# Constraining transient times of of bimodal age spectra in the UTLS using in-situ measurements

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Based on in-situ measurements of $CO_2$ and $N_2O$ we present a method to determine
transient times in the lowermost stratosphere. Traditionally mean values of $CO_2$ in
the stratosphere have been assigned to the the mean age of air in a particular region.
However, the latter holds only for the stratosphere at $N_2O < 250$ ppbv, where the sea-
sonal cycle of $CO_2$ is dampenend due to quasi horizontal mixing in the stratosphere.
Below, where the seasonal cycle of $CO_2$ is evident, age spectra are best represented
by bimodal functions consisting of a young fraction representing rapid transport from
the troposphere with short transient times and a slow part. Thus, the mean age largely
differs from the respective transient time since it is the result of bimodal transient time
distribution. Besides the simple $CO_2$ mean on $N_2O$ isopleths, the respective transient
time of the young peak of the age spectrum can be deduced from the $N_2O$-$CO_2$ corre-
lation. The latter is deduced from in-situ measurements and compared to age spectra
based on the same data. Furthermore, the method might also provide a possibility to
test transport time scales and origin of air masses in GCM's and CCM's.