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Investigating stratospheric circulation and chemistry changes over three decades with trace gas data from aircraft, large balloons, and AirCores

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Laube et al. (2020) investigated stratospheric changes between 2009 and 2018 with halogenated trace gas data (CFC-11, CFC-12, H-1211, H-1301, HCFC-22, and SF_6) from air samples collected via aircraft and AirCores, and compared the mixing ratios and average stratospheric transit times derived from these observations with those from a global model. We here expand this analysis in three ways: firstly, by adding data from further traces gases such as CFC-115, C_2F_6, and HCFC-142b to broaden the range of tropospheric trends and stratospheric lifetimes, both of which help to assess the robustness of inferred long-term trends in the stratosphere; secondly, by increasing the temporal span of the observations to nearly three decades using new AirCore observations as well as reanalysed archived air samples collected on board high altitude aircraft and large balloons in the 1990s and 2000s; and thirdly, by investigating the fractional release factors and mean ages of air derived from the aforementioned species as measures of their stratospheric chemistry and the strength of the Brewer-Dobson circulation. In combination with model data from the Chemical Langrangian Model of the Stratosphere (CLaMS) this unique data set allows for an unprecedented evaluation of stratospheric chemistry and dynamics in the mid-latitudes of the Northern Hemisphere.

References

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