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# Does the Brewer-Dobson Circulation change?

# Three Decades of Mean Age of Air Data Derived from Stratospheric $SF_6$ Measurements

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It is known that changes in the atmospheric greenhouse gas loading lead to an increase of the radiative forcing in the atmosphere. Model studies, as referenced in the WMO/UNEP Scientific Assessments of Ozone Depletion 2006, predict that this increase leads to a change in the characteristics of the overturning mean meridional circulation of the middle atmosphere, the Brewer-Dobson circulation. We investigate the Brewer-Dobson circulation using stratospheric measurements of long-lived age tracers such as $SF_6$, by calculating the stratospheric mean age of air. It is defined as the mean transit time from the entrance region of the stratosphere at the tropical tropopause, to the location of the observation and is therefore a direct measure of the strength of the overturning meridional circulation. By reanalysing stratospheric balloon-borne whole air samples, we obtain for the first time a high quality data set of in-situ $SF_6$ measurements on a consistent calibration scale spanning three decades from 1975 until 2006. This unique $SF_6$ data set was used to investigate changes in the stratospheric mean age of air. For minimization of the uncertainty, fitting algorithms for the vertical age of air profiles were used and the mean age of air was derived for specific altitude intervals. Sensitivity studies were performed by varying the input data set, to take into account the limited number of in-situ measurements and their seasonal and spatial distribution. In contrast to the model predictions, the trend in the stratospheric mean age derived

from these $SF_6$ measurements shows no decrease, but rather suggests a weak increase.