Supplementary material for Multi-model assessment of stratospheric ozone return dates and ozone recovery in CCMVal-2 models

V. Eyring, I. Cionni, G. E. Bodeker, A. J. Charlton-Perez, D. E. Kinnison, J. F. Scinocca, D. W. Waugh, H. Akiyoshi, S. Bekki, M. P. Chipperfield, M. Dameris, S. Dhomse, S. M. Frith, H. Garny, A. Gettelman, A. Kubin, U. Langematz, E. Mancini, M. Marchand, T. Nakamura, L. D. Oman, S. Pawson, G. Pitari, D. A. Plummer, E. Rozanov, T. G. Shepherd, K. Shibata, W. Tian, P. Braesicke, S. C. Hardiman, J. F. Lamarque, O. Morgenstern, J. A. Pyle, D. Smale, and Y. Yamashita

Correspondence to: Veronika Eyring (veronika.eyring@dlr.de)

In this supplementary material, we show Figure 1 of the primary article for the tropical, northern midlatitudes and southern midlatitudes annual mean (Figure S1) and for the Arctic March and Antarctic October mean (Figure S2). In addition, we show the individual models for the 1960 baseline-adjusted ozone (Figures S3 to S6), temperature (Figures S7 to S10), and total column ozone (Figures S12 and S13) projections for REF-B2, fODS and fGHG. As Figure 5, Figure S11 shows the 1960 baseline-adjusted annual mean w* between 20°S and 20°N at 70 hPa from REF-B2 and fGHG, but with the individual models added. Finally, we show Figure 4 of the primary article, but for the individual chemistry-climate models in the tropics (Figures S14 to S18), northern midlatitudes (Figures S19 to S23), southern midlatitudes (Figures S24 to S28), spring-time Arctic (Figures S29 to S33) and spring-time Antarctic (Figures S34 to S38)**.** All information found in the supplementary material is also referred to in the primary article. For presentations, two animations are included in the supplementary material that show the development of decadal multi-model mean total column ozone from the 1960s to the 2090s over the Antarctic in October and over the Arctic in March from the 17 CCMs reference simulations.

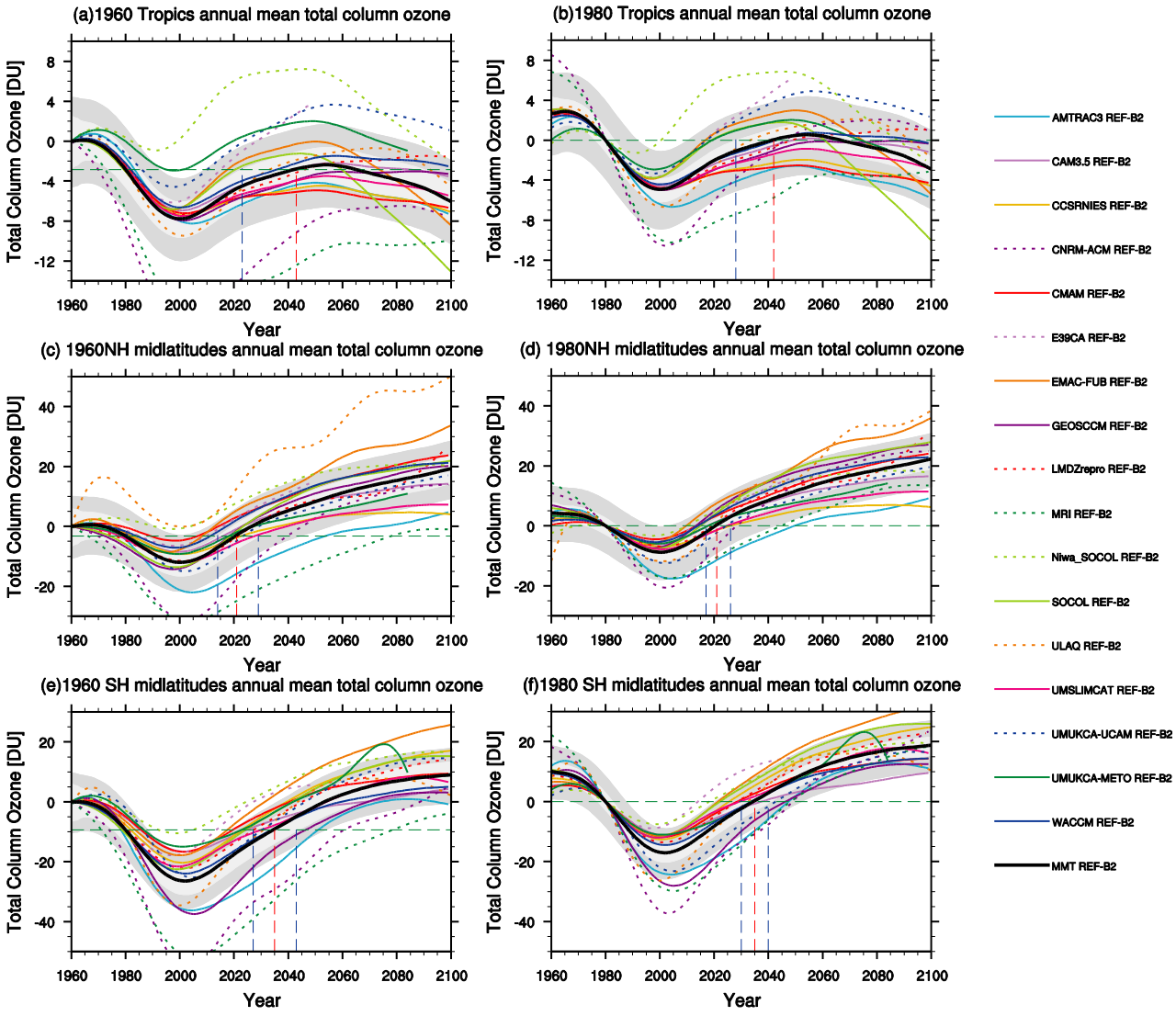

Figure S1. Same as Figure 1, but 1960 (left) and 1980 (right) baseline-adjusted annual mean global total ozone column from the 17 reference simulations (REF-B2) for the tropics (upper row), northern midlatitudes (middle row) and southern midlatitudes (lower row).

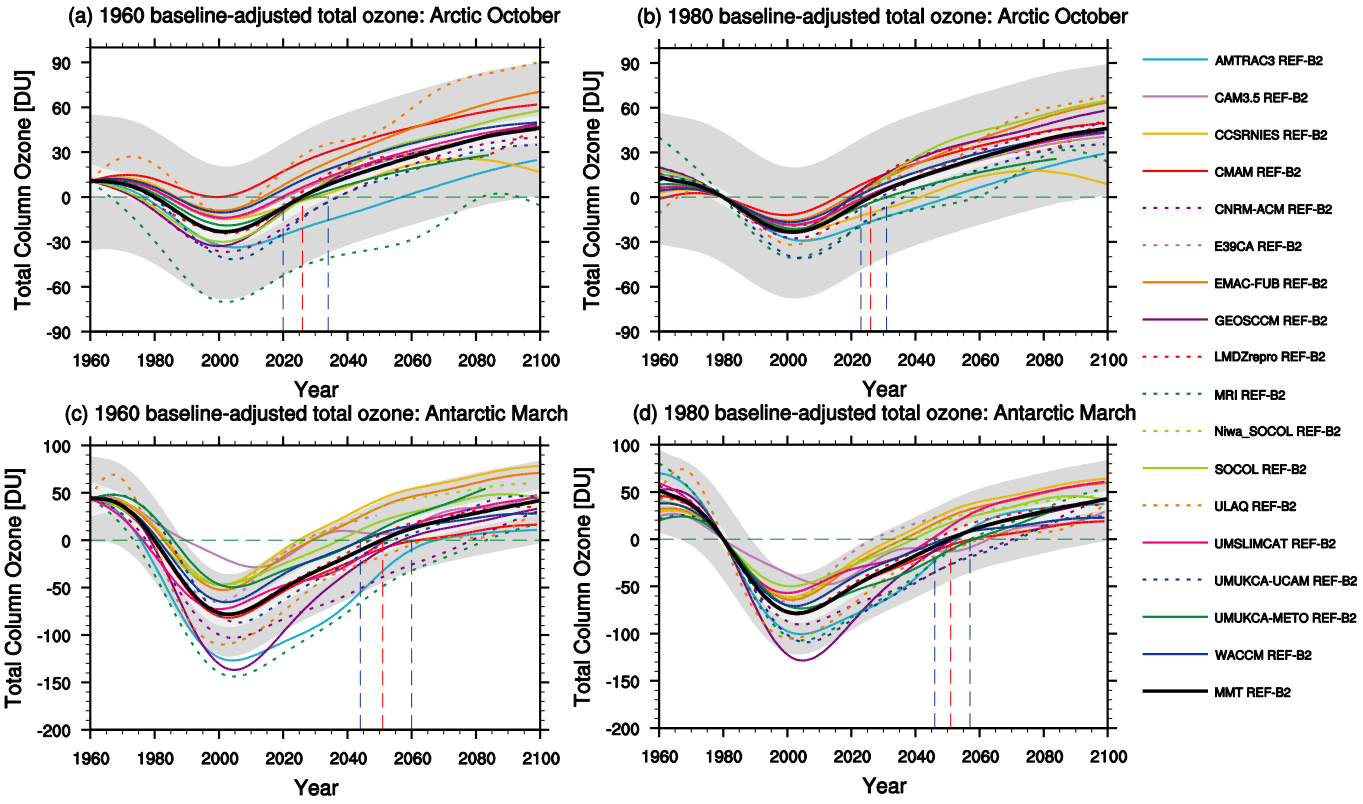

Figure S2. Same as Figure 1, but 1960 (left) and 1980 (right) baseline-adjusted global total ozone column from the 17 reference simulations (REF-B2) for the Arctic March mean (upper row) and the Antarctic October mean (lower row).

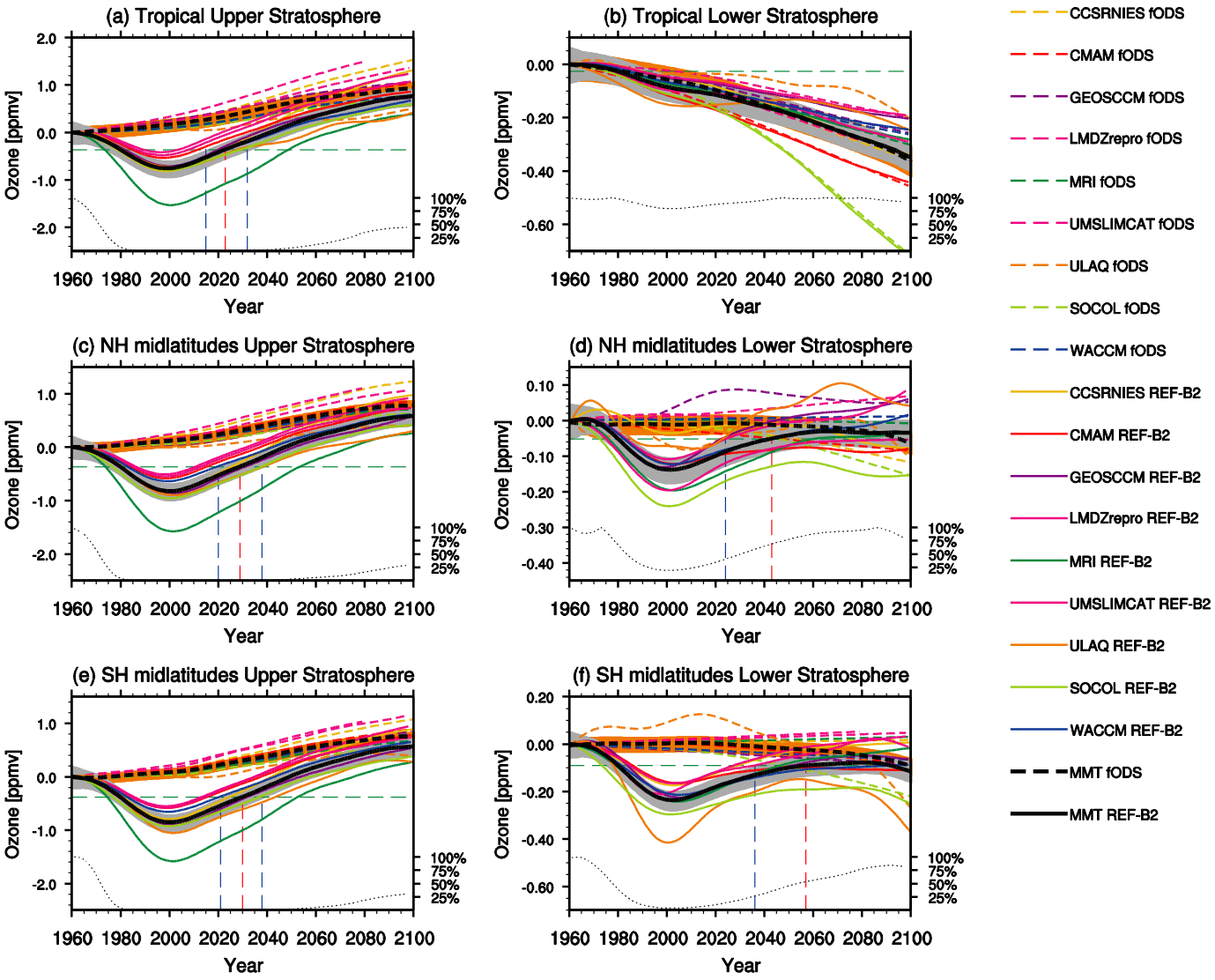

Figure S3. Same as Figure 2, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fODS (dashed lines and orange shaded area).

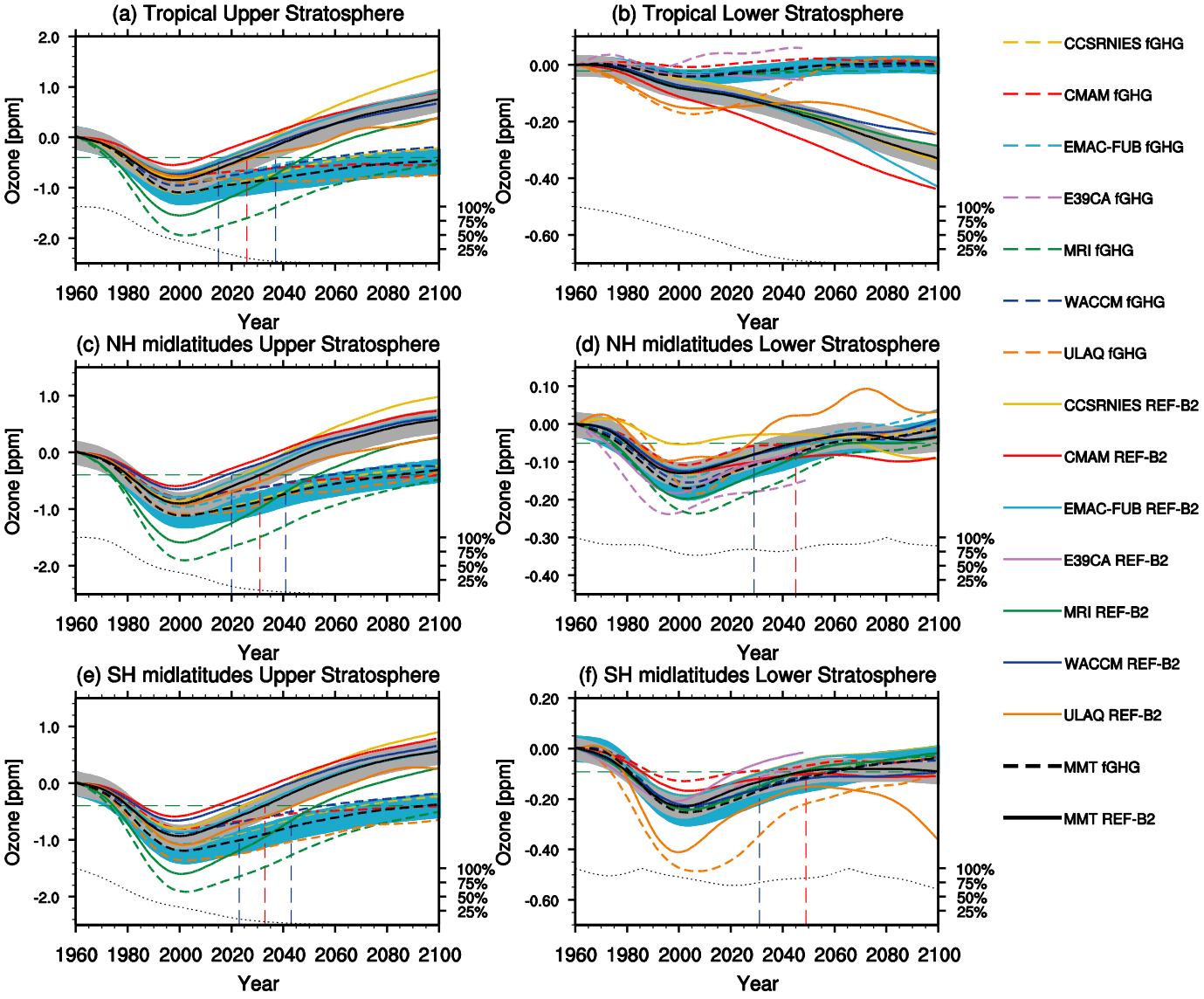

Figure S4. Same as Figure 2, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fGHG (dashed lines and blue shaded area).

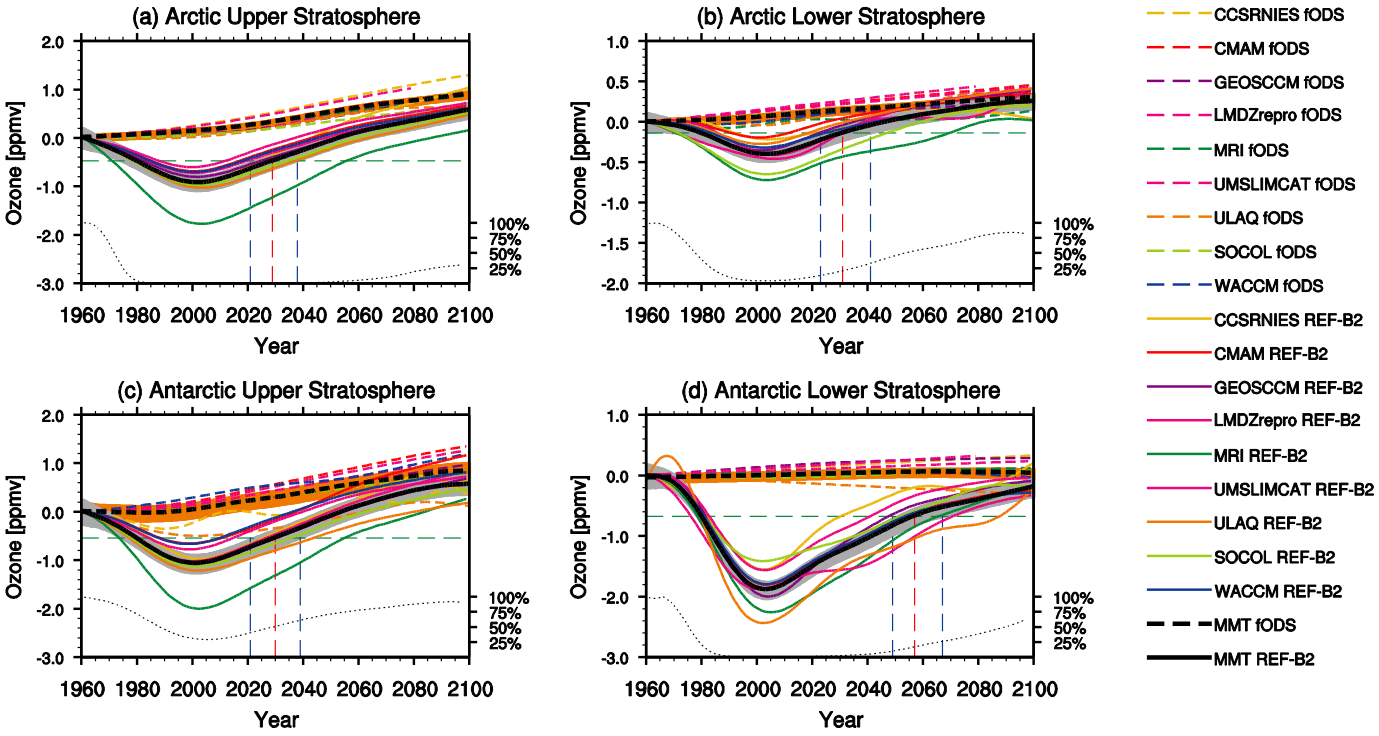

Figure S5. Same as Figure 8, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fODS (dashed lines and orange shaded area).

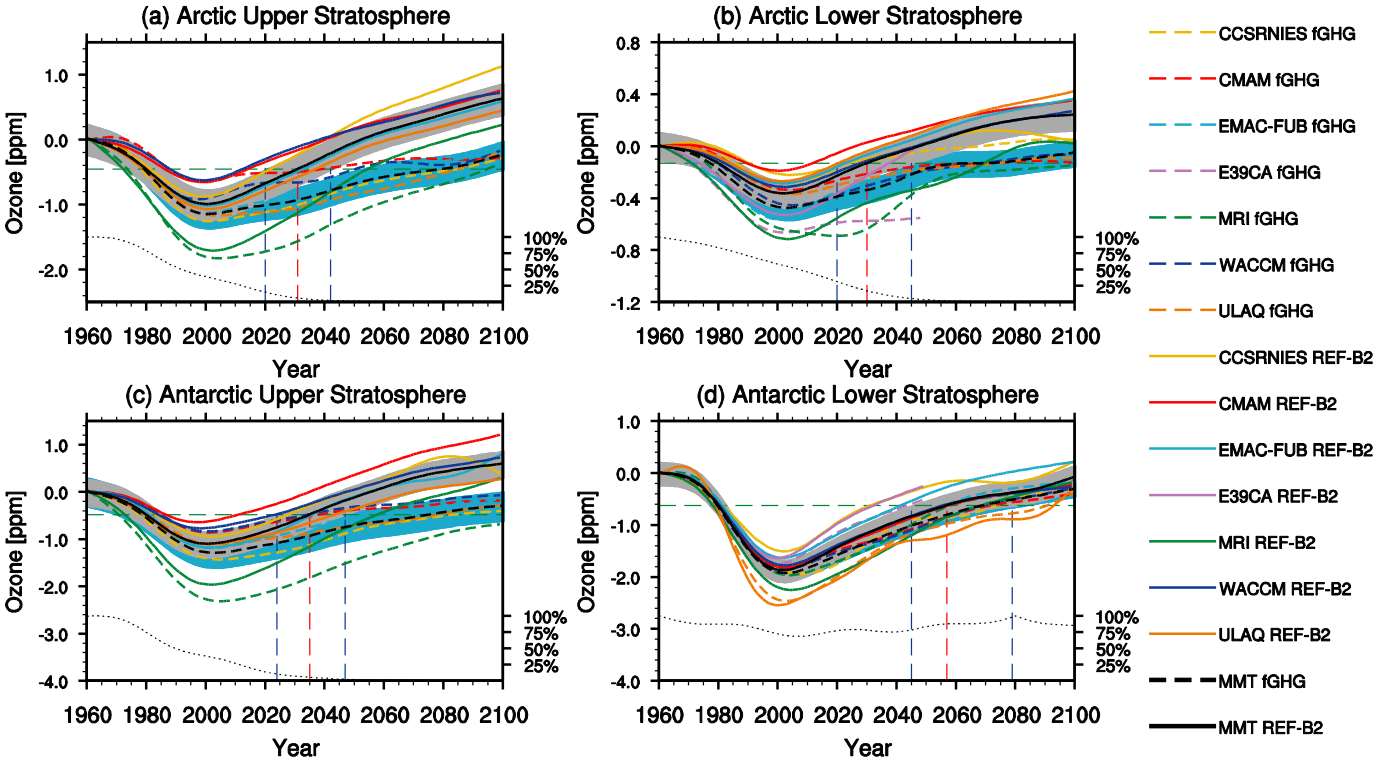

Figure S6. Same as Figure 8, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fGHG (dashed lines and blue shaded area).

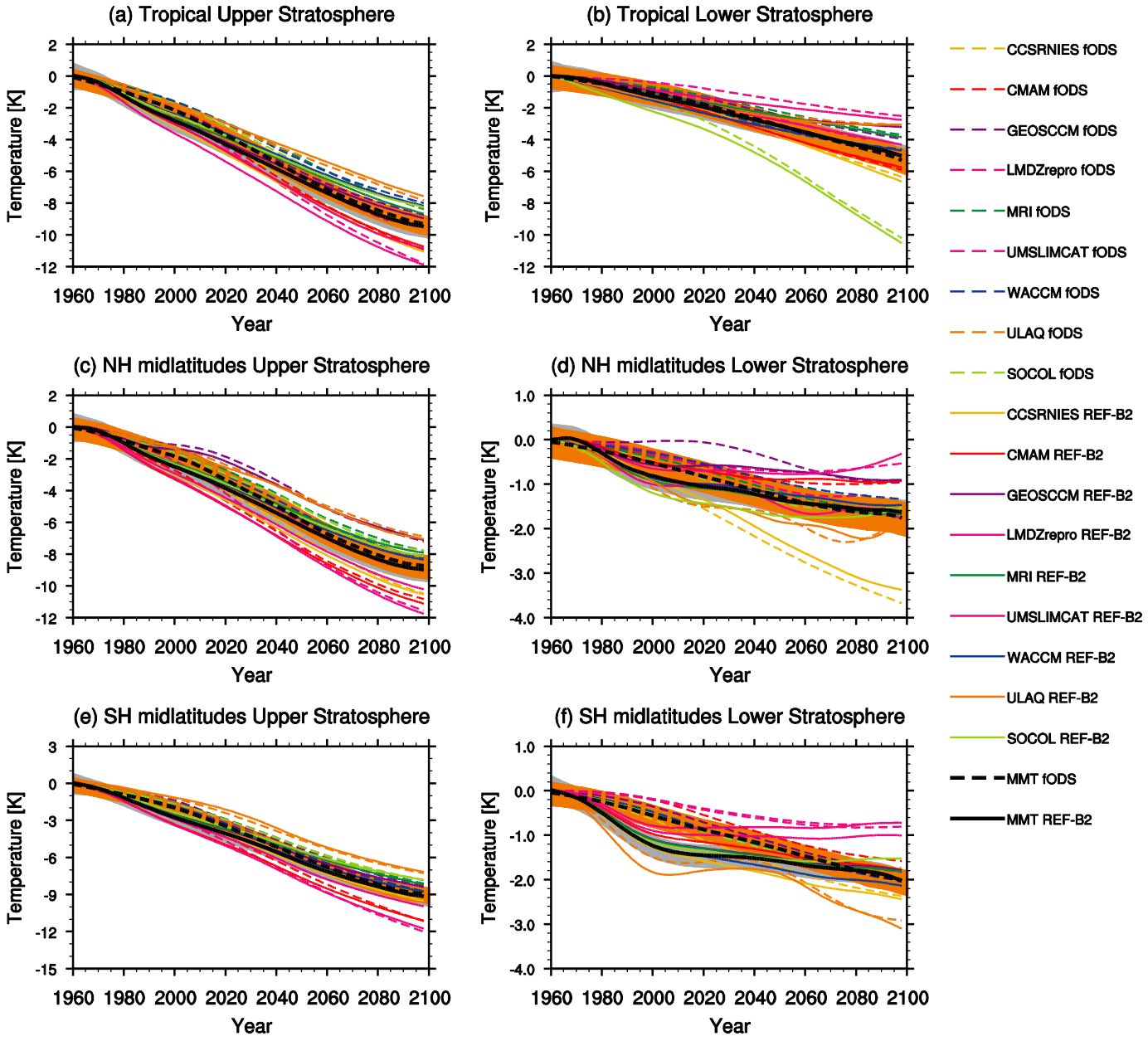

Figure S7. Same as Figure 3, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fODS (dashed lines and orange shaded area).

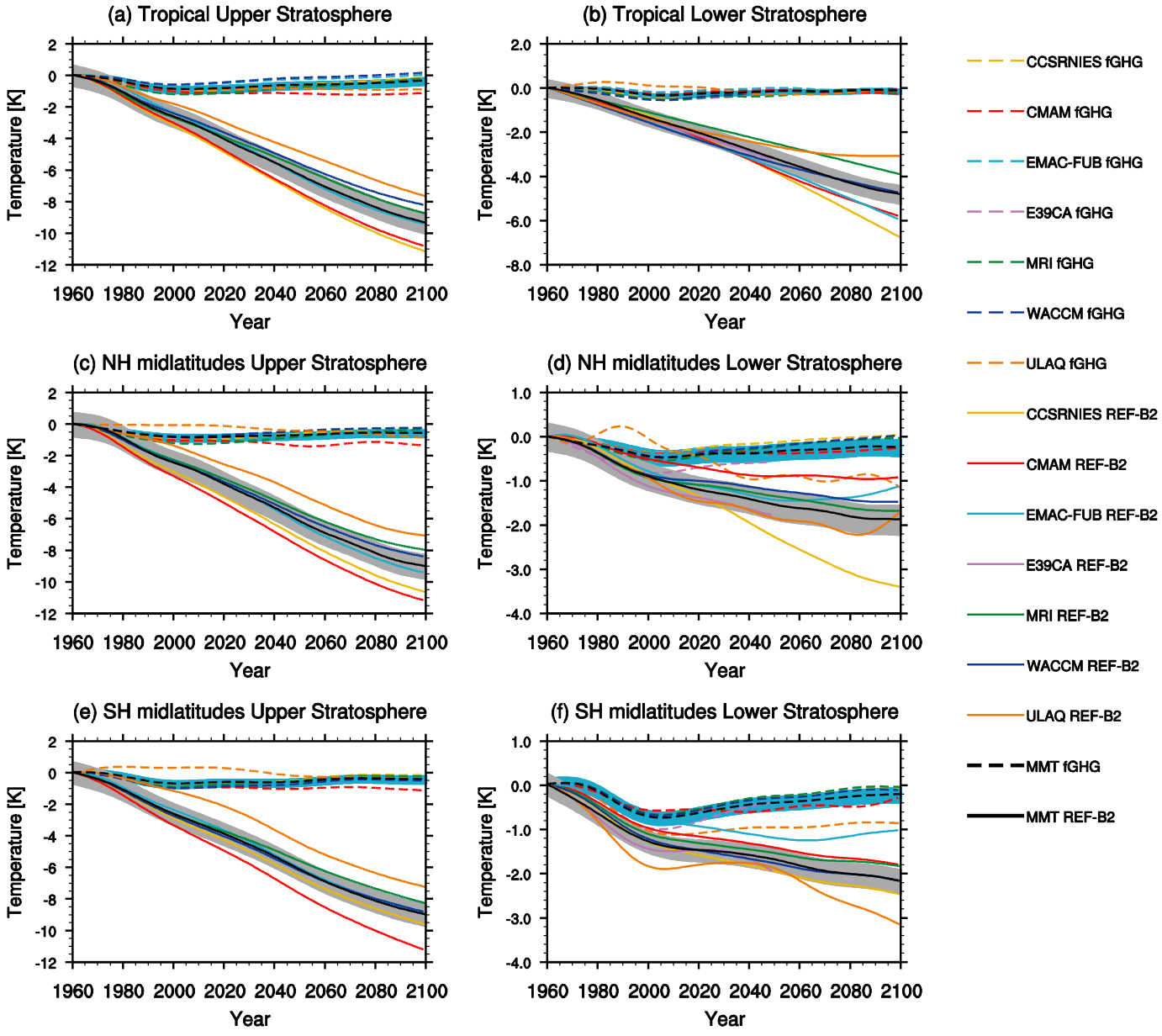

Figure S8. Same as Figure 3, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fGHG (dashed lines and blue shaded area).

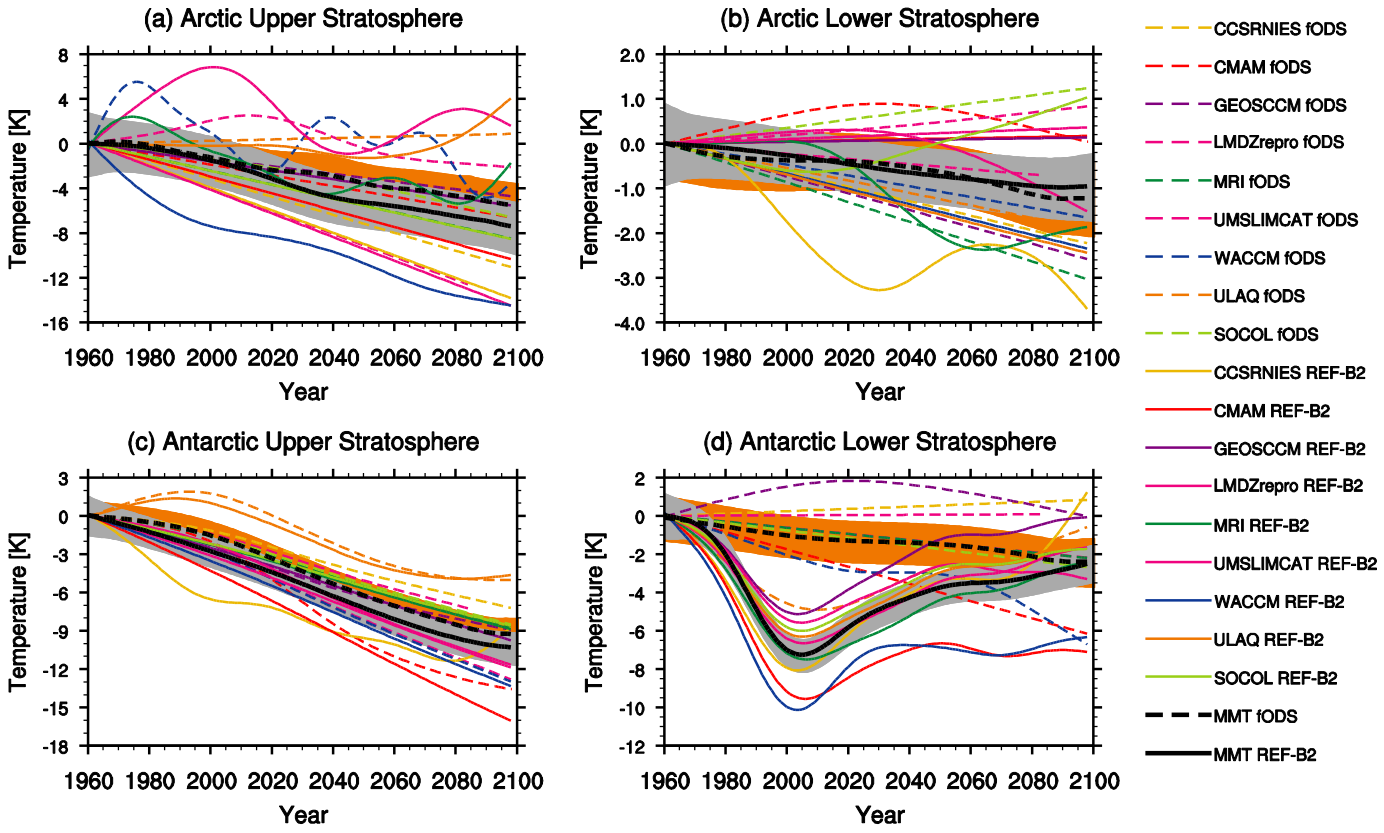

Figure S9. Same as Figure 9, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fODS (dashed lines and orange shaded area).

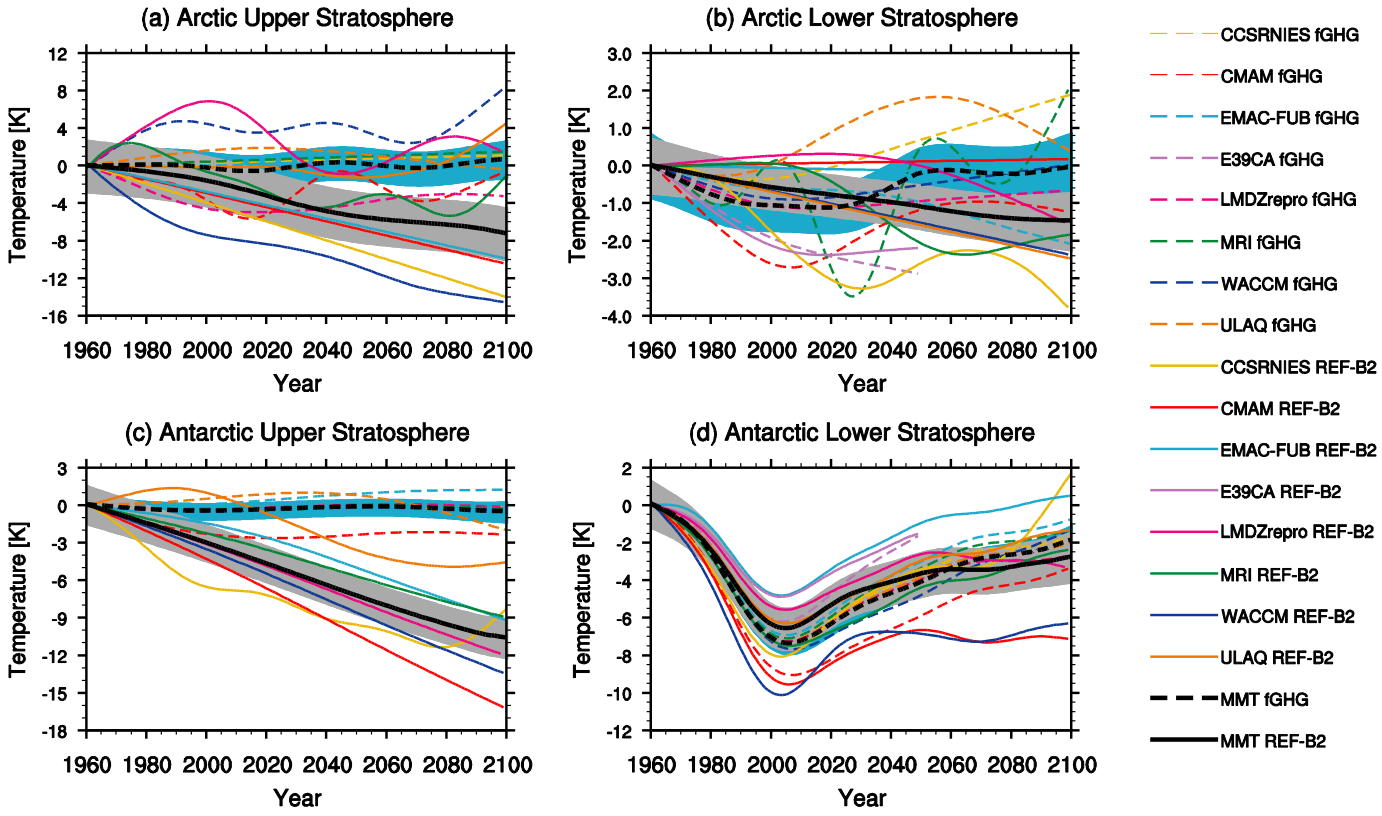

Figure S10. Same as Figure 9, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fGHG (dashed lines and blue shaded area).

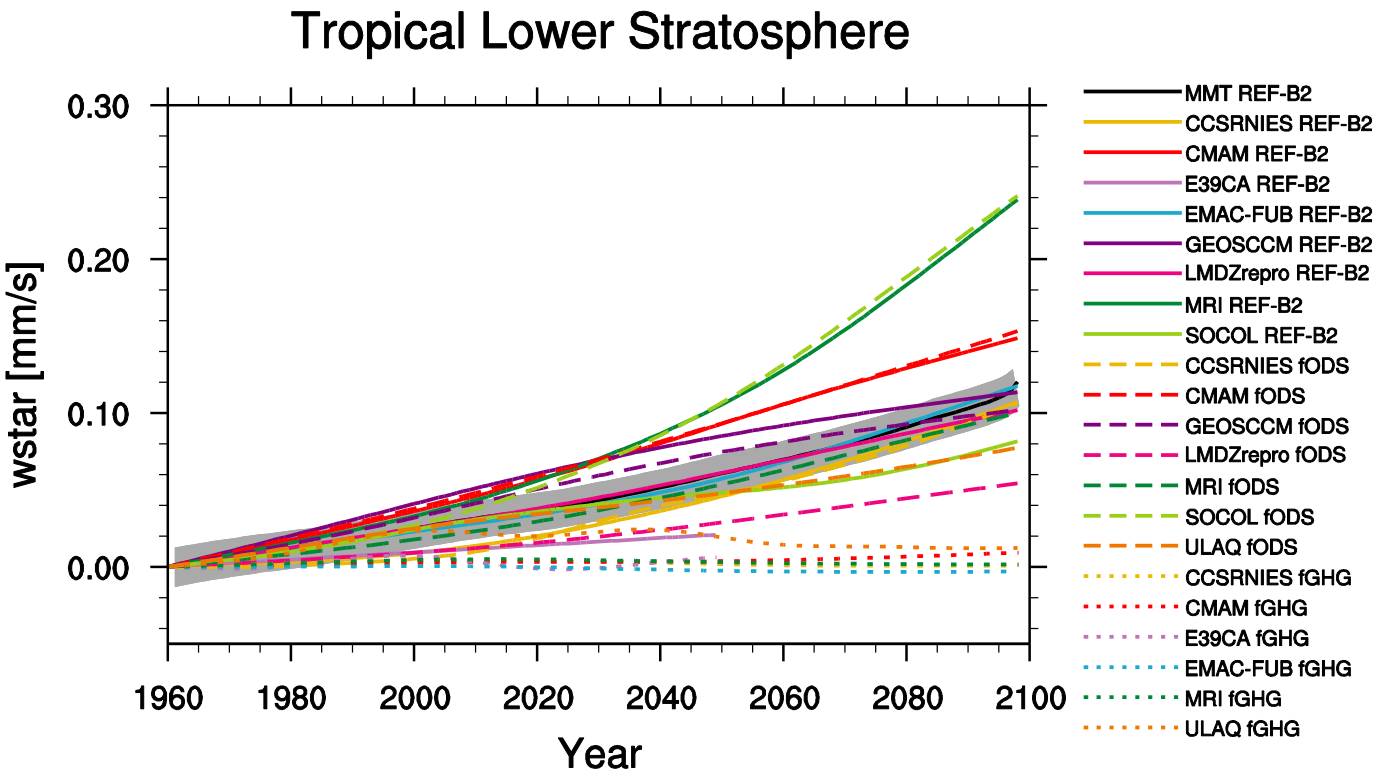

Figure S11. Same as Figure 5, but with individual models added.

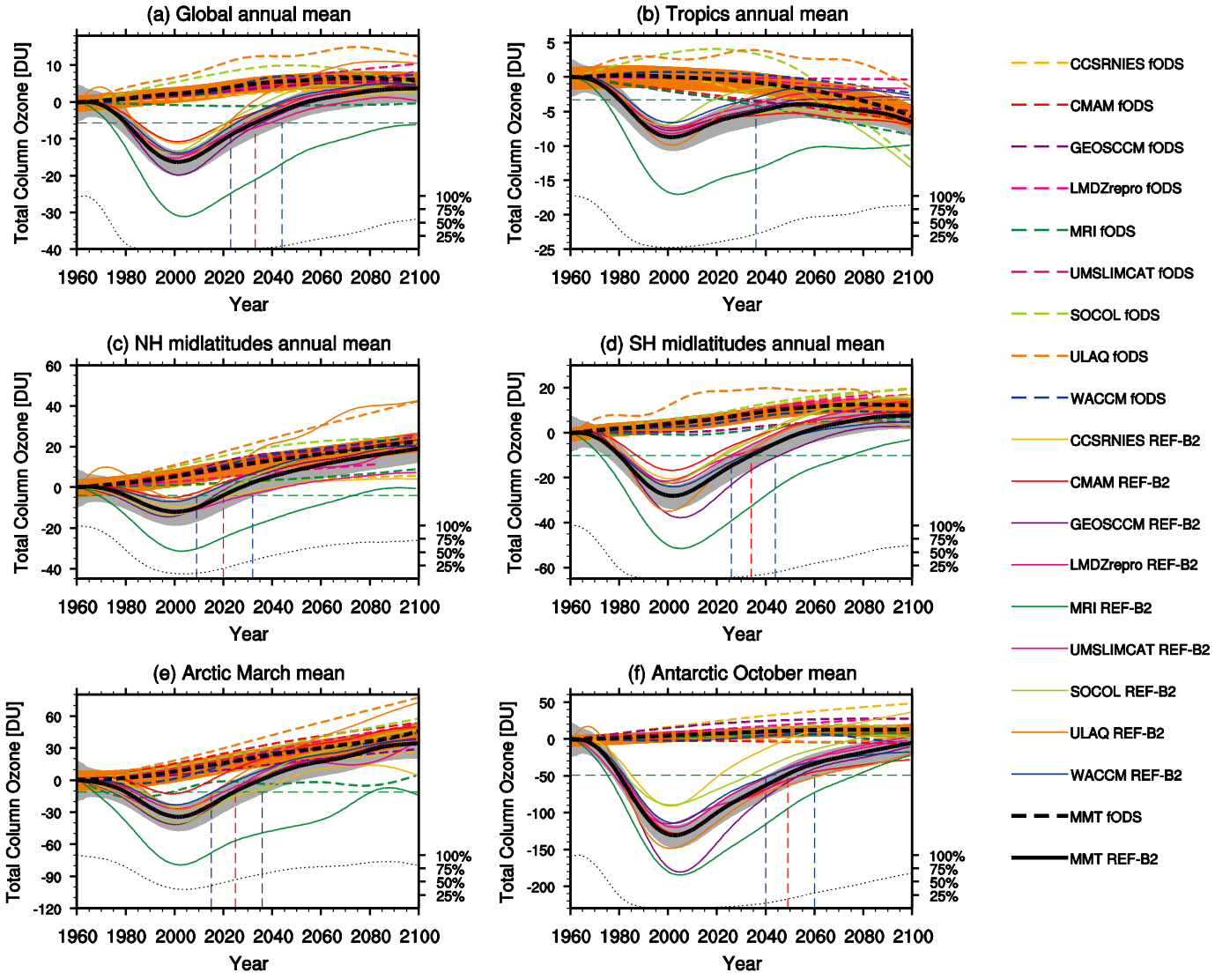

Figure S12. Same as Figure 6, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fODS (dashed lines and orange shaded area).

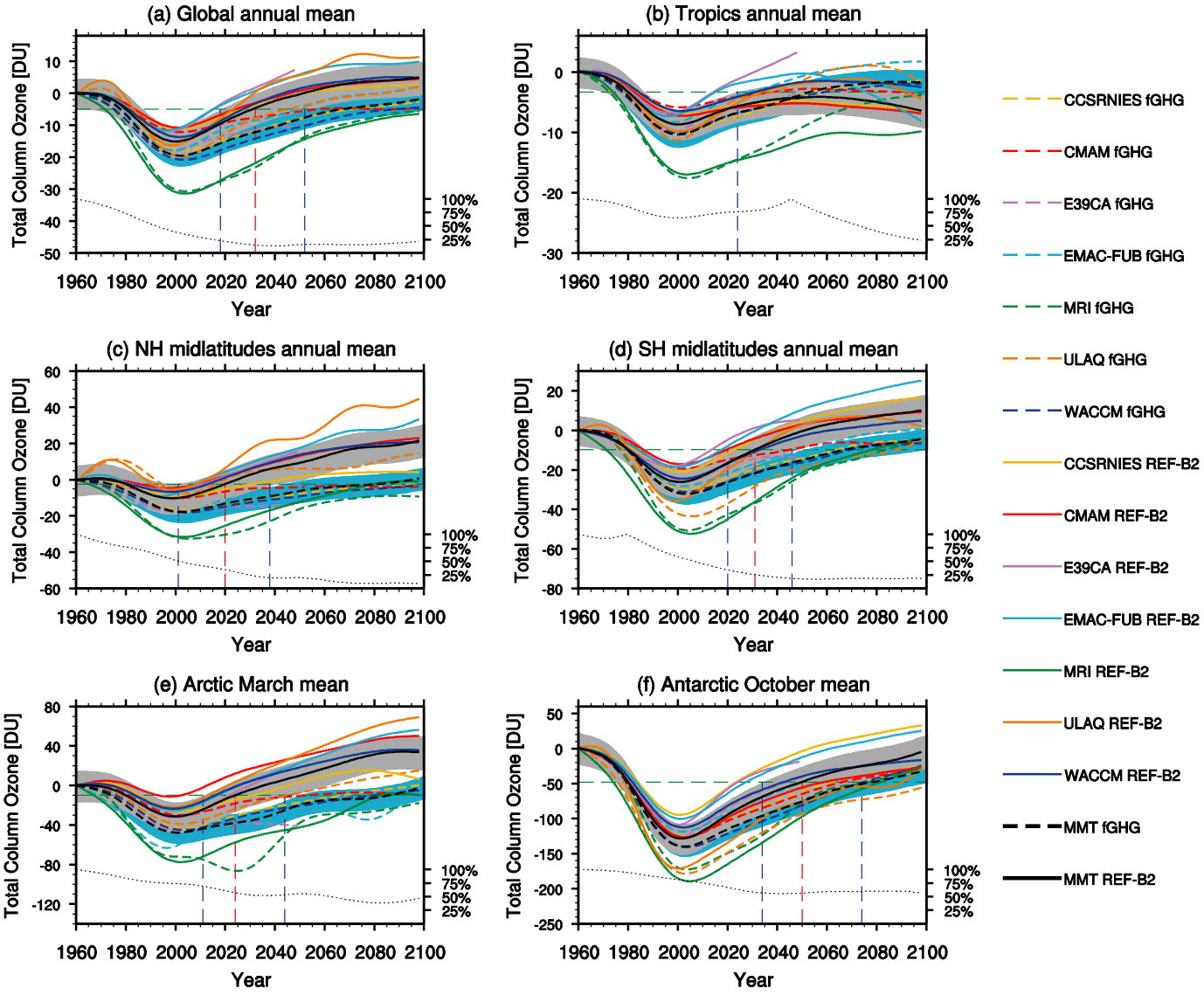

Figure S13. Same as Figure 6, but with individual models added and only for REF-B2 (solid lines and grey shaded area) and fGHG (dashed lines and blue shaded area).

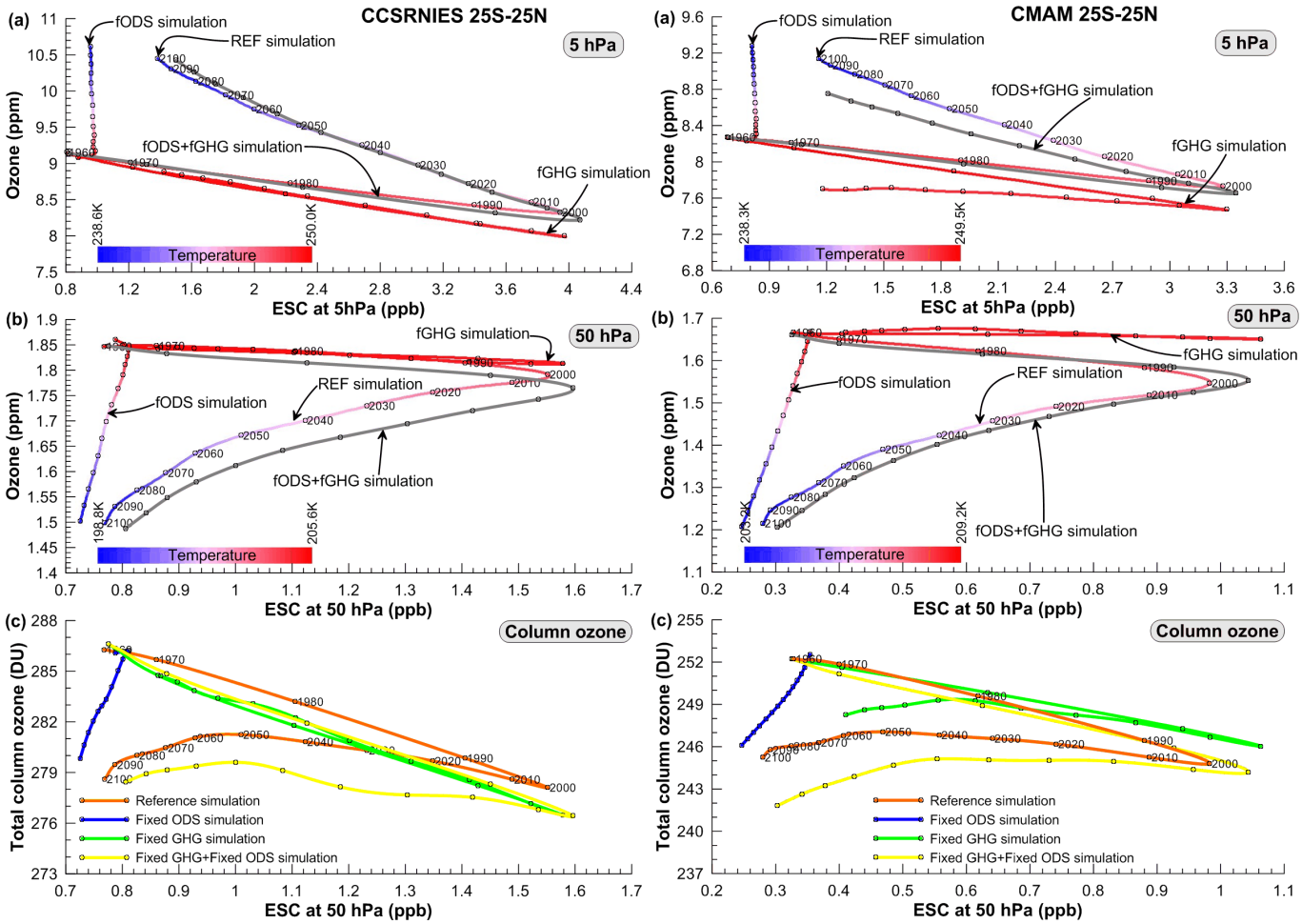

Figure S14. Same as Figure 4, but for CCSRNIES (left) and CMAM (right) in the tropics (25°S-25°N annual mean).

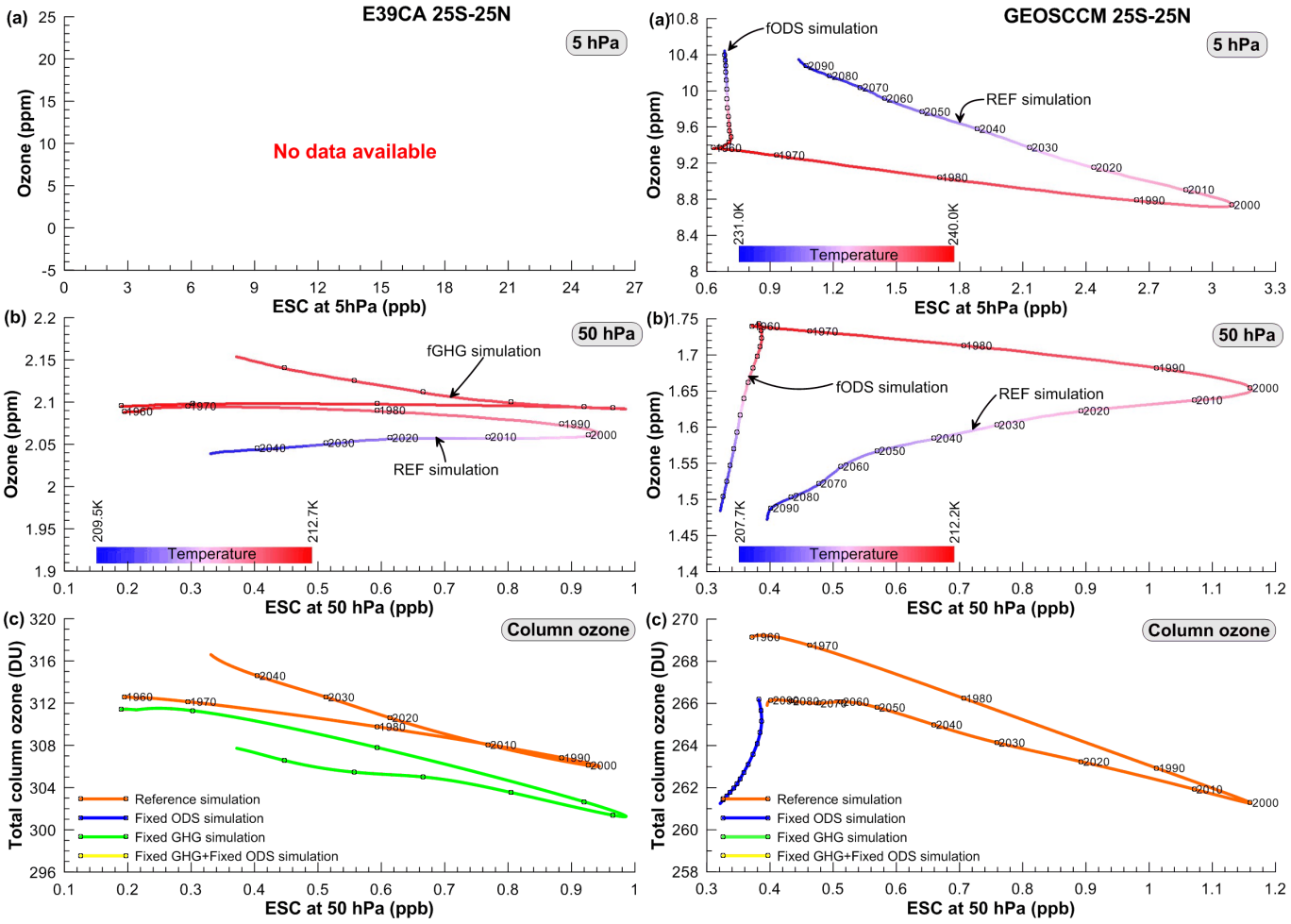

Figure S15. Same as Figure 4, but for E39CA (left) and GEOSCCM (right) in the tropics (25°S-25°N annual mean).

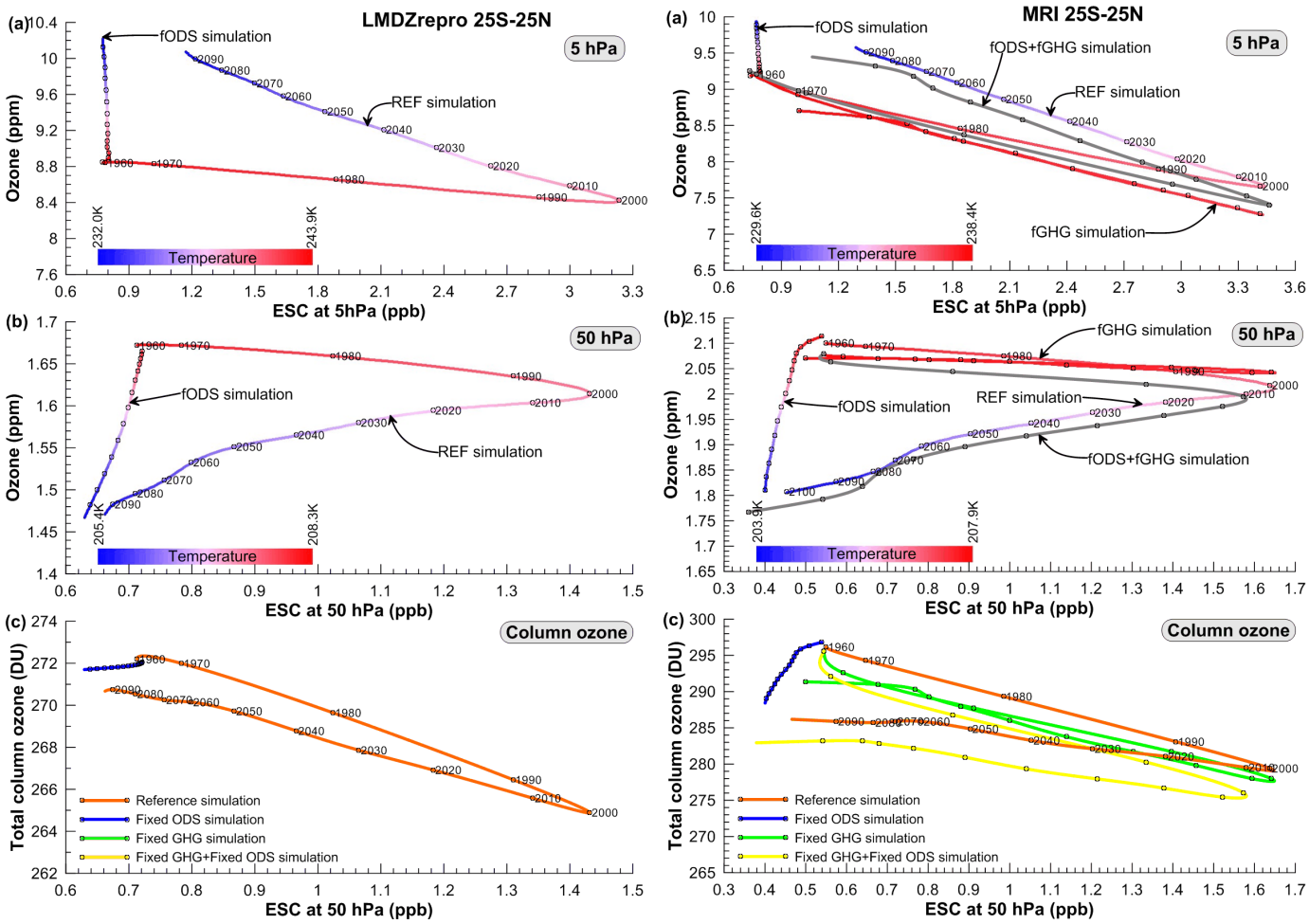

Figure S16. Same as Figure 4, but for LMDZrepro (left) and MRI (right) in the tropics (25°S-25°N annual mean).

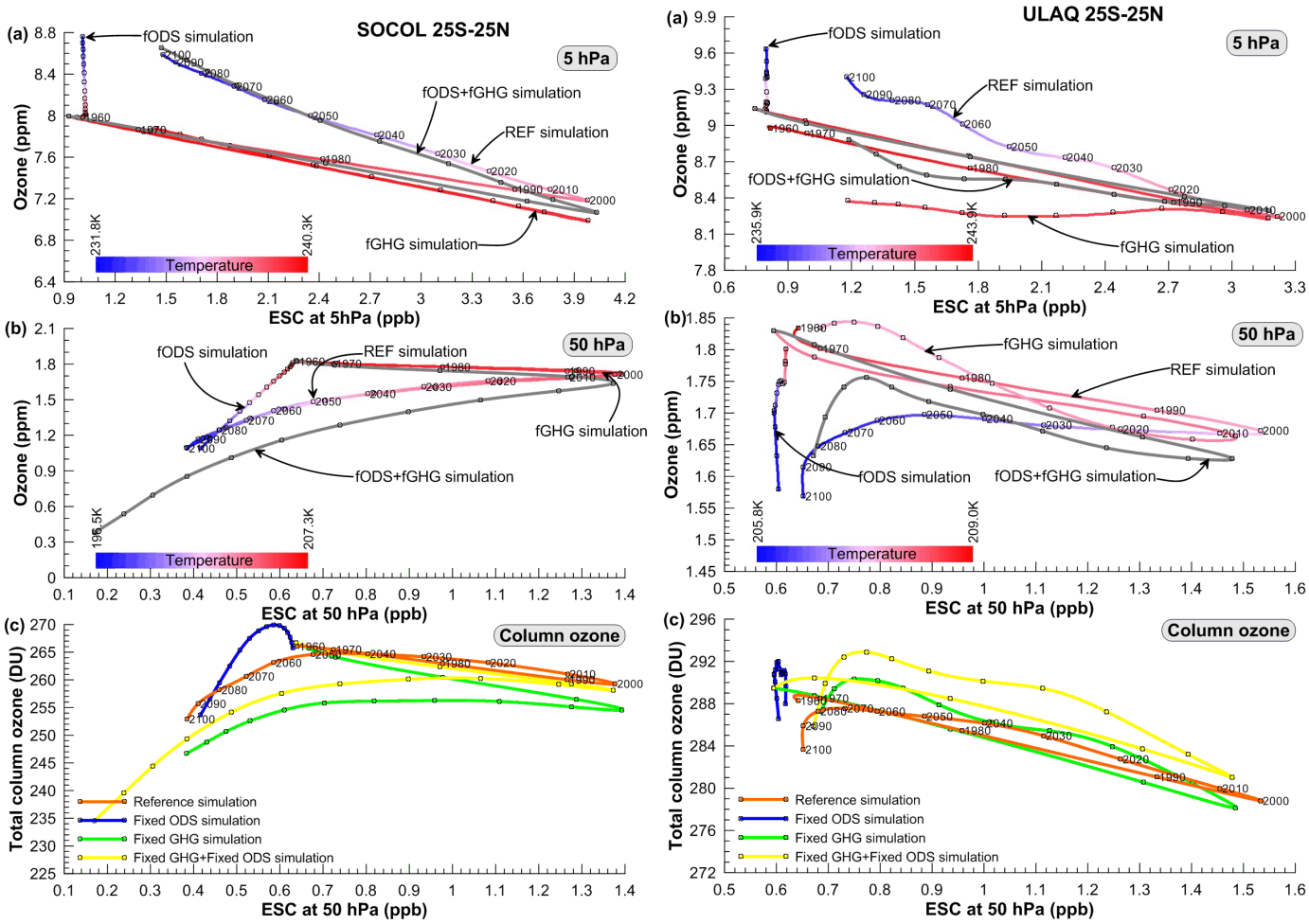

Figure S17. Same as Figure 4, but for SOCOL (left) and ULAQ (right) in the tropics (25°S-25°N annual mean). Note that the SOCOL fGHG simulation is carried out with varying SSTs and SICs instead of fixed at 1960 conditions as in all other simulations. The simulation is therefore not included in the fGHG multi-model mean in the main paper.

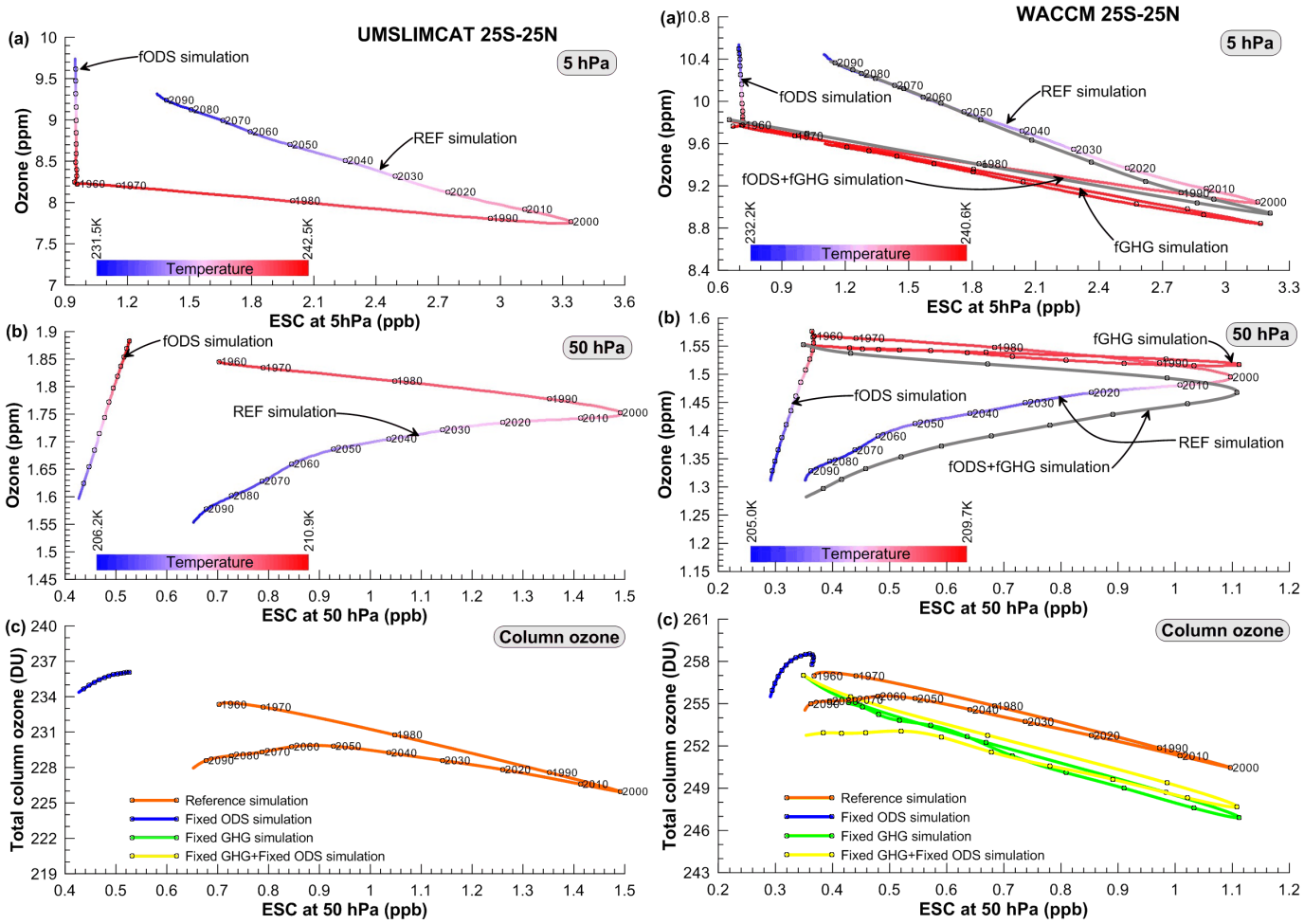

Figure S18. Same as Figure 4, but for UMSLIMCAT (left) and WACCM (right) in the tropics (25°S-25°N annual mean).

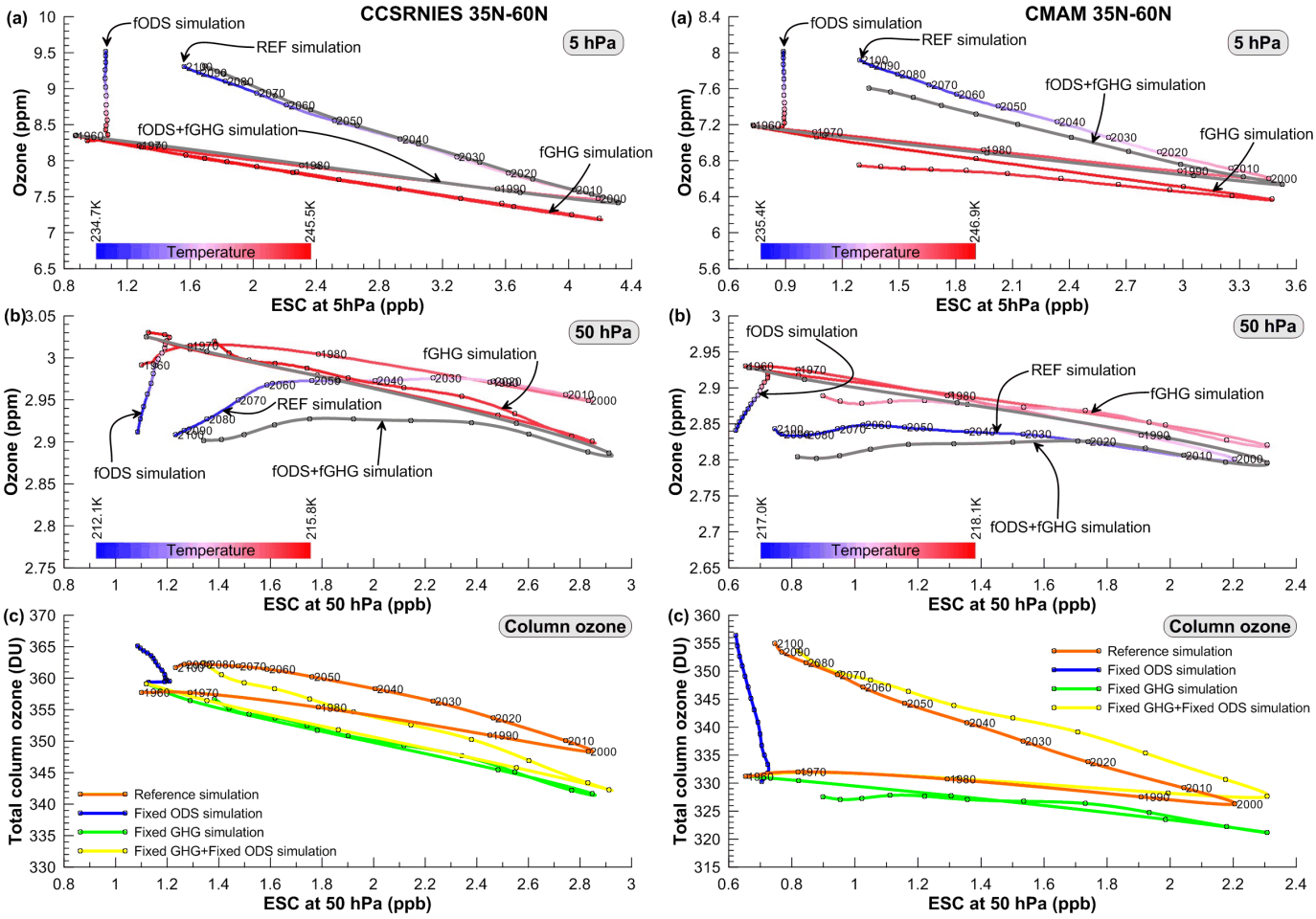

Figure S19. Same as Figure 4, but northern midlatitudes for CCSRNIES (left) and CMAM (right).

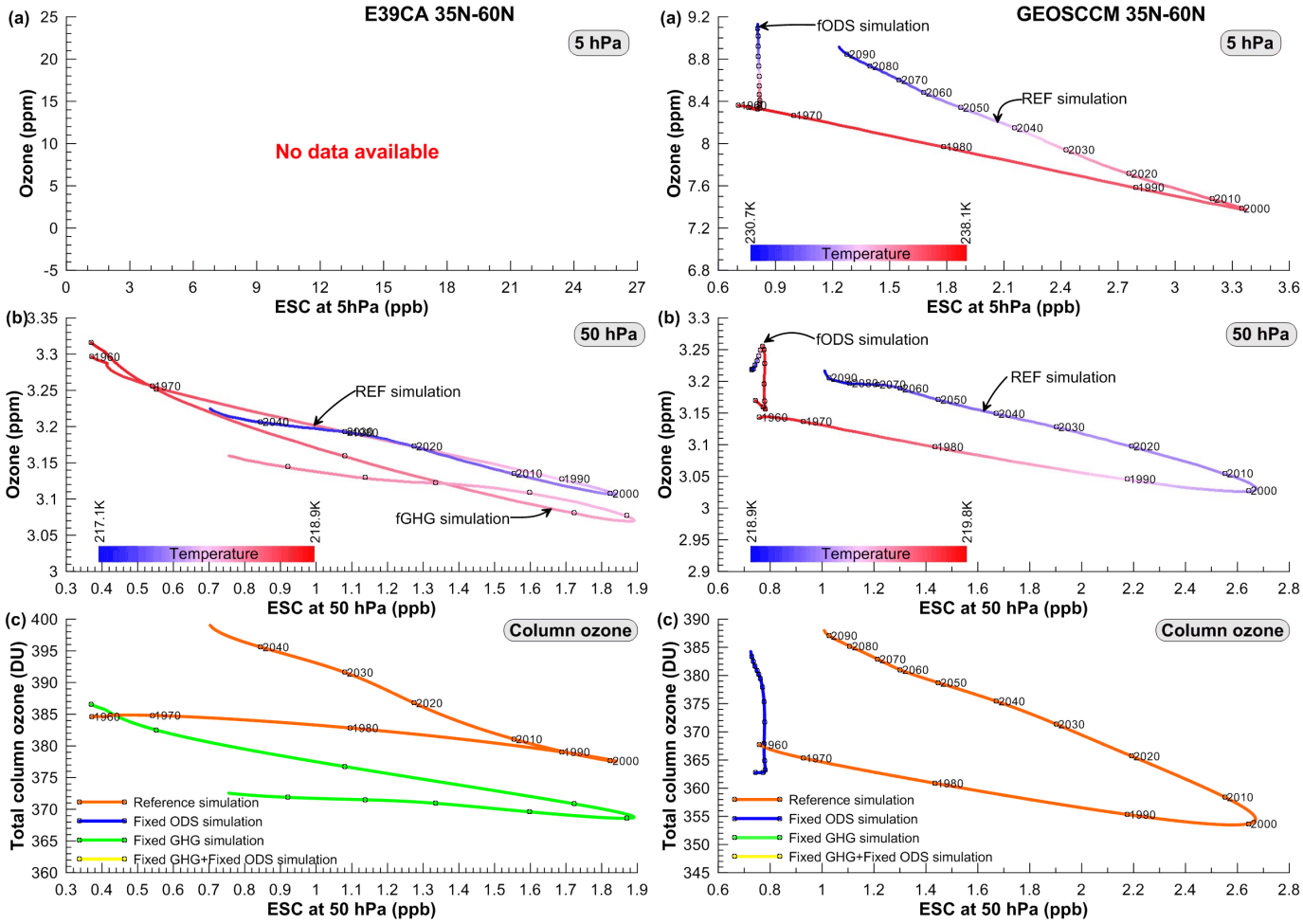

Figure S20. Same as Figure 4, but northern midlatitudes for E39CA (left) and GEOSCCM (right).

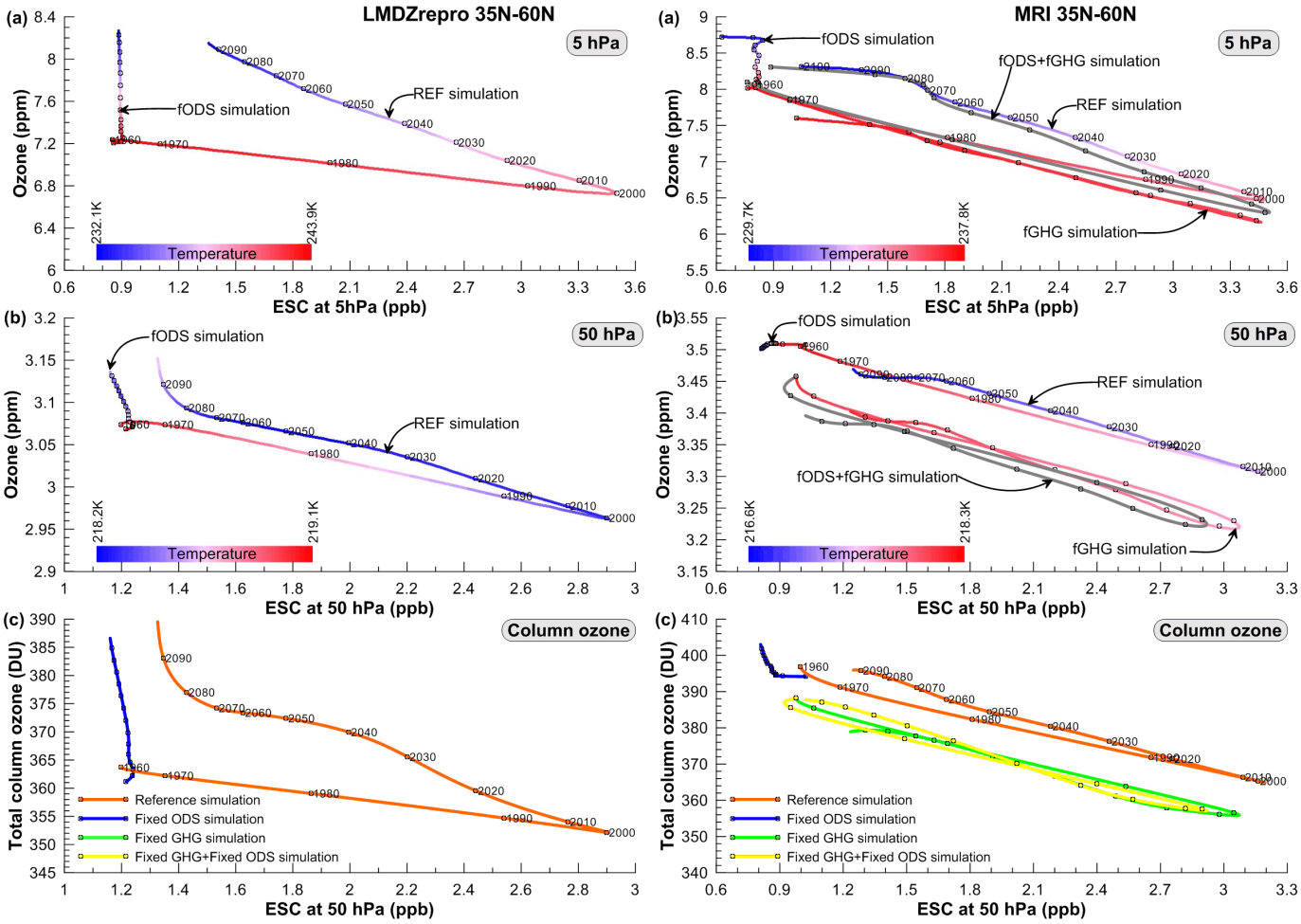

Figure S21. Same as Figure 4, but northern midlatitudes for LMDZrepro (left) and MRI (right).

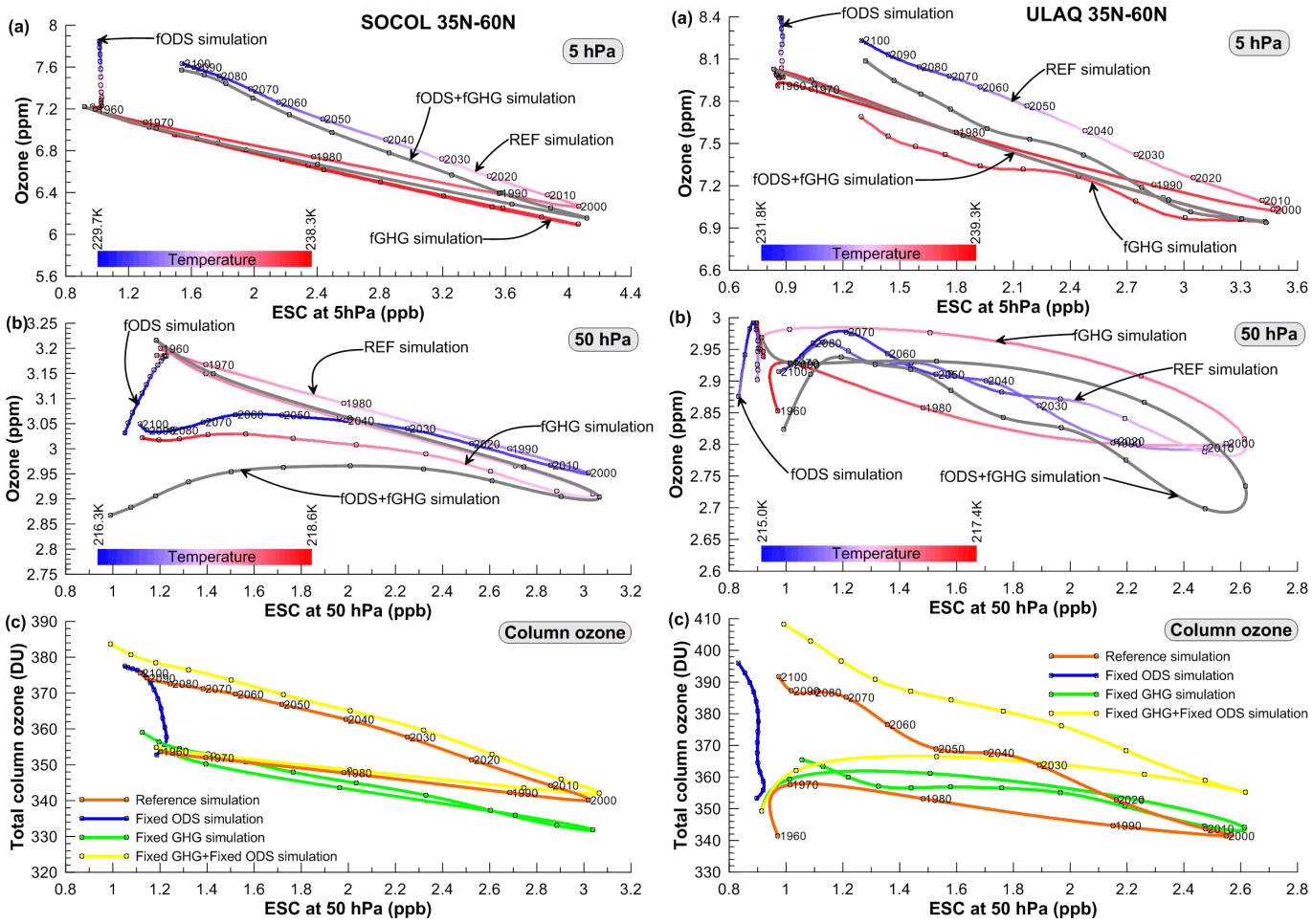

Figure S22. Same as Figure 4, but northern midlatitudes for SOCOL (left) and ULAQ (right). Note that the SOCOL fGHG simulation is carried out with varying SSTs and SICs instead of fixed at 1960 conditions as in all other simulations. The simulation is therefore not included in the fGHG multi-model mean in the main paper.

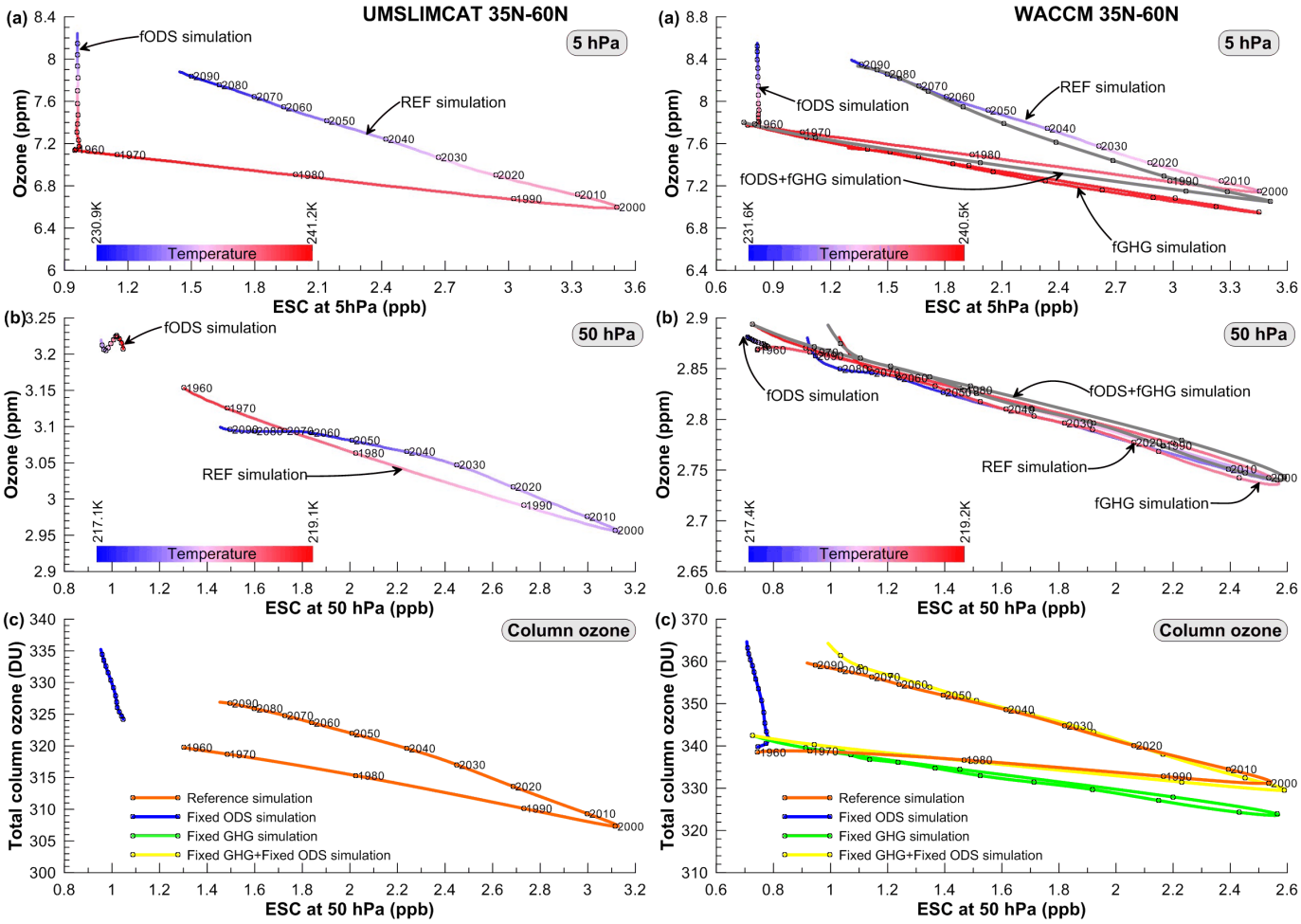

Figure S23. Same as Figure 4, but northern midlatitudes for UMSLIMCAT (left) and WACCM (right).

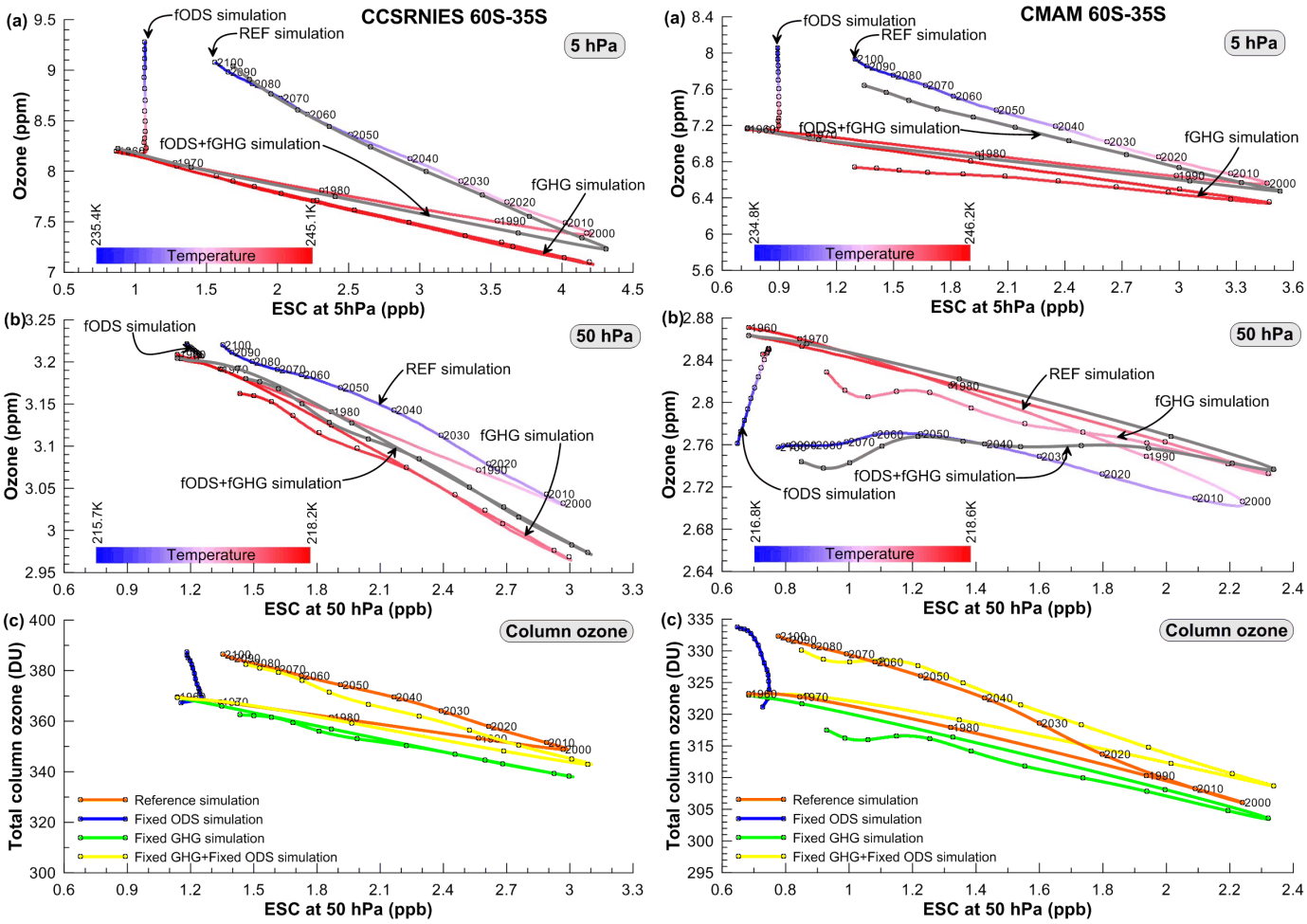

Figure S24. Same as Figure 4, but southern midlatitudes for CCSRNIES (left) and CMAM (right).

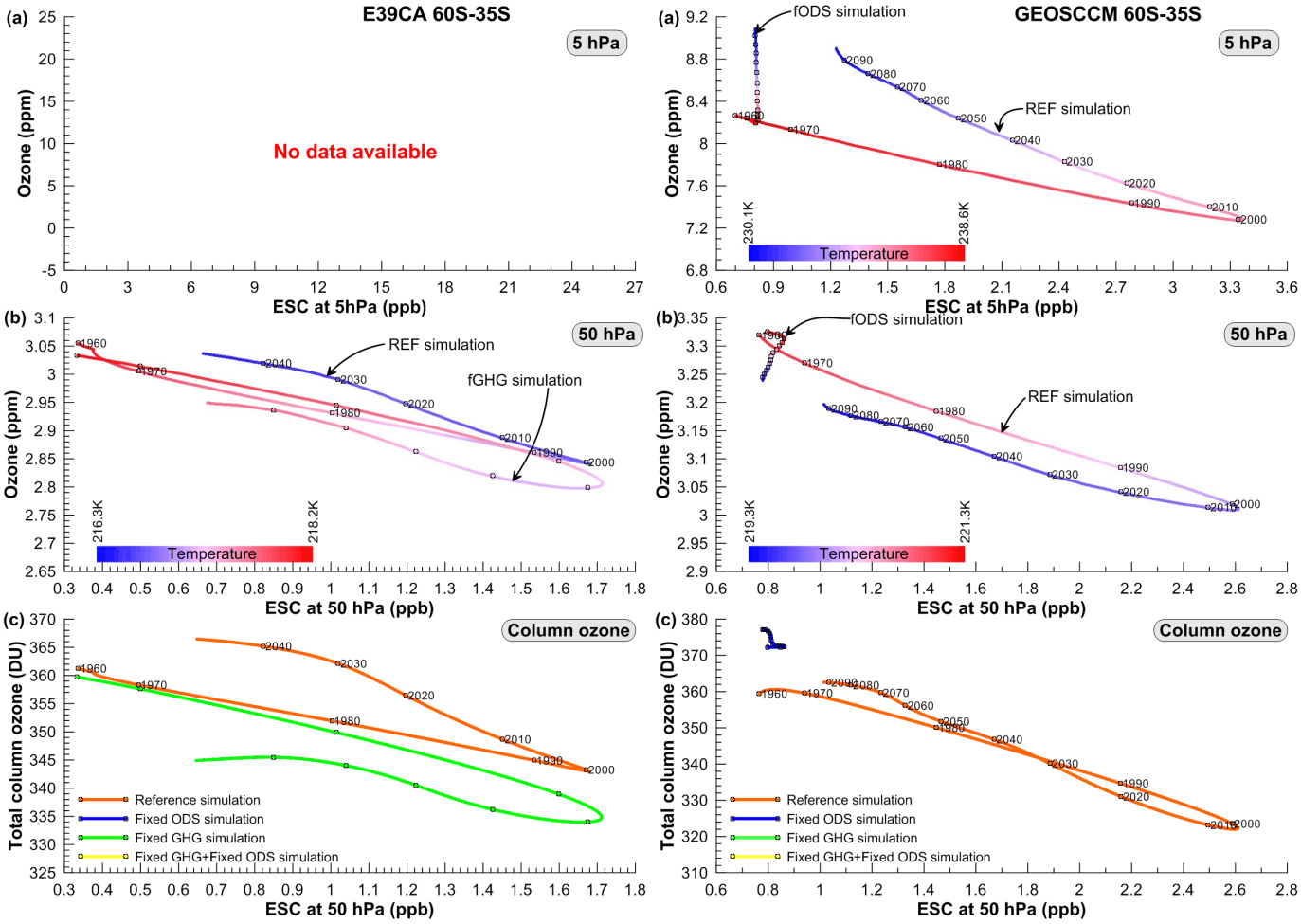

Figure S25. Same as Figure 4, but southern midlatitudes for E39CA (left) and GEOSCCM (right).

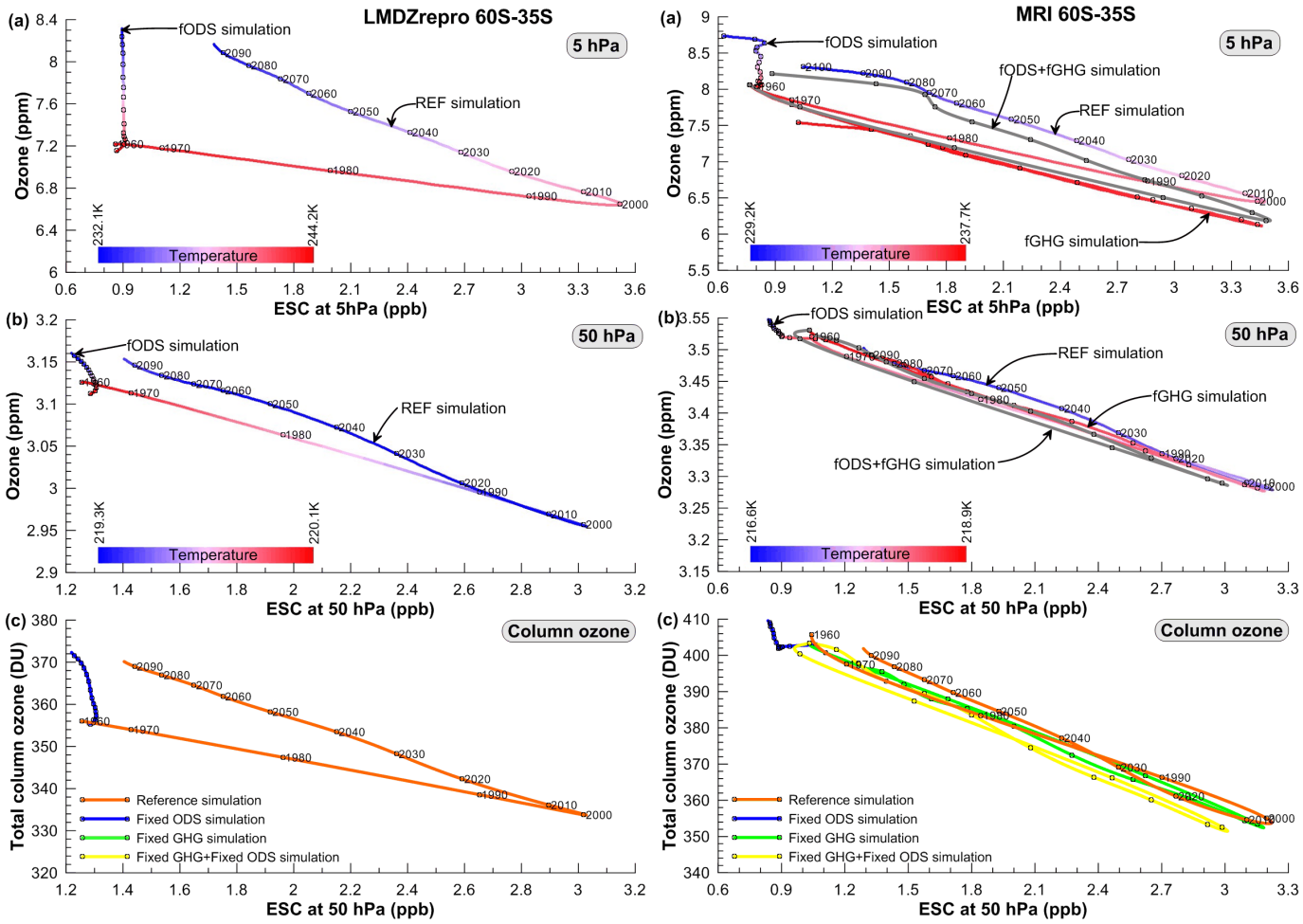

Figure S26. Same as Figure 4, but southern midlatitudes for LMDZrepro (left) and MRI (right).

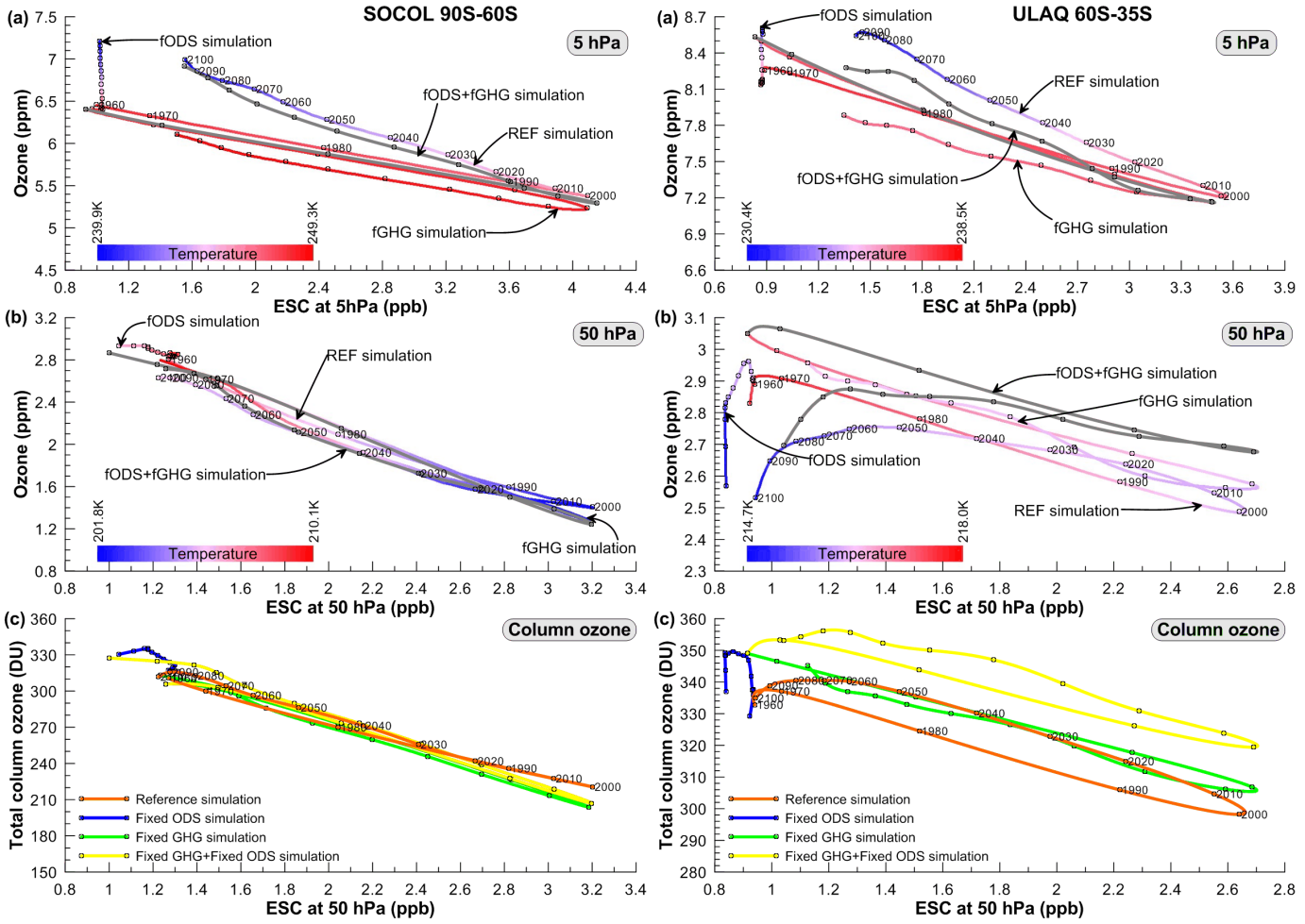

Figure S27. Same as Figure 4, but southern midlatitudes for SOCOL (left) and ULAQ (right). Note that the SOCOL fGHG simulation is carried out with varying SSTs and SICs instead of fixed at 1960 conditions as in all other simulations. The simulation is therefore not included in the fGHG multi-model mean in the main paper.

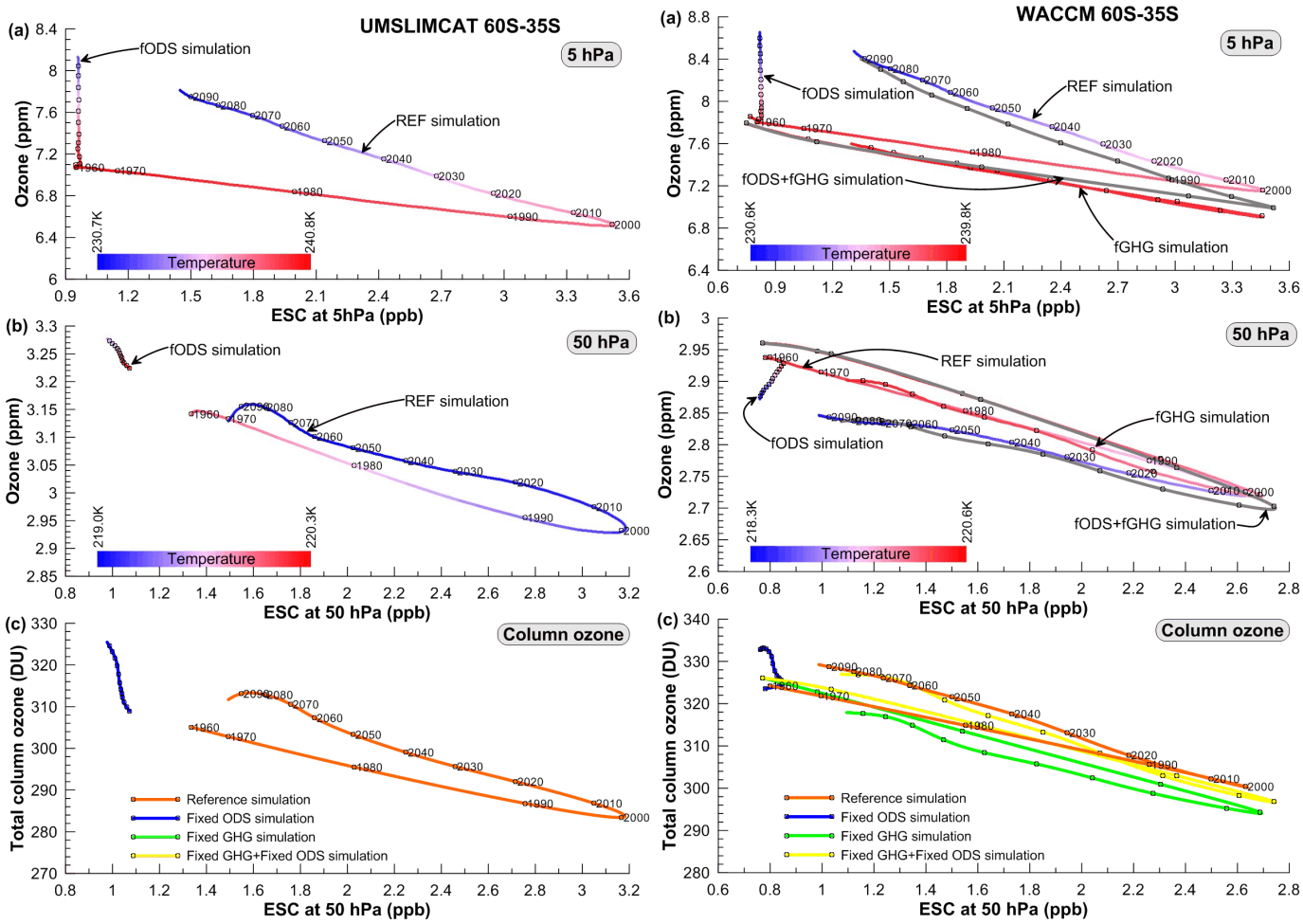

Figure S28. Same as Figure 4, but southern midlatitudes for UMSLIMCAT (left) and WACCM (right).

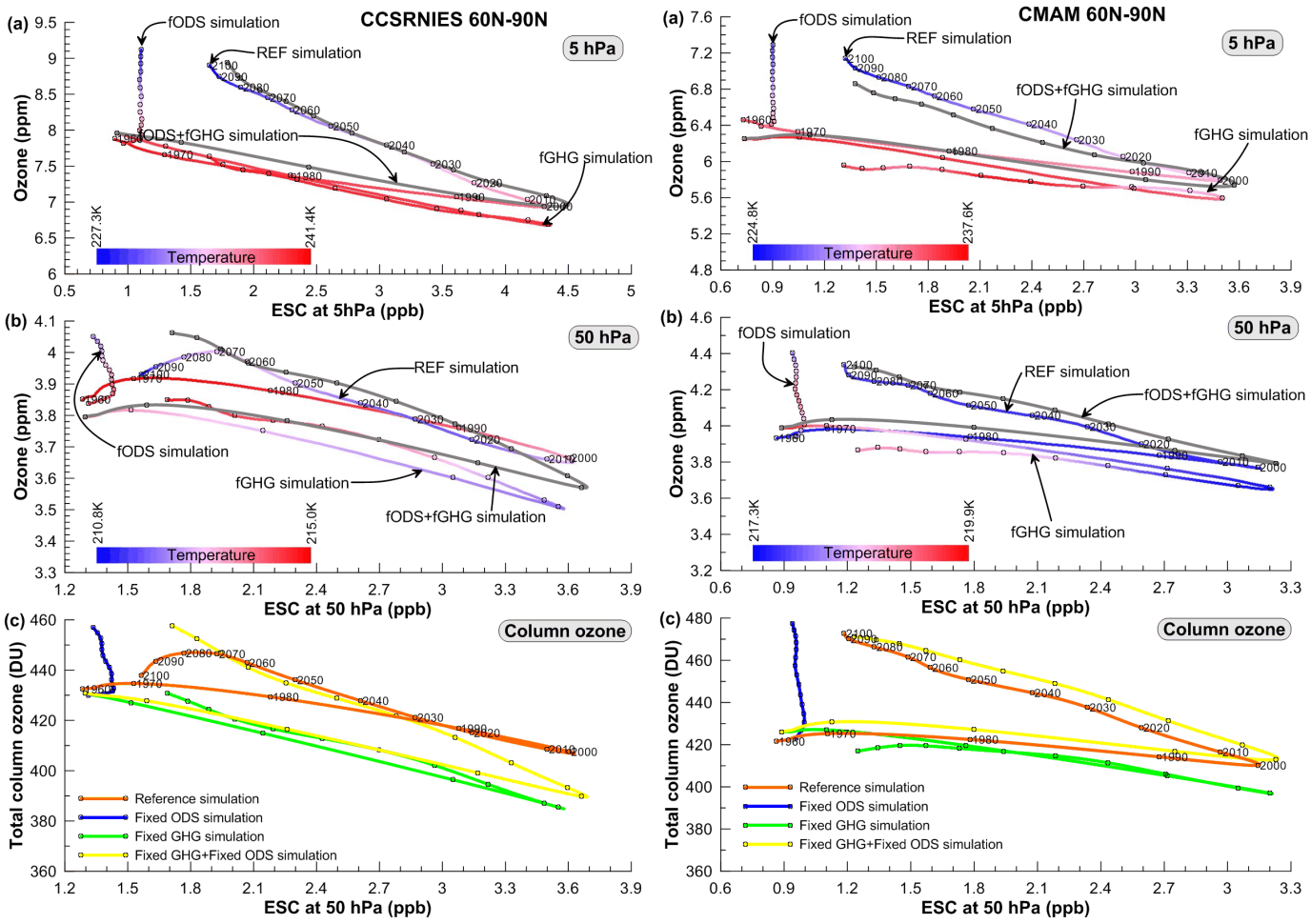

Figure S29. Same as Figure 4, but spring-time Arctic for CCSRNIES (left) and CMAM (right).

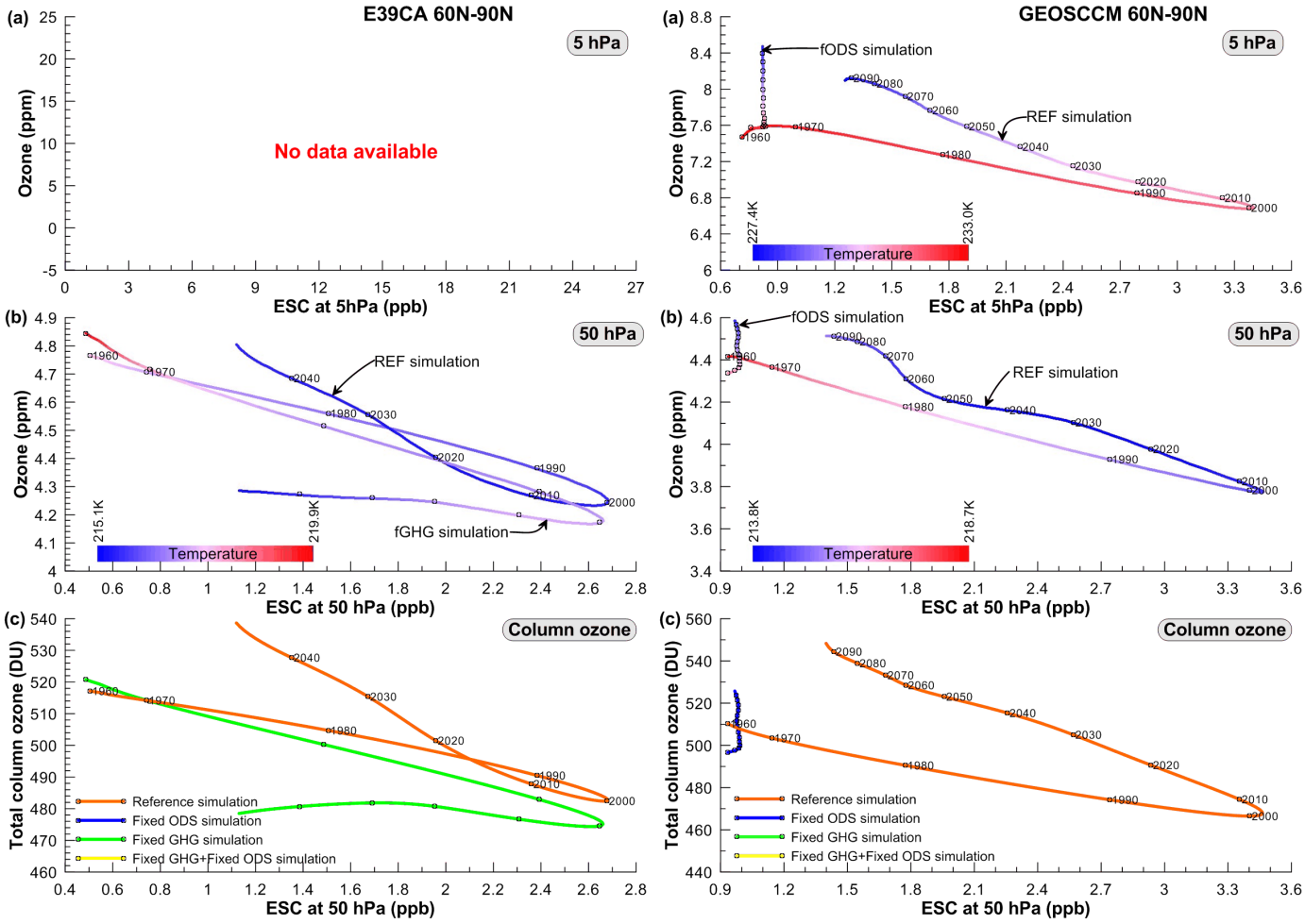

Figure S30. Same as Figure 4, but spring-time Arctic for E39CA (left) and GEOSCCM (right).

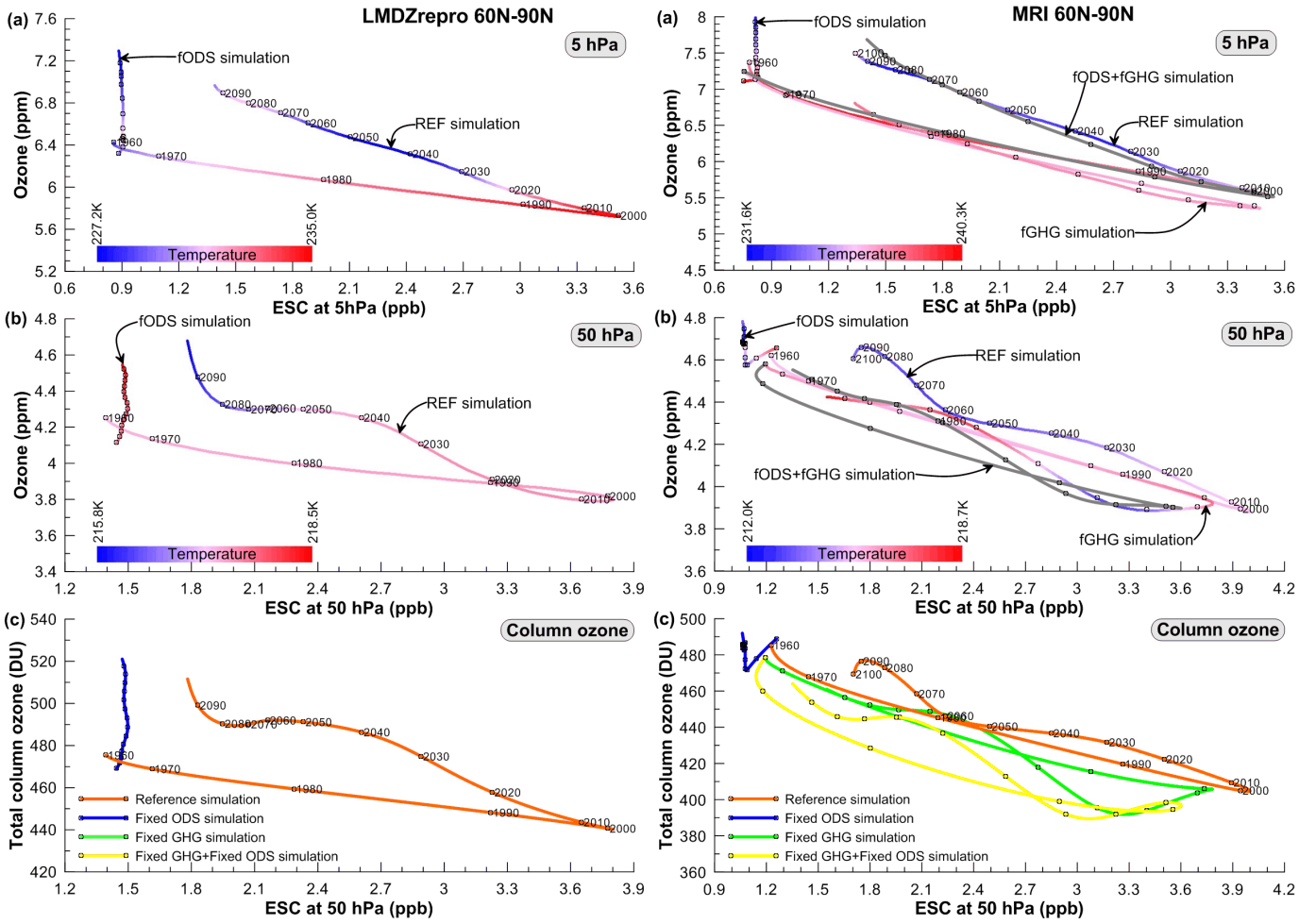

Figure S31. Same as Figure 4, but spring-time Arctic for LMDZrepro (left) and MRI (right).

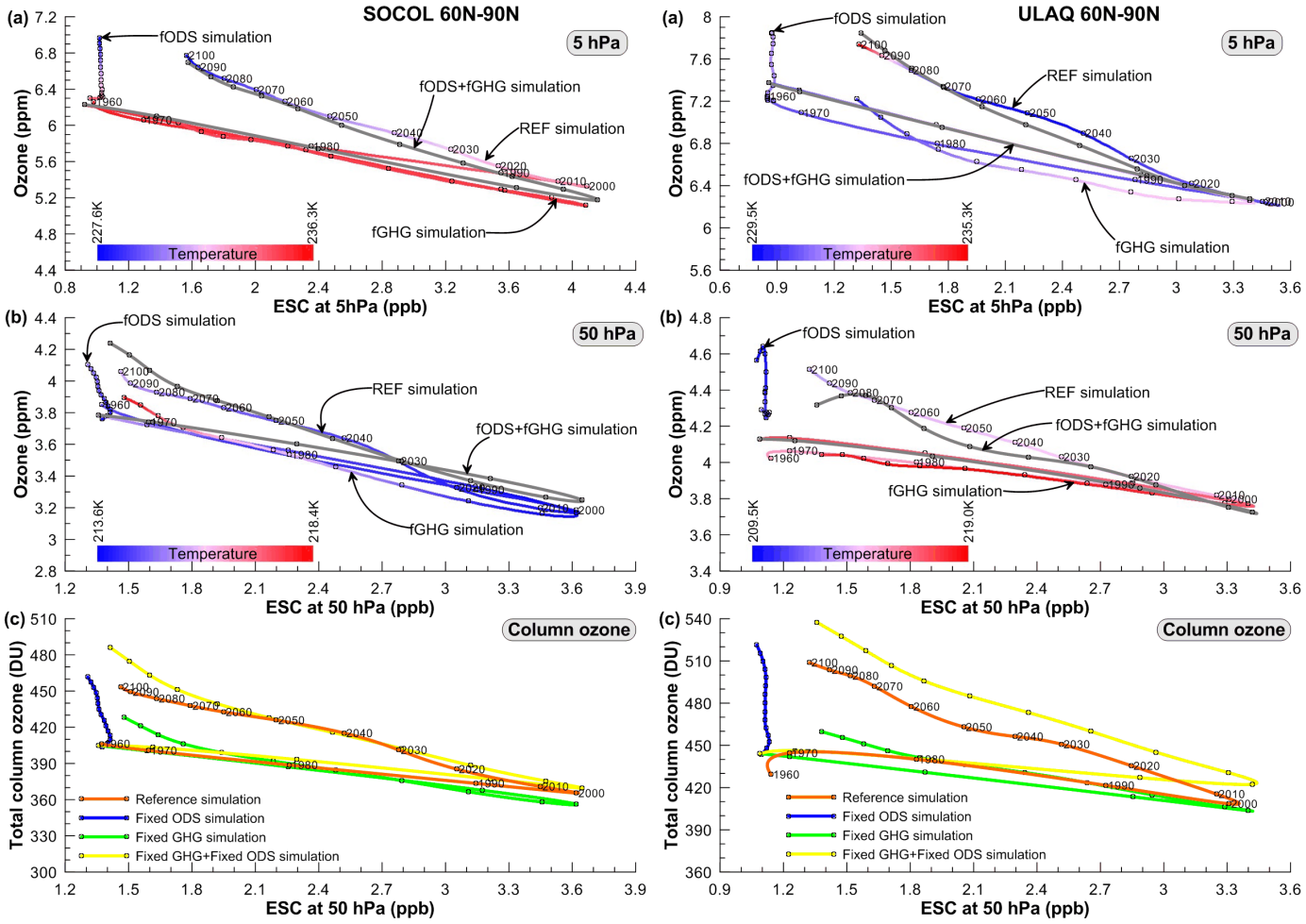

Figure S32. Same as Figure 4, but spring-time Arctic for SOCOL (left) and ULAQ (right). Note that the SOCOL fGHG simulation is carried out with varying SSTs and SICs instead of fixed at 1960 conditions as in all other simulations. The simulation is therefore not included in the fGHG multi-model mean in the main paper.

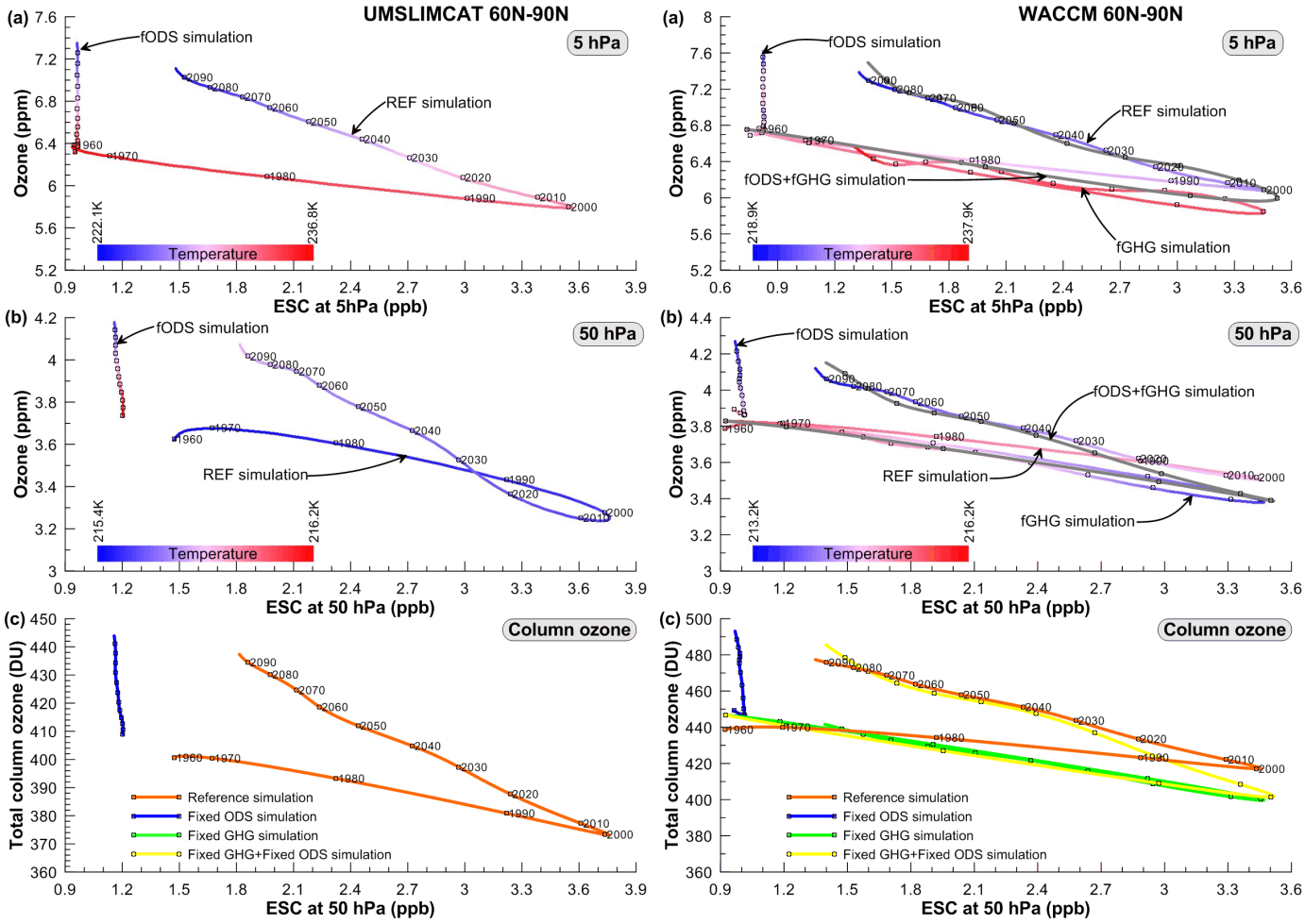

Figure S33. Same as Figure 4, but spring-time Arctic for UMSLIMCAT (left) and WACCM (right).

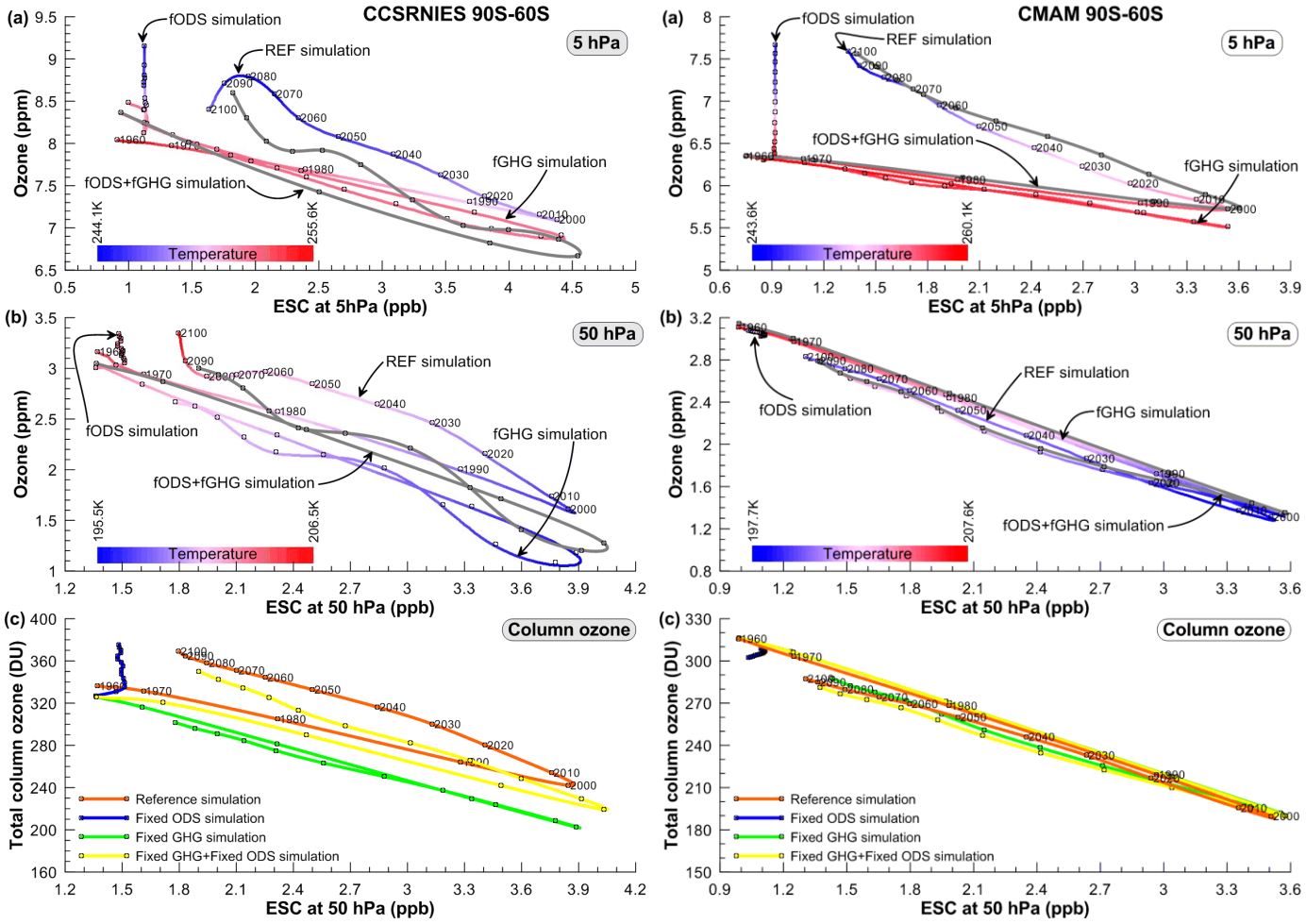

Figure S34. Same as Figure 4, but spring-time Antarctic for CCSRNIES (left) and CMAM (right).

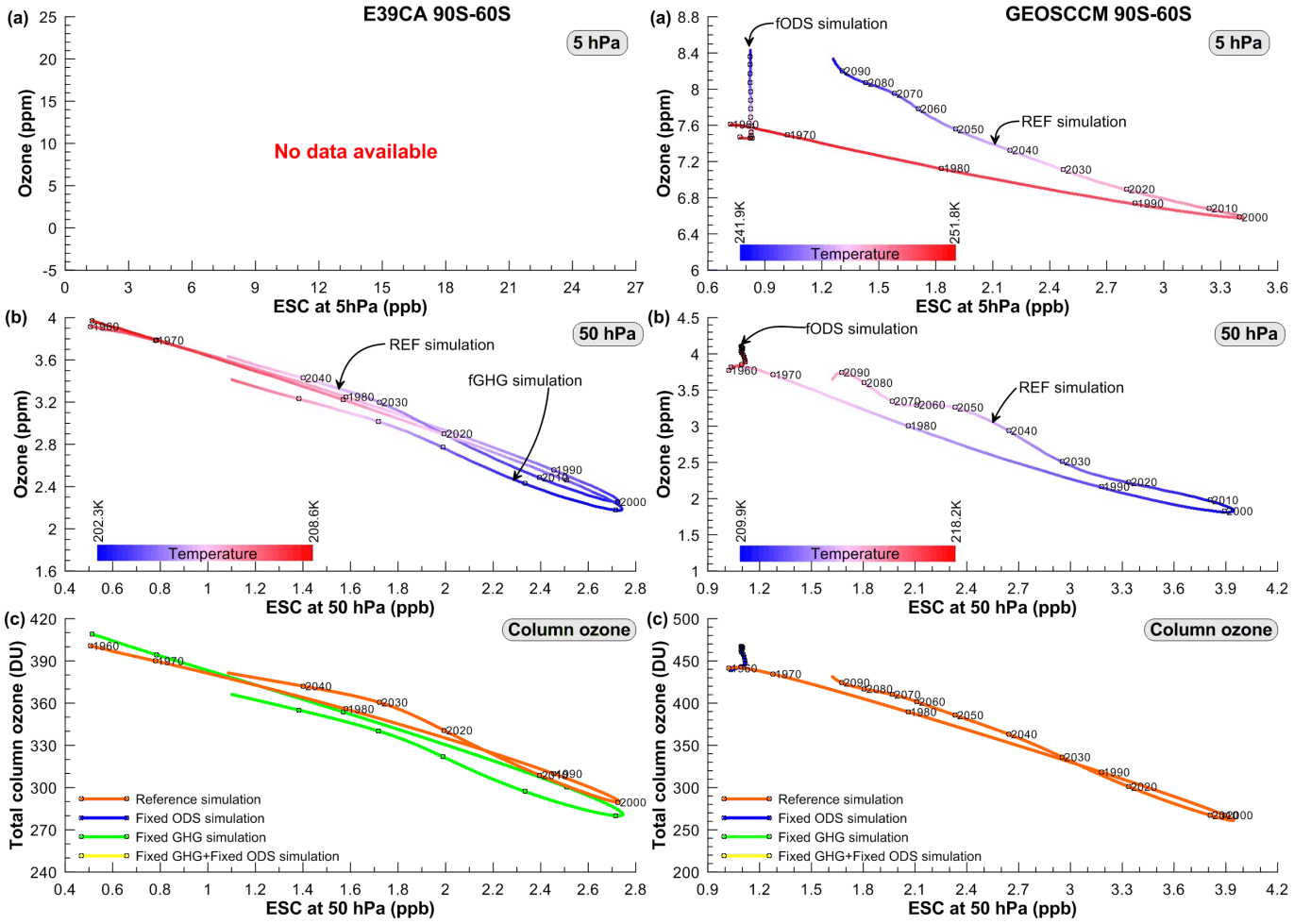

Figure S35. Same as Figure 4, but spring-time Antarctic for E39CA (left) and GEOSCCM (right).

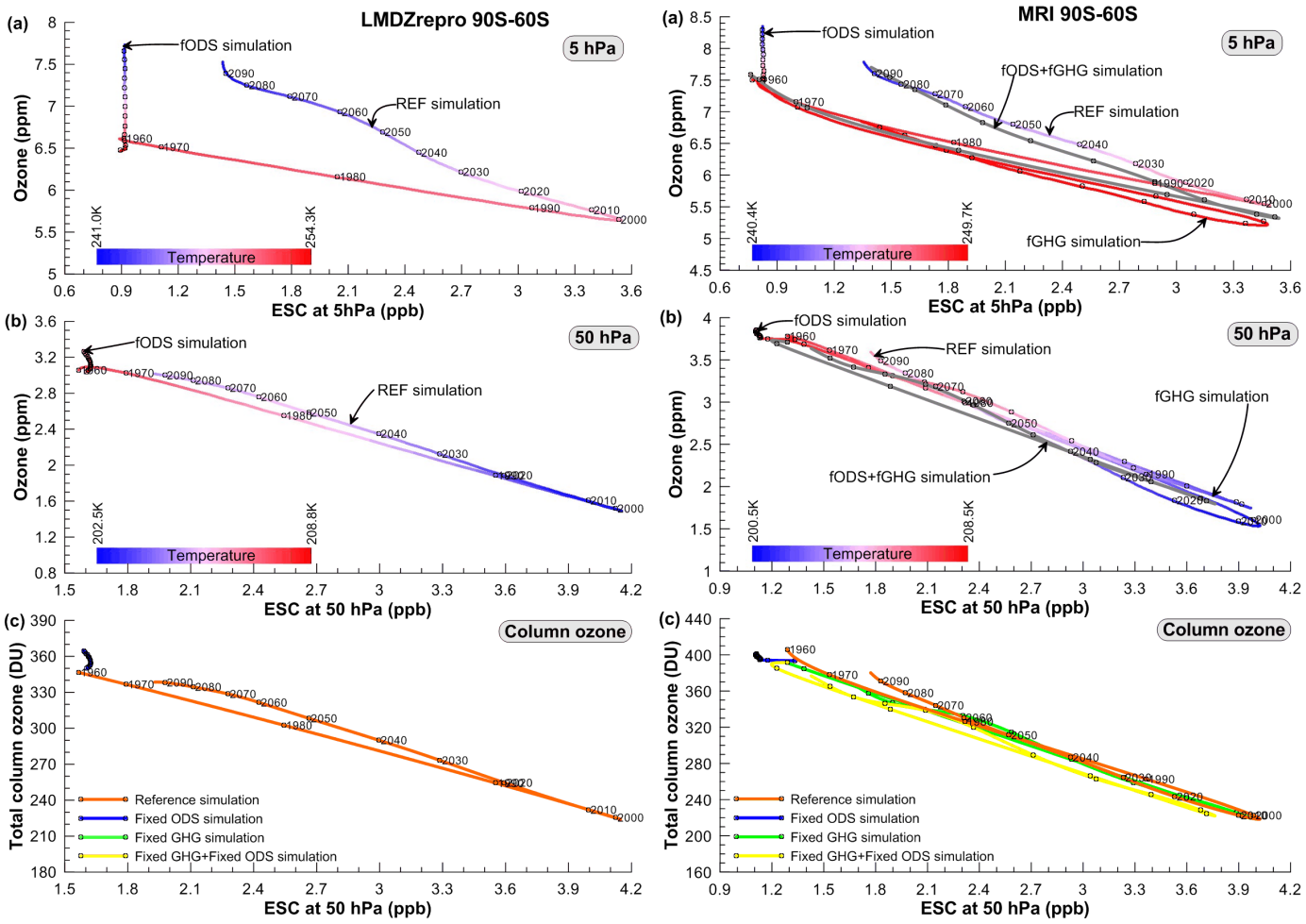

Figure S36. Same as Figure 4, but spring-time Antarctic for LMDZrepro (left) and MRI (right).

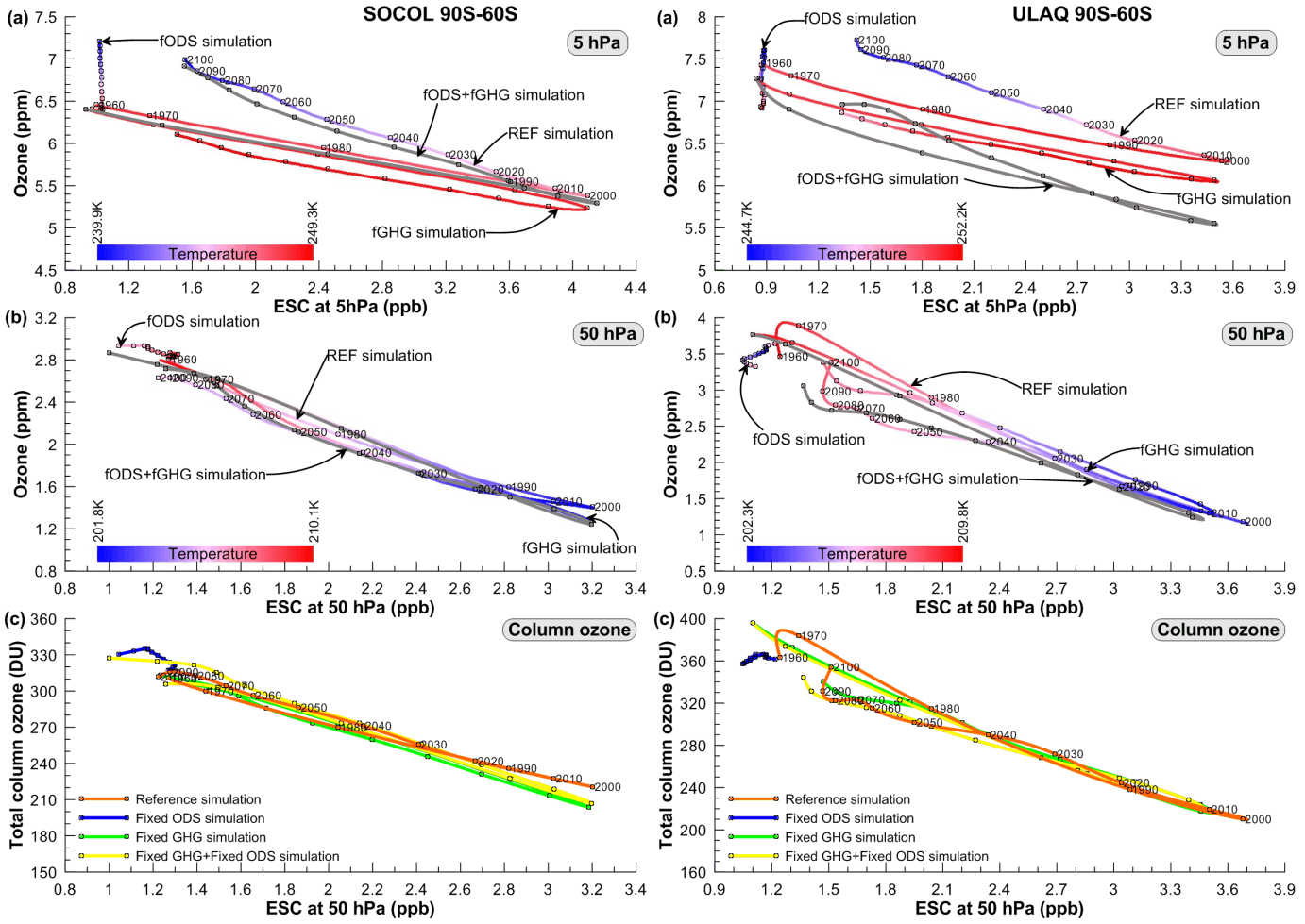

Figure S37. Same as Figure 4, but spring-time Antarctic for SOCOL (left) and ULAQ (right). Note that the SOCOL fGHG simulation is carried out with varying SSTs and SICs instead of fixed at 1960 conditions as in all other simulations. The simulation is therefore not included in the fGHG multi-model mean in the main paper.

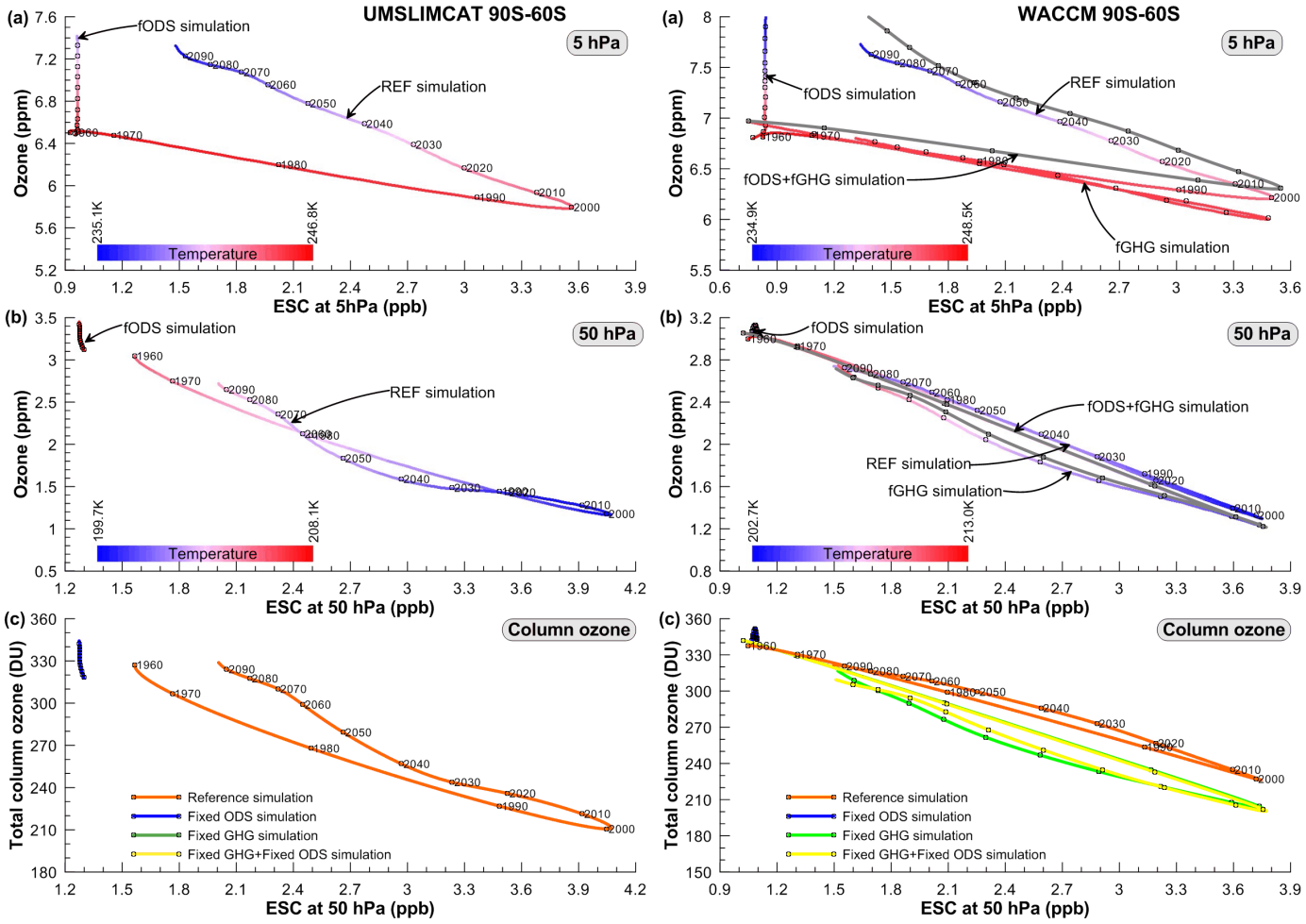

Figure S38. Same as Figure 4, but spring-time Antarctic for UMSLIMCAT (left) and WACCM (right).