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.

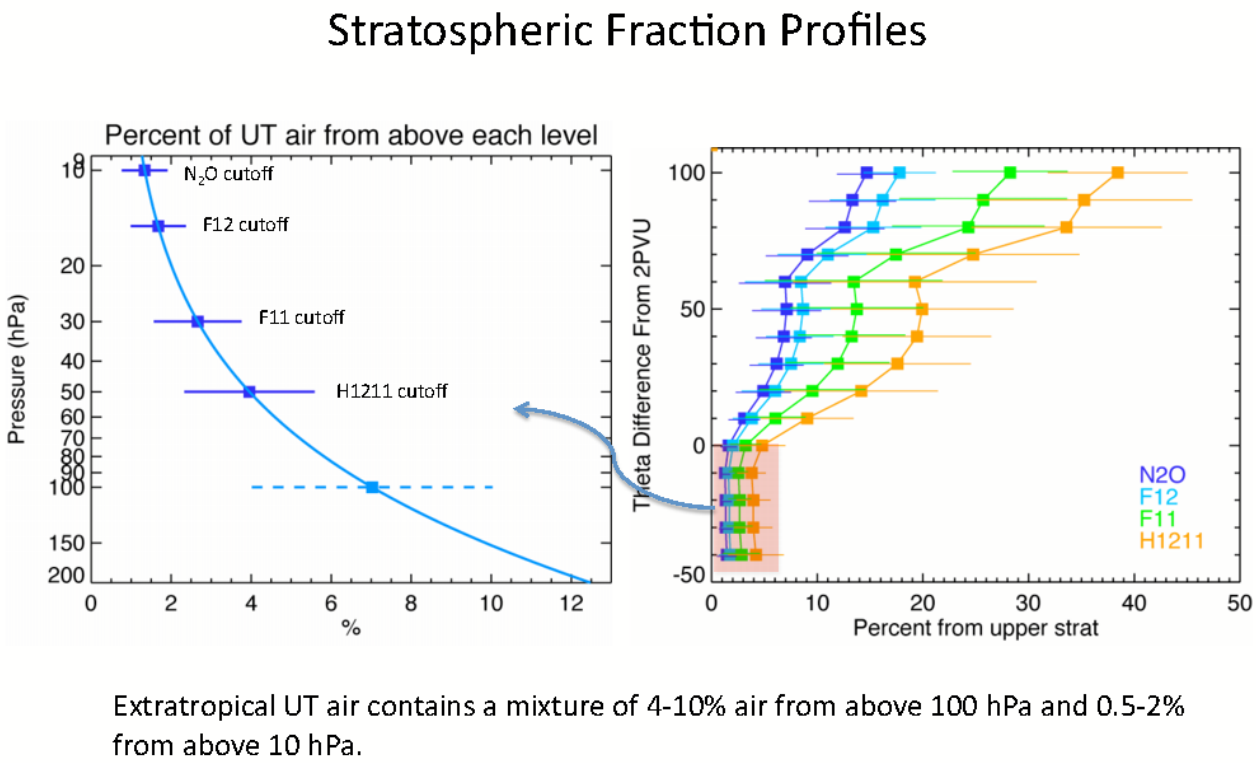

Figure 1. Fractions of air in the lowermost stratosphere and upper troposphere that have come from above various levels in the stratosphere calculated from photolytic tracer correlations.