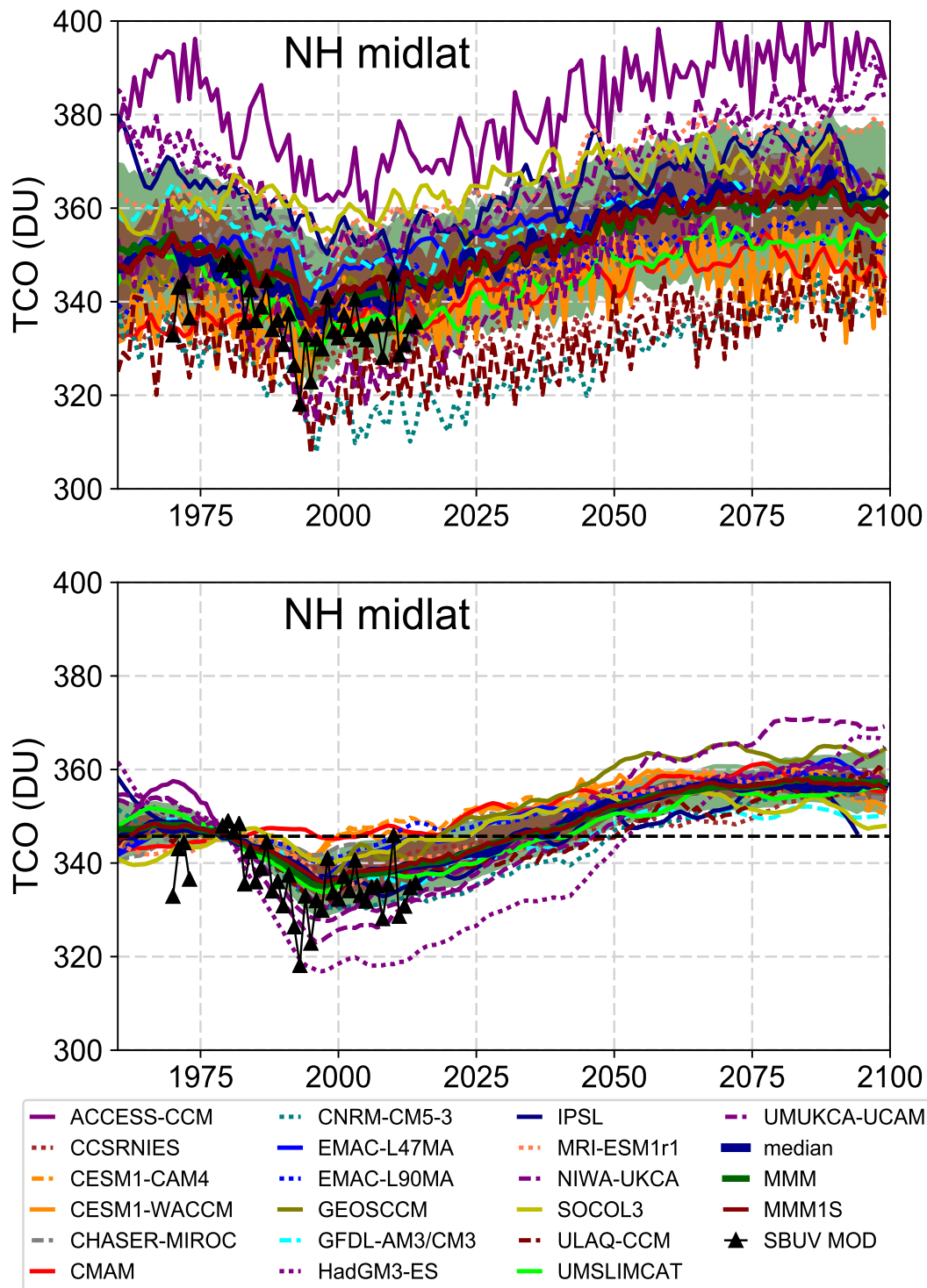


Figure S3. As Figure S1 but for annual mean total column ozone for NH mid-latitudes ($35^{\circ}\text{N} - 60^{\circ}\text{N}$).

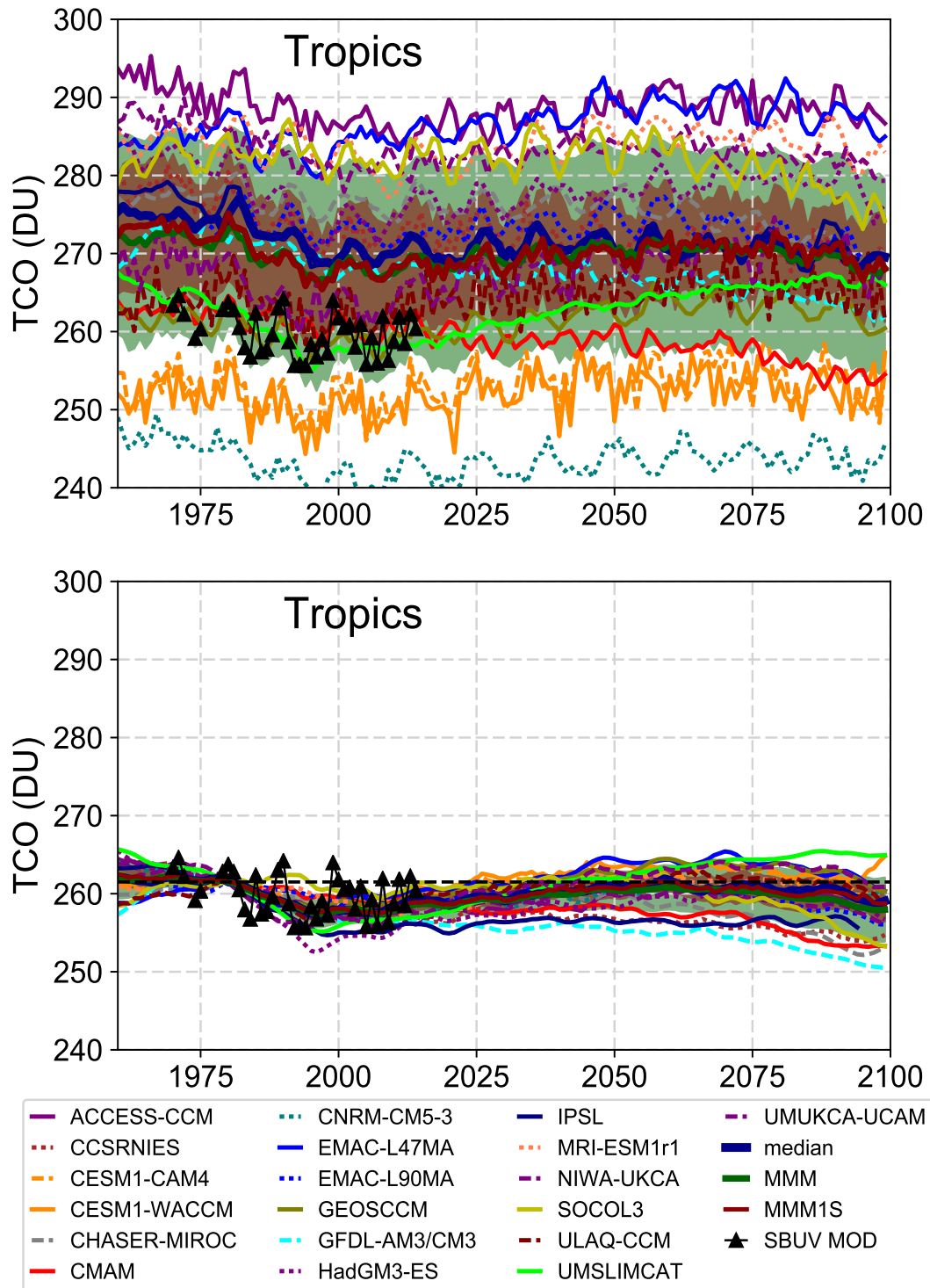


Figure S4. As Figure S1 but for annual mean total column ozone for the tropics (20°S – 20°N).

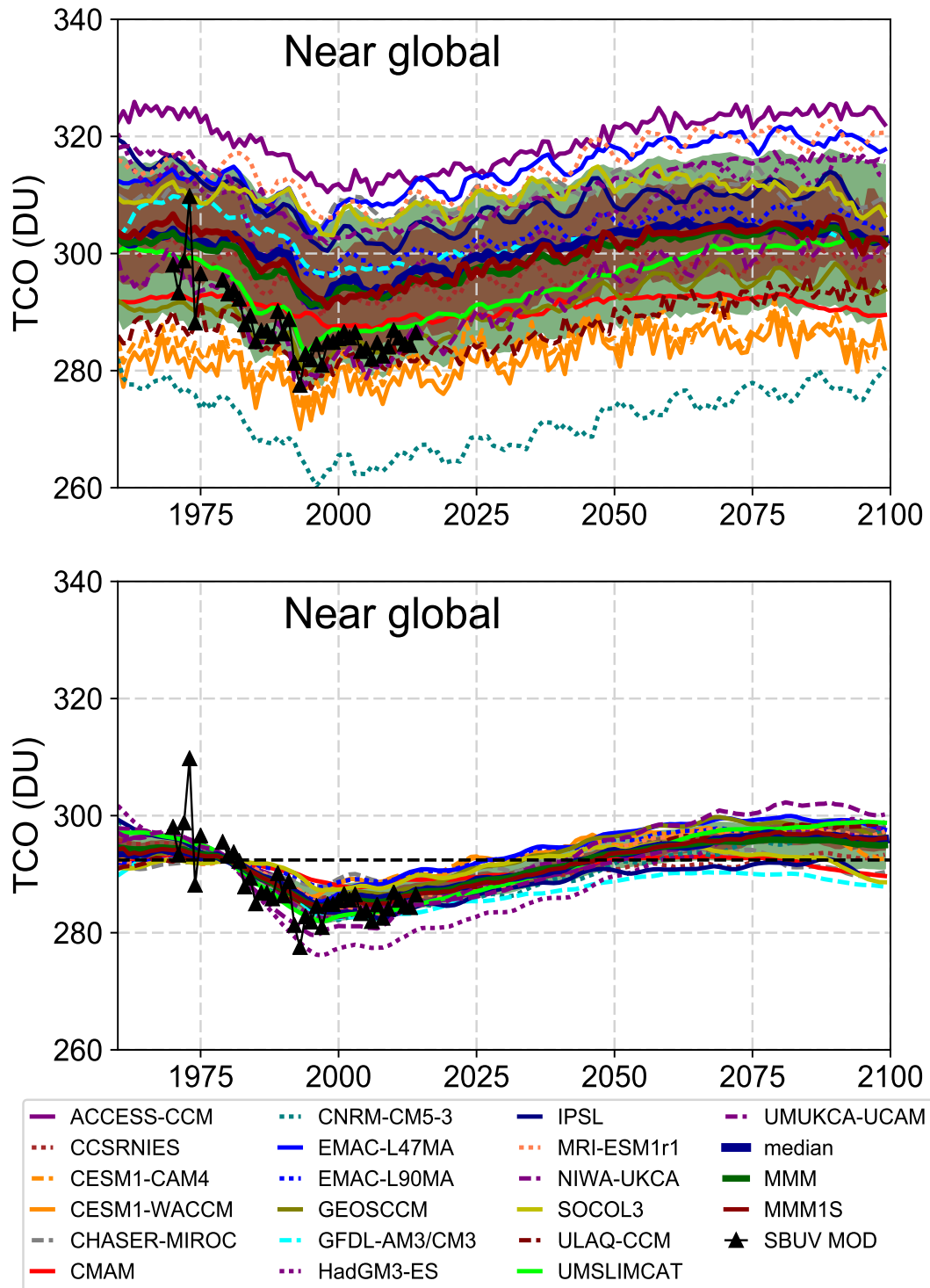


Figure S5. As Figure S1 but for annual mean near-global mean (60°S – 60°N) total column ozone.

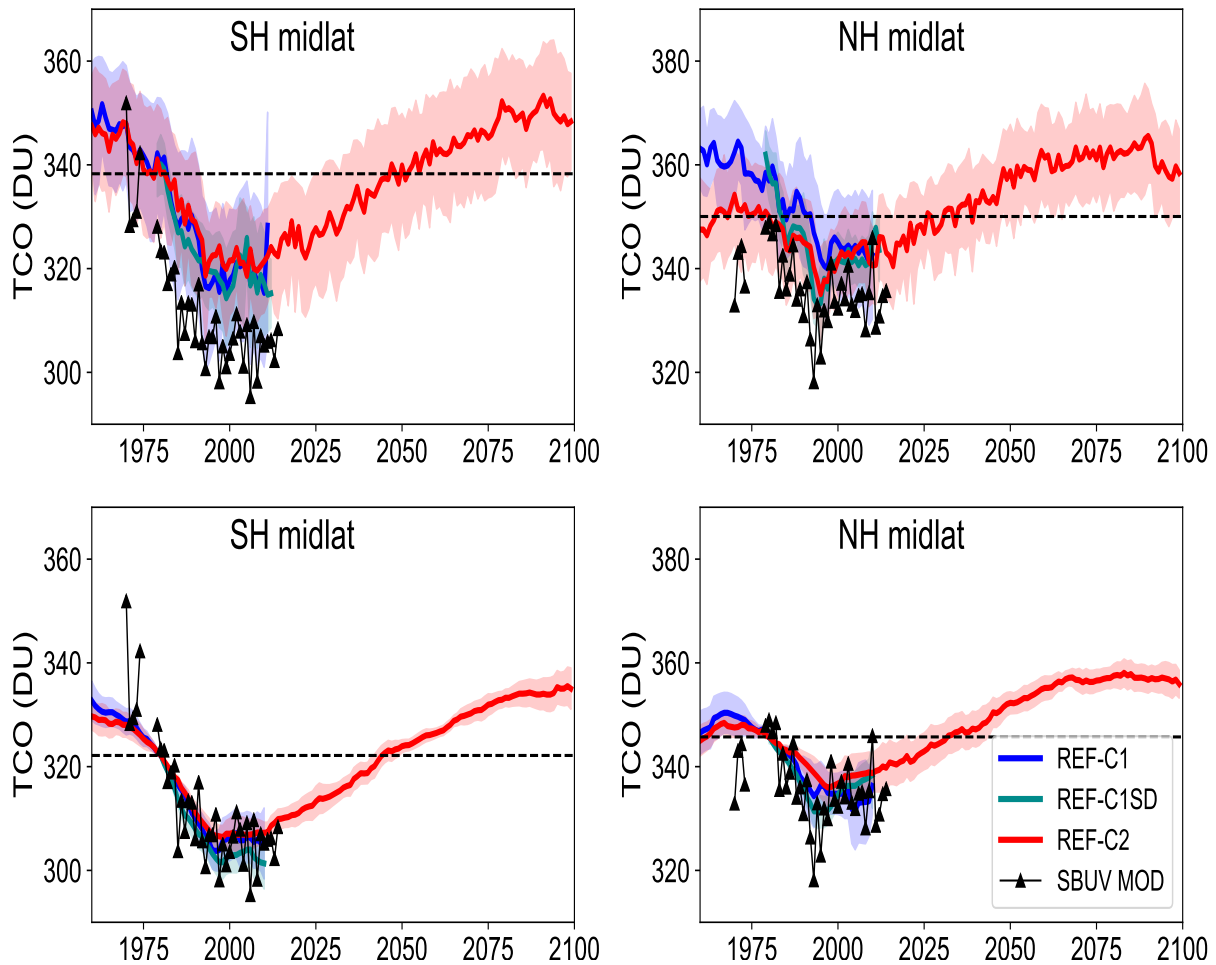


Figure S6. MMM1S total column ozone time series (DU) from REF-C1 (blue), REF-C1SD (dark cyan) and REF-C2 (red) simulations for (left) SH mid-latitudes (60°S – 35°S) and (right) NH mid-latitudes (35°N – 60°N). Dashed black lines show 1980 reference value for a given zonal latitude band. The top row shows the unadjusted modelled values and the bottom row shows the time series adjusted with respect to mean 1980-1984 observations. Also shown are merged SBUV observations.

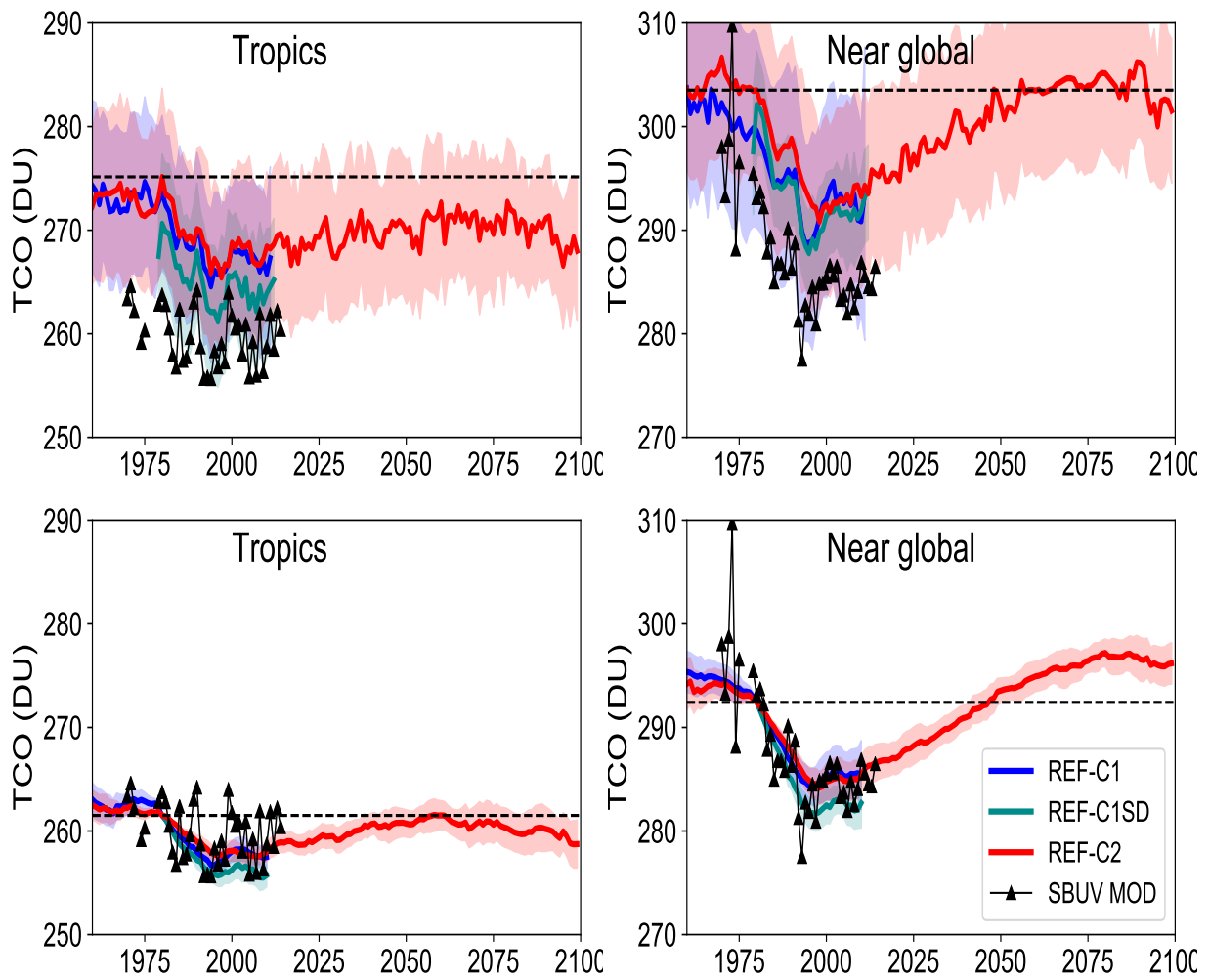


Figure S7. As Figure S6 but for the tropics (20°S – 20°N) and near-global average (60°S – 60°N).

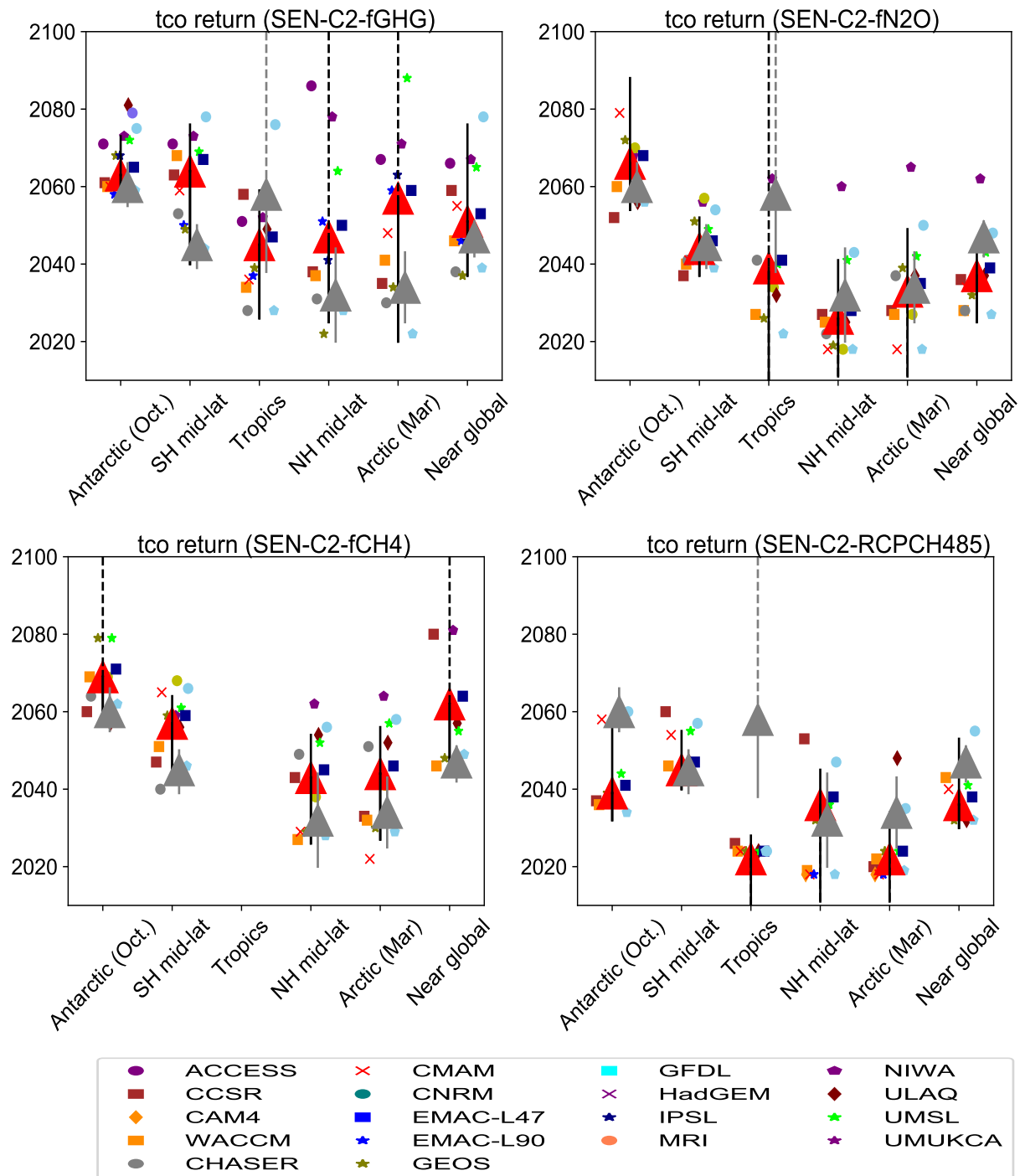


Figure S8. Estimated MMM1S return dates (red triangles) of total column ozone from the SEN-C2-fGHG, SEN-C2-fN2O, SEN-C2-fCH4 and SEN-C2-CH4RCP85 simulations for different latitude bands. The estimated 1- σ uncertainties are shown with vertical black lines. Estimates for individual models are shown with coloured dots. Some individual models do not predict a return of column ozone in the tropics. Return dates from REF-C2 (see Figure 4 in main paper) are shown with grey triangles.

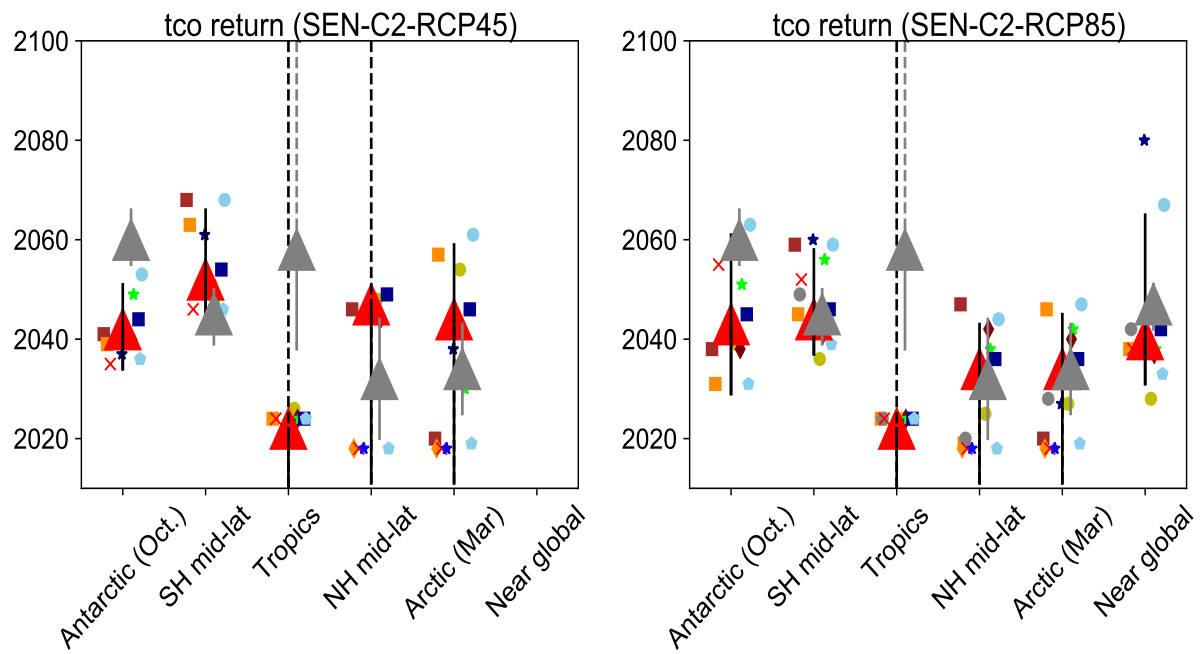


Figure S9. As Figure S8 but for the SEN-C2-RCP45 and SEN-C2-RCP85 simulations.

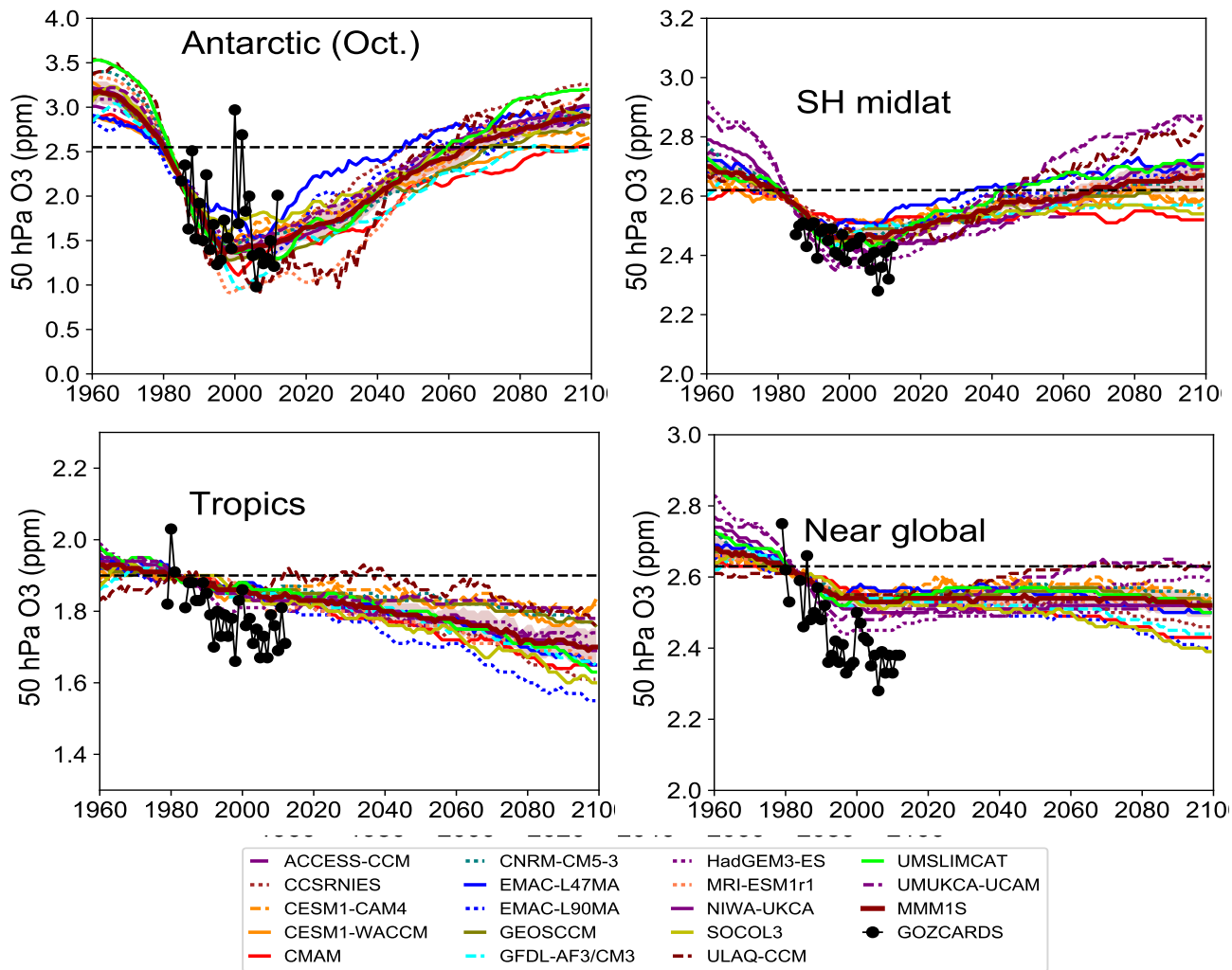


Figure S10. Time series of adjusted ozone at 50 hPa from the REF-C2 simulations for Antarctic ($60^{\circ}\text{N} - 90^{\circ}\text{N}$), SH mid-latitudes ($60^{\circ}\text{S} - 35^{\circ}\text{S}$), tropics ($20^{\circ}\text{S} - 20^{\circ}\text{N}$) and near-global ($60^{\circ}\text{S} - 60^{\circ}\text{N}$) mean. The dark red line shows the MMM1S and the shaded region indicates corresponding $1-\sigma$ standard deviation. The reference value for year 1980 is shown with dashed black line. Also shown are observations from the GOZCARD merged dataset.

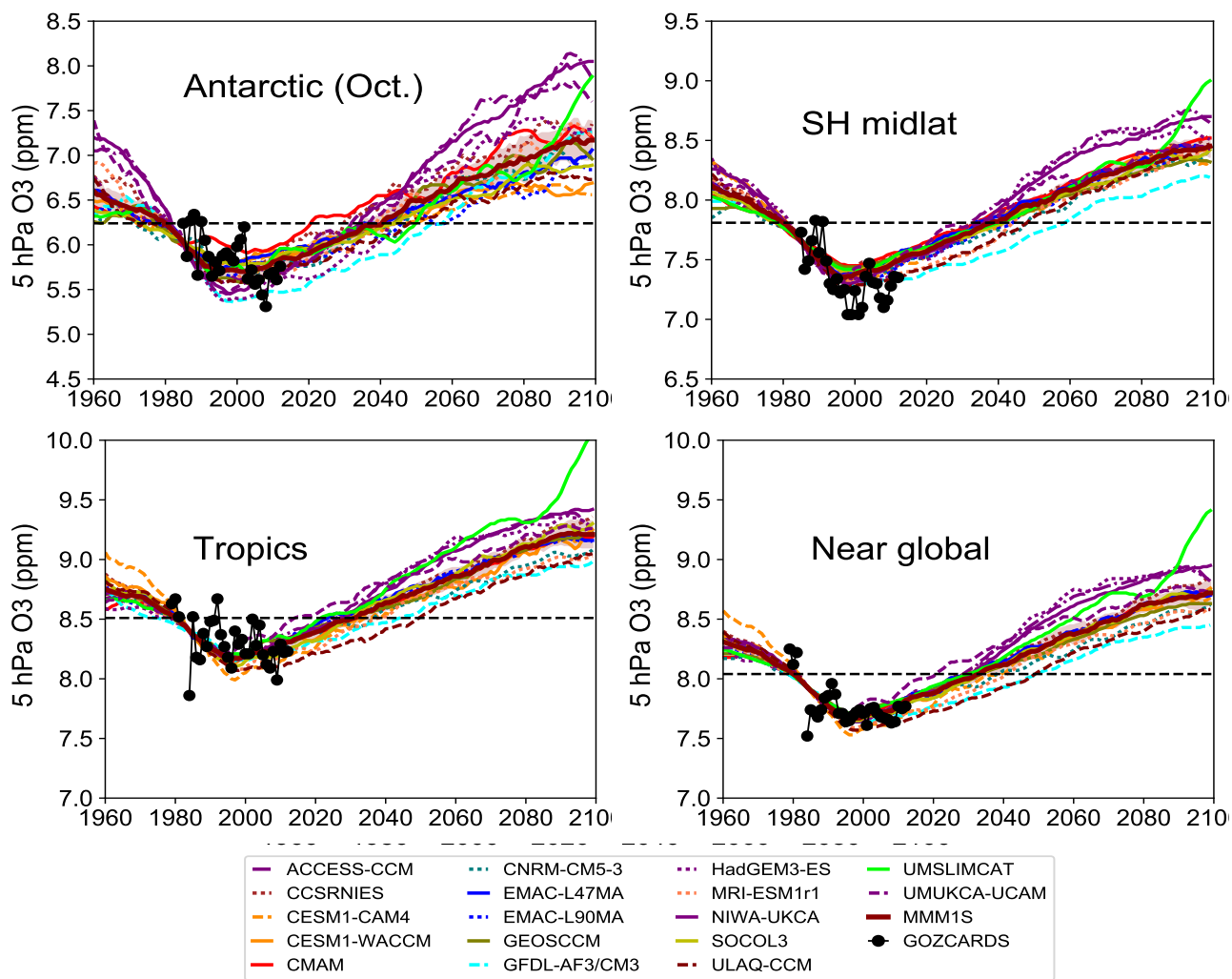


Figure S11. As Figure S10 but for 5 hPa.

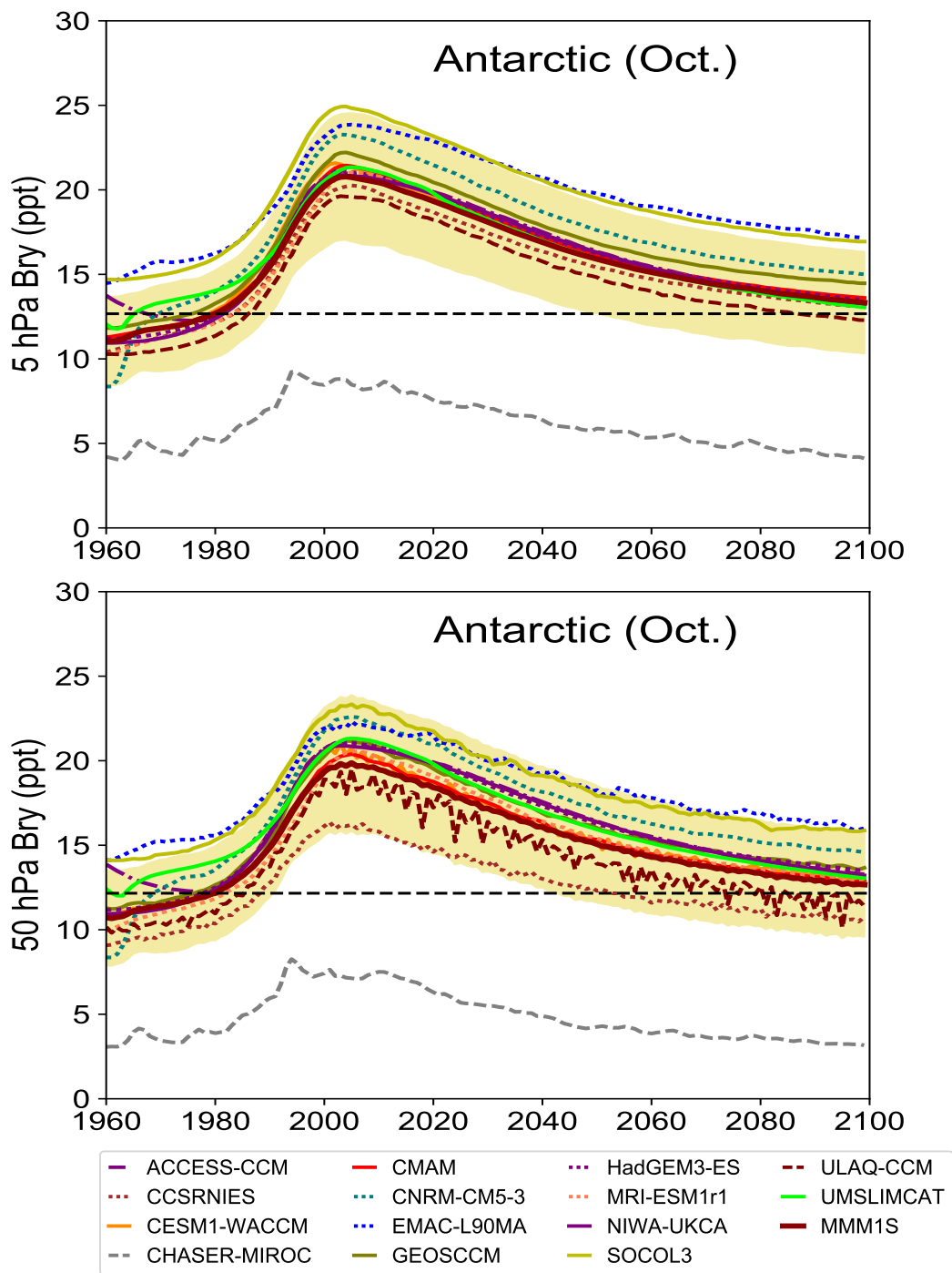


Figure S12. Evolution of inorganic bromine (Bry, ppt) at 5 hPa (top) and 50 hPa (bottom) from the REF-C2 simulations.

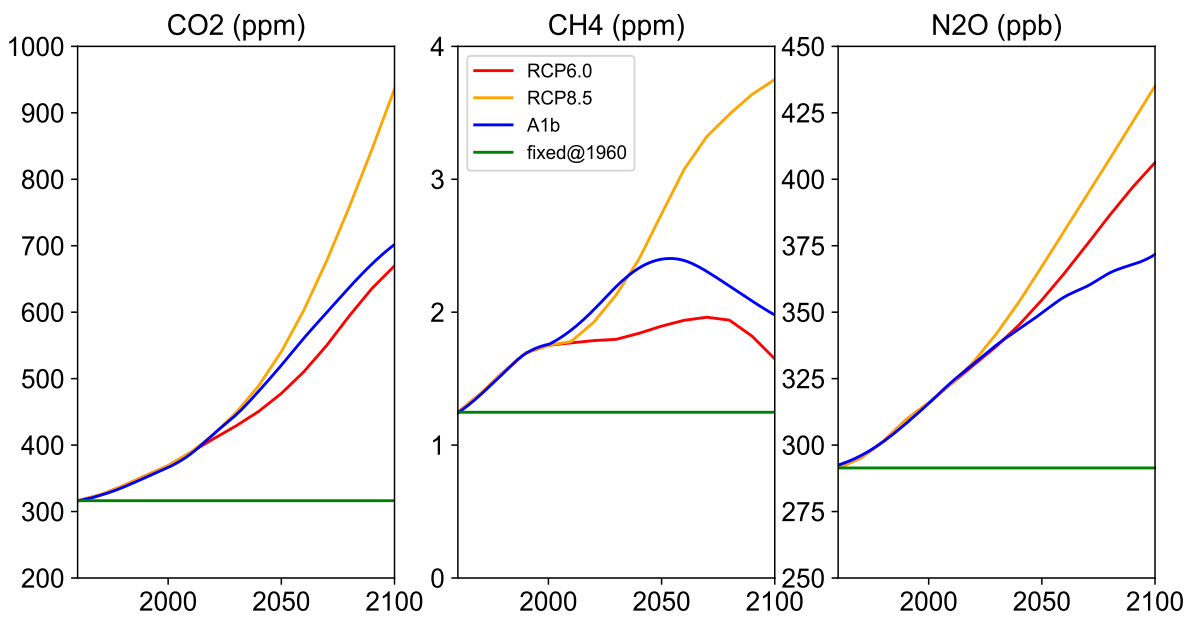


Figure S13. Volume mixing ratios (vmrs) of CO₂, CH₄ and N₂O used in the REF-C2 (RCP6.0, red lines), and SEN-C2-RCP8.5 (orange lines) simulations along with the values from the SRES A1b scenario (blue lines). The values for reference year 1960 are shown with green lines.

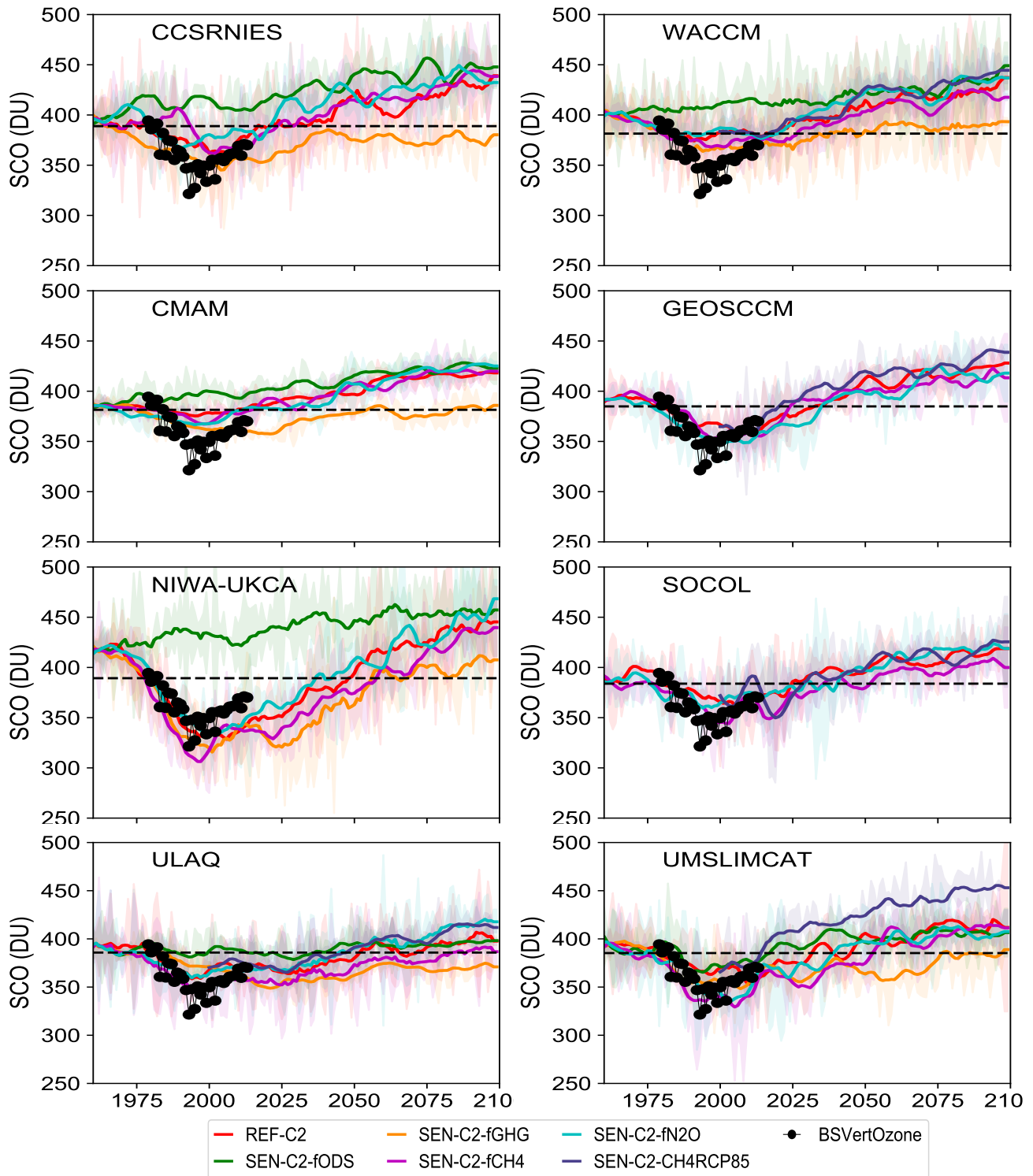


Figure S14. Evolution of Arctic (March, (60°N – 90°N)) stratospheric ozone columns (DU) from selected models for REF-C2, SEN-C2-fODS, SEN-C2-fCH4, SEN-C2-fN2O and SEN-C2-CH4RCP85 simulations. Also shown are observations from the merged SBUV dataset.

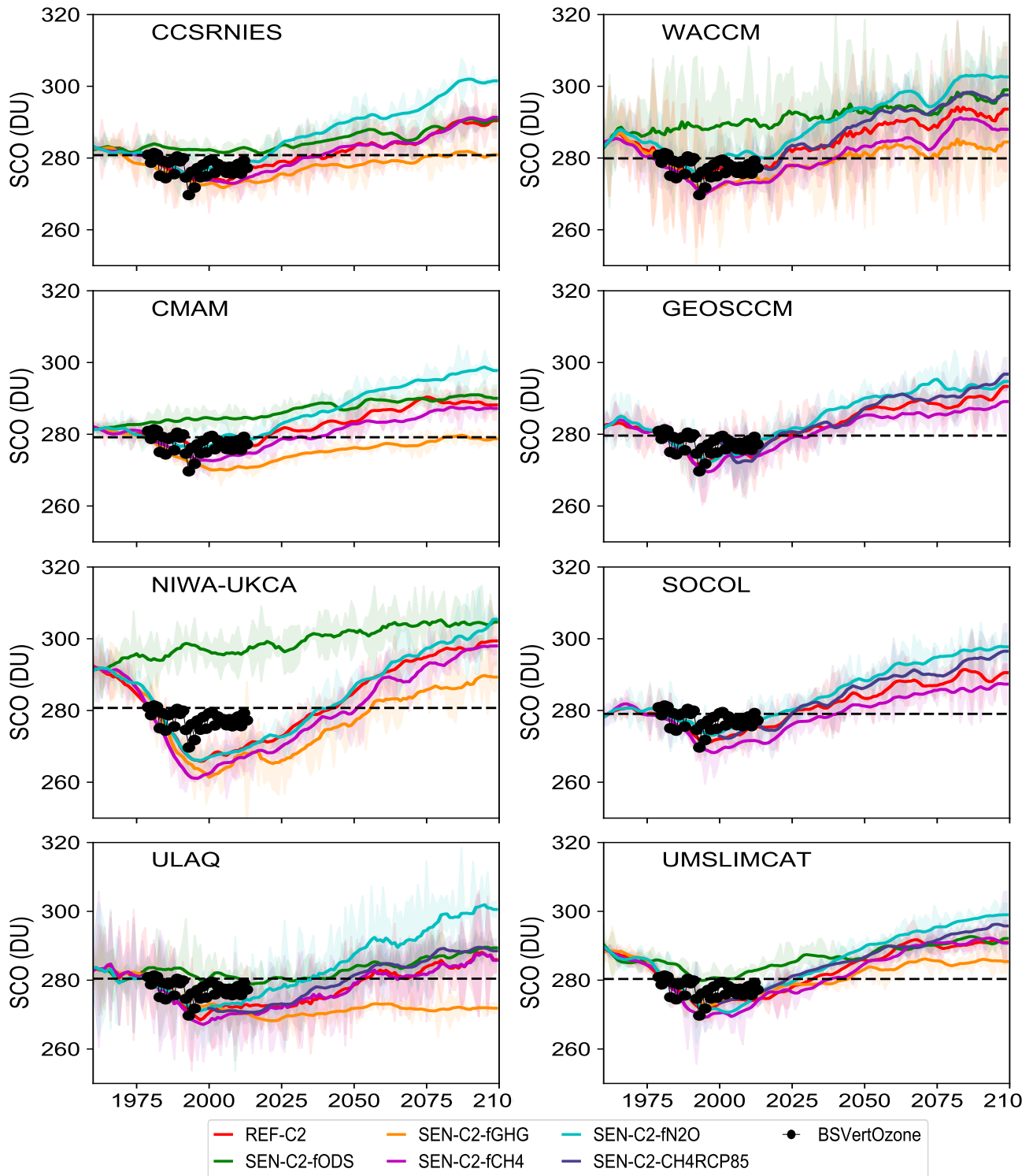


Figure S15. As Figure S14 but for NH mid-latitudes (35°N – 60°N).

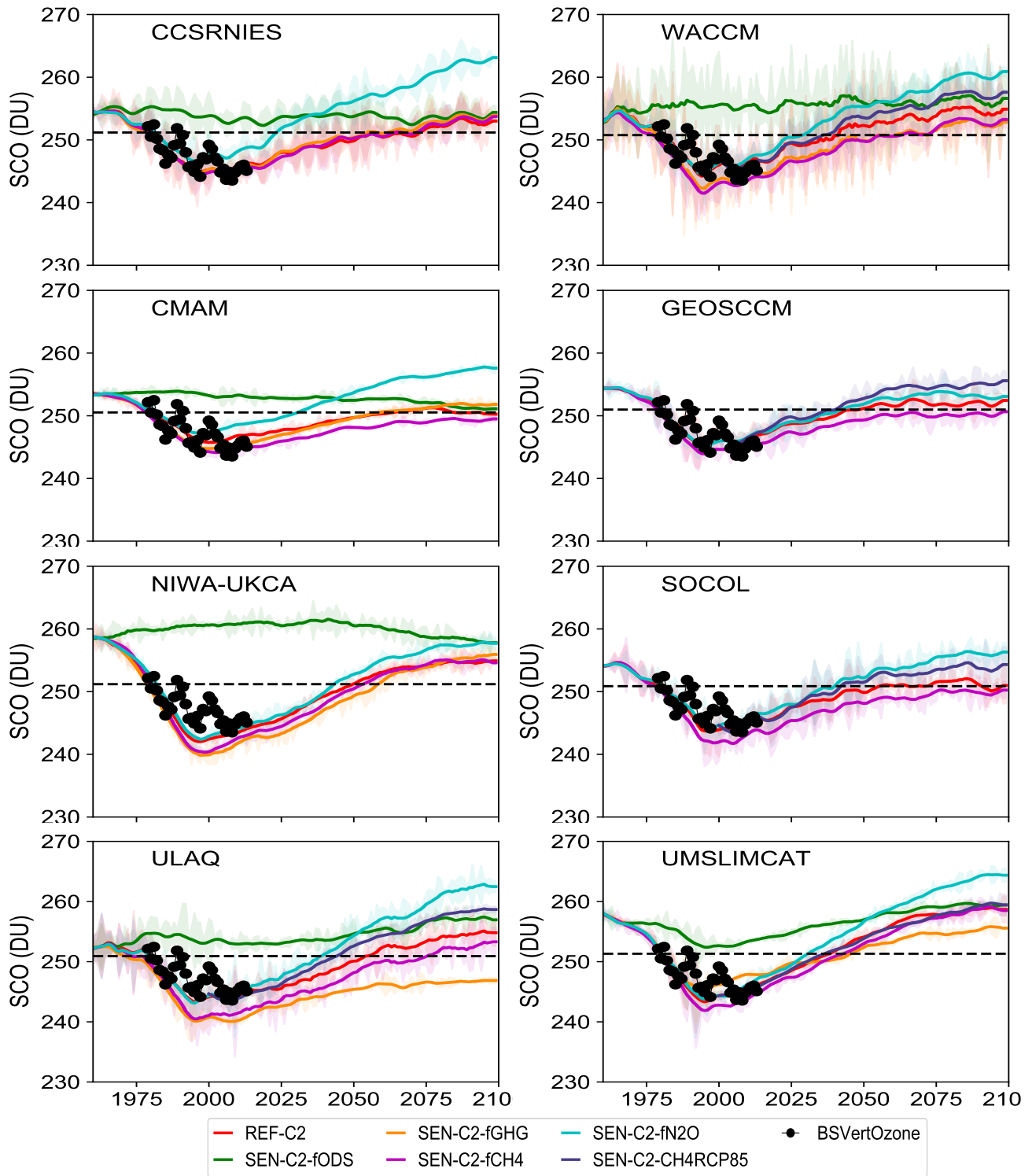


Figure S16. As Figure S14 but for near-global average (60°S – 60°N).

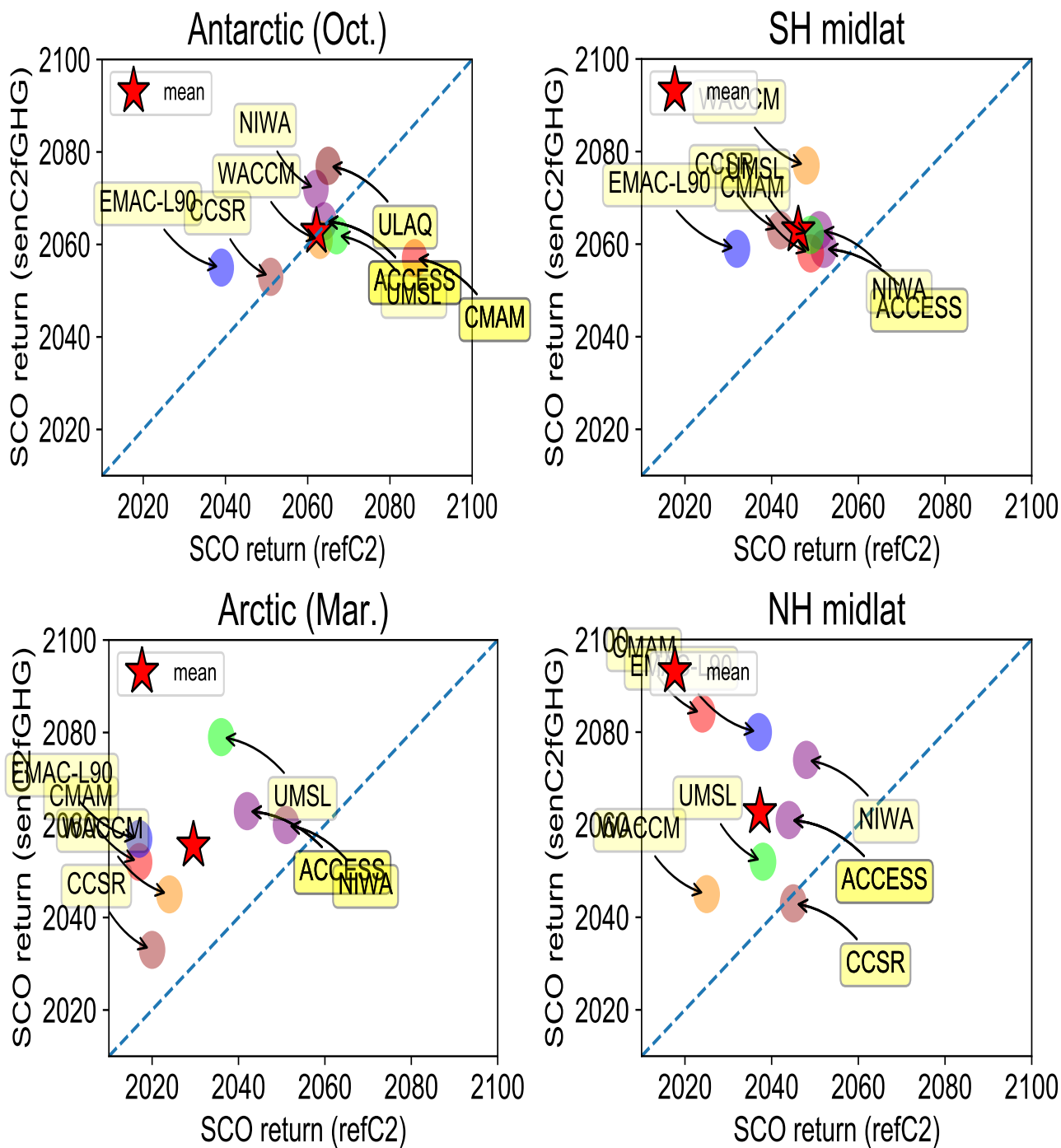


Figure S17. Correlation plots of stratospheric column ozone (SCO) return dates from the SEN-C2-fGHG simulations against SCO return dates from REF-C2 simulations for individual models within four latitude bands.

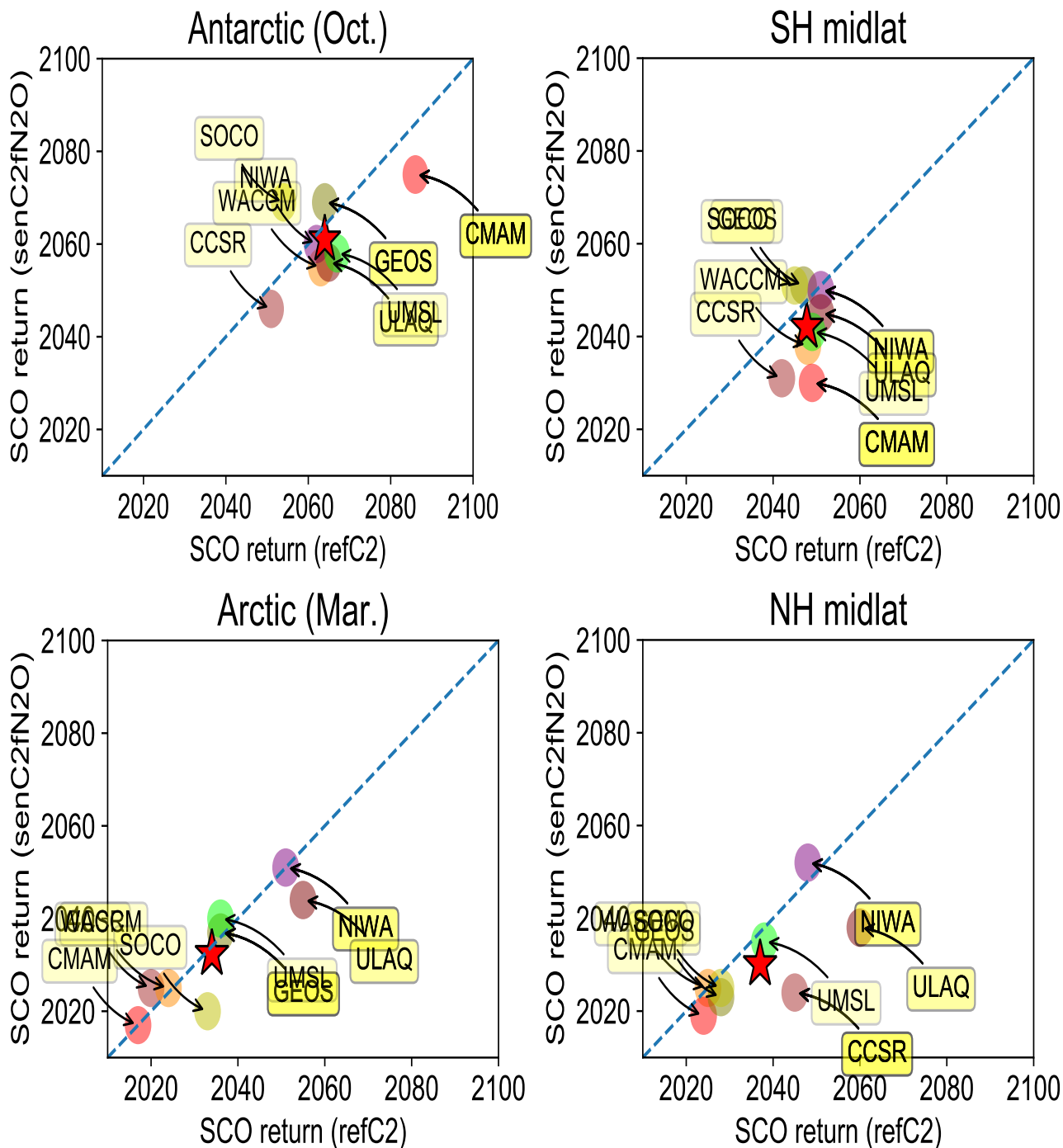


Figure S18. As Figure S17 but for simulation SEN-C2-fN2O.

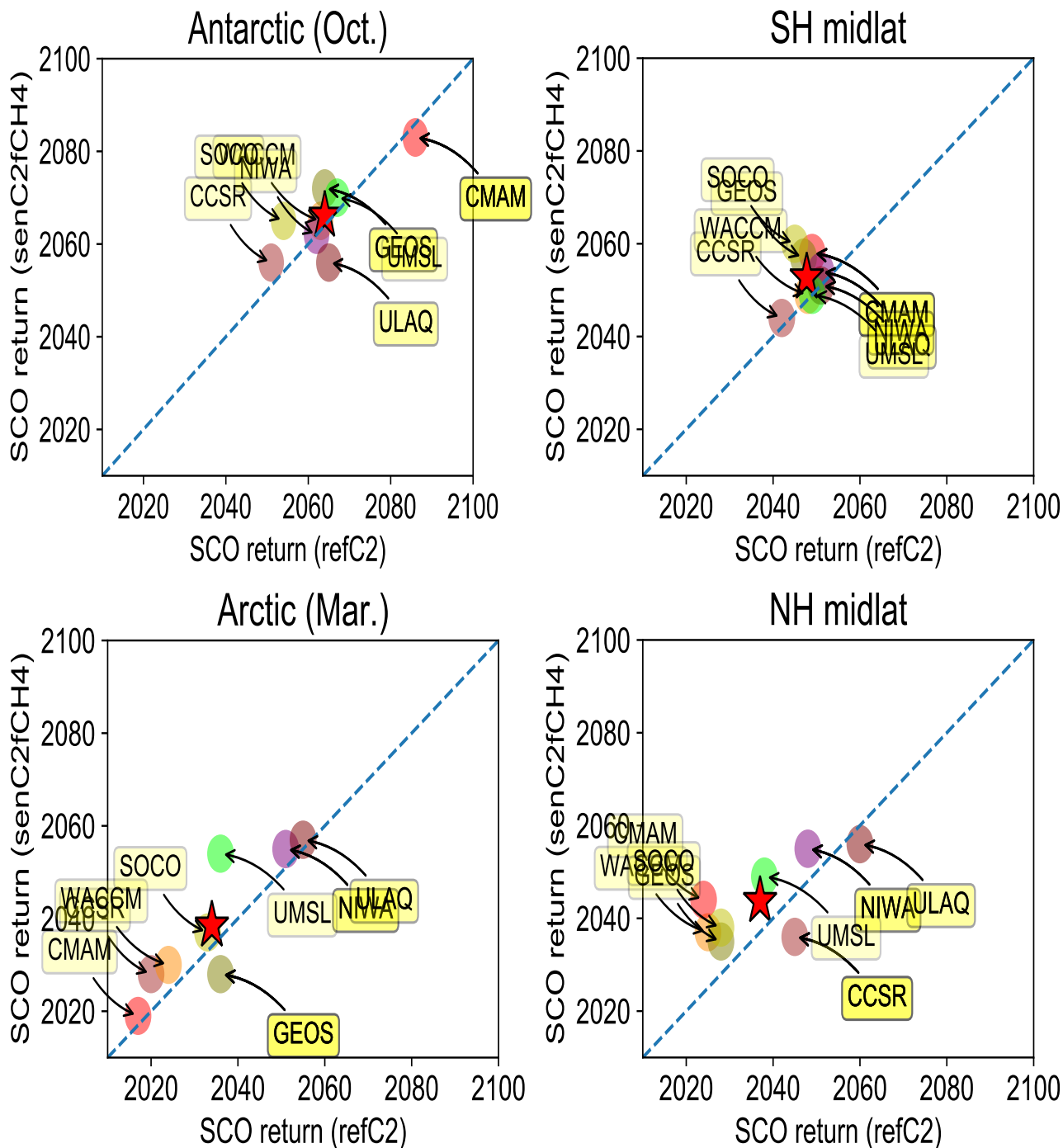


Figure S19. As Figure S17 but for simulation SEN-C2-fCH4.

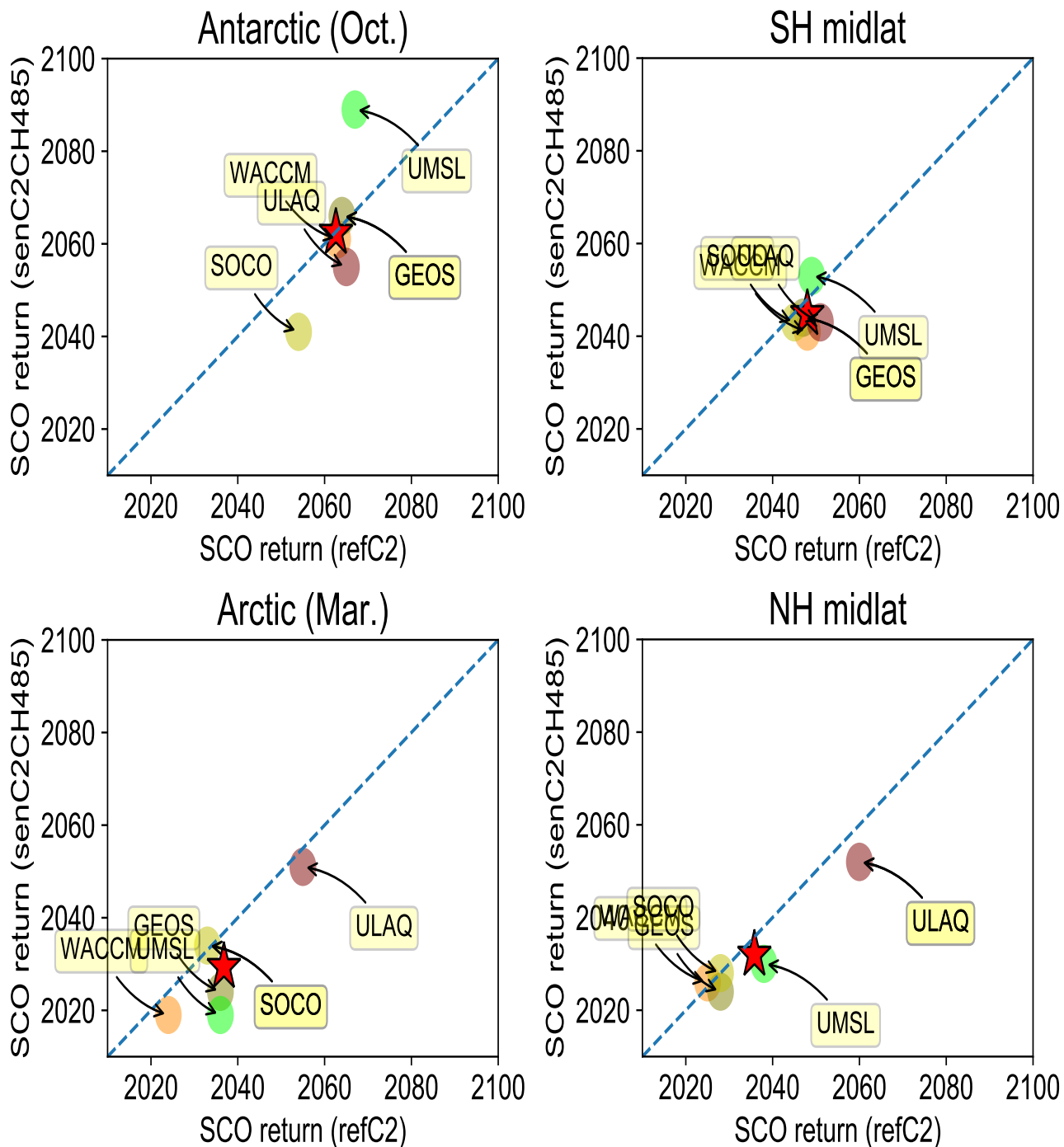


Figure S20. As Figure S17 but for simulation SEN-C2-CH4RCP85.