



Evidence for Stratospheric Circulation Changes Over the Past Three Decades From Multiple Measurement Sources

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Observed indicators of stratospheric zonal mean circulation changes have been difficult to attain due to a lack of sufficient long-term stratospheric measurements. Several such datasets do exist however and each of them suggests that changes have occurred in the stratospheric circulation over the last 30 years. We show that the changes seen in the measured or measurement-based indicators of stratospheric circulation, mean age of air from SF₆ and CO₂, TOMS/SBUV total ozone and residual circulation calculations, are consistent with each other. We also use a simple model of the stratosphere, the tropical leaky pipe model, to estimate the scale and vertical structure of circulation and mixing changes that can result in the observed stratospheric trace gas changes on both the short-term, several year time scale and the long-term, 30 year time scale. The long-term changes in the stratospheric circulation suggested in this study are at odds with global chemistry climate model simulations and thus it is clearly important to more fully understand why such a difference exists.