Investigation of stratospheric circulation using long-lived tracers with WACCM, BASCOE CTM, and a reanalysis of MLS observations

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The stratospheric circulation is investigated over the period 2005-2015 using WACCM4 (Whole Atmosphere Community Climate Model version 4), together with BASCOE CTM (Chemistry-Transport Model; Chabrillat et al., 2018) and a reanalysis of stratospheric composition observed by MLS: BRAM2 (BASCOE Reanalysis of AURA MLS release 2).

We use long-lived tracers (N2O, H_2O) and the Transformed Eulerian Mean framework (Abalos et al., 2017) to analyse the tracers budget including the mean analysis increment for BRAM2. We focus on the annual and seasonal June-July-August mean of the advection and eddy mixing terms and on the impact of the Quasi-Biennial Oscillation (QBO).

For both tracers, the annual mean pattern is in general agreement among the three datasets but larger differences are found in JJA. Eddy mixing in WACCM (free dynamics and free chemistry) is smaller and has less variability than in the CTM (constrained dynamics and free chemistry) and in BRAM2 (constrained dynamics and chemistry). In addition, the SH polar transport barrier in WACCM is weaker with respect to the CTM and BRAM2.

The next step of our research is to perform this analysis with the newer version of WACCM (version 6) as well as additional BASCOE CTM runs using different reanalysis products or short-term forecasts. Multi-decadal changes in the terms of the budget, and their space dependence, will be investigated as well.

References

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