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The application of fractional release factors in stratospheric chemistry and dynamics

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We investigate the concept of fractional release factors (FRF) to evaluate changes in stratospheric transport and chemistry from an observational point of view. The FRF is the fraction of a trace gas that has been dissociated in the stratosphere by chemical processes. It can be determined by the analysis of aircraft or balloon samples from trace gases, provided that the tropospheric timeseries of the tracer is known.

A change of FRF on constant age of air surfaces for chemical active species with different stratospheric lifetimes may be an indication for variations in transport pathways. For instance a change in the amount of recirculated air would alter the relation between FRF and age of air. Thus the knowledge of variations in FRF may serve as a diagnostic tool to investigate structural changes in the Brewer-Dobson-Circulation.

On the other hand, the FRF directly enters the calculation of chemically important quantities like the Ozone Depletion Potential (ODP) and the Equivalent Effective Stratospheric Chlorine (EESC). The EESC is used to quantify the amount of inorganic halogen in the stratosphere and therefore it serves as a measure for the recovery date of the ozone layer.

We analyse the temporal evolution of the FRF for different halocarbons within the EMAC Model. We also present results on the influence of temporal trends on the FRF, depending on the method used to calculate FRF. We show that the computational method for FRF needs to be reassessed and show implications on crucial parameters like e.g EESC.