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Highly resolved observations of trace gases in the lowermost stratosphere and upper troposphere from the Spurt project: an overview

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Abstract. During SPURT (Spurenstofftransport in der Tropopausenregion, trace gas transport in the tropopause region) we performed measurements of a wide range of trace gases with different lifetimes and sink/source characteristics in the northern hemispheric upper troposphere (UT) and lowermost stratosphere (LMS). A large number of in-situ instruments were deployed on board a Learjet 35A, flying at altitudes up to 13.7 km, at times reaching to nearly 380 K potential temperature. Eight measurement campaigns (consisting of a total of 36 flights), distributed over all seasons and typically covering latitudes between 35° N and 75° N in the European longitude sector (10° W–20° E), were performed. Here we present an overview of the project, describing the instrumentation, the encountered meteorological situations during the campaigns and the data set available from SPURT. Measurements were obtained for N_2O, CH_4, CO, CO_2, CFC12, H_2, SF_6, NO, NO_y, O_3 and H_2O. We illustrate the strength of this new data set by showing mean distributions of the mixing ratios of selected trace gases, using a potential temperature-equivalent latitude coordinate system. The observations reveal that the LMS is most stratospheric in character during spring, with the highest mixing ratios of O_3 and NO_y and the lowest mixing ratios of N_2O and SF_6. The lowest mixing ratios of NO_y and O_3 are observed during autumn, together with the highest mixing ratios of N_2O and SF_6 indicating a strong tropospheric influence. For H_2O, however, the maximum concentrations in the LMS are found during summer, suggesting unique (temperature- and convection-controlled) conditions for this molecule during transport across the tropopause. The SPURT data set is presently the most accurate and complete data set for many trace species in the LMS, and its main value is the simultaneous measurement of a suite of trace gases having different lifetimes and physical-chemical histories. It is thus very well suited for studies of atmospheric transport, for model validation, and for investigations of seasonal changes in the UT/LMS, as demonstrated in

accompanying and elsewhere published studies.

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