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Empirical age spectra in the lower stratosphere derived from in-situ measurements of halocarbons during TACTS/ESMVal

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The age spectrum is the transit time distribution of the fluid constituents in a specific stratospheric air parcel and therefore contains all the information of the air parcel's transport history. Unfortunately, it is not possible to directly measure the age spectrum of a stratospheric air parcel. Only the first moment of the distribution – the mean age of air – is directly observable from observations of passive tracers like SF6 and CO_2. However, it is possible to reconstruct the age spectrum from a bunch of chemical active tracers with different stratospheric lifetimes (Schoeberl et al., 2005; Ehhalt et al., 2007) assuming to first order that the age spectrum follows the analytical solution given by Hall and Plumb (1994).
Here, we will present empirical age spectra in the extratropical lower stratosphere of the northern hemisphere derived from a dataset gathered during the combined campaigns TACTS (Transport and Composition in the UT/LMS) and ESMVal (Earth System Model Validation). About 20 halocarbons have been measured with the new developed in-situ GC/MS instrument GHOST-MS. These chemical active species have different stratospheric lifetimes ranging from several days (e.g. Methylbromoform) up to several decades (e.g. CFC-12).

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