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Can we estimate lifetimes from observed stratospheric trace-gas distributions?

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The atmospheric lifetime of a trace gas is defined as the ratio of its global atmospheric burden to its annually averaged global loss rate and it can be used to predict the future evolution of the specie. Here, we are interested in the lifetimes of the dominant ozone-depleting substances (ODS), which are the prerequisite for the calculation of their ozone-depletion potentials (ODPs). Due to the fact that there is some evidence that the lifetimes for some important ODSs like CFC-11 may be somewhat longer than reported in past assessments (WMO, 2011) re-evaluation of the dominant ODP lifetimes will be done in the framework of SPARC.

Some of the most important of the ODSs, i.e. CFCs and halons, have solely stratospheric sinks and their stratospheric equals their atmospheric lifetime. For these compounds the best reference is still the work of Volk et al. (1997) which is based upon the theoretical work of Plumb and Ko (1992) and Plumb (1996). In this work, we will discuss the implications of seasonality, tropospheric trends, latitudinal tropospheric tracer gradients and quasi-horizontal transport between the tropics and the extratropics on the validity and applicability of the two methods for lifetime calculations described by Volk et al. (1997).

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