Unique Transport Diagnostics from Airborne In Situ Trace Gas Measurements

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We describe several unique transport diagnostics based on in situ trace gas measurements from aircraft and balloon platforms. These transport diagnostics include quantifying the fraction of air in the upper troposphere and lowermost stratosphere (UT/LS) that has come from the stratospheric ‘overworld’, calculating transport time scales and surface origins of air in the UT/LS and estimating multi-year to multi-decadal changes in the stratospheric mean meridional circulation and horizontal mixing. These diagnostics have relevance for understanding a number of important processes in the atmosphere and are particularly important to compare to global chemistry-climate model output.

Stratospheric Fraction Profiles

Extratropical UT air contains a mixture of 4-10% air from above 100 hPa and 0.5-2% from above 10 hPa.

Figure 1. Fractions of air in the lowermost stratosphere and upper troposphere that have come from above various levels in the stratosphere calculated from photolytic tracer correlations.