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Is stratospheric air getting younger with time?

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Most climate models have predicted that with the increase in greenhouse gases concentrations, the stratospheric circulation will intensify, showing younger age-of-air (AoA) values in this region (e.g. Butchart et al., 2010; WMO, 2011). However, balloon and satellite observations do not agree with the widespread modelled trend towards younger age-of-air (Engel et al., 2009; Stiller et al., 2012). To increase our confidence in climate-chemistry projections, the causes for the apparent age-of-air disagreement between observations and most models need to be identified.

Here we have carried out stratospheric simulations with a chemistry transport model (CTM) to evaluate the stratospheric circulation with the ERA-Interim dataset produced by the European Centre for Medium-Range Weather Forecasts (ECMWF).

The ERA-Interim reanalysis provides age-of-air (AoA) distributions in very good agreement with observations in the lower stratosphere. Given this agreement, we have used our simulations to quantify interannual variability and trends in the stratospheric AoA for the whole ERA-Interim period (1979-present).

Our model results with ERA-Interim fields disagree with the decreasing tendency in age-of-air widespread in most models, but are in good agreement with the recent age-of-air studies based on observations. To explore potential causes for the AoA trends in our model, Lagrangian calculations are also performed to assess mixing processes for the ERA-Interim period. Potential links between our modelled AoA trends and stratospheric ozone evolution are also shown.

References:

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