Improving the understanding of the stratospheric aerosol layer

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Aerosols in the stratosphere are chemically and radiatively important for climate.

Significant short term and long term variability has been observed, resulting in observed changes in surface temperature and stratospheric ozone.

CSD research has examined

- Aerosol compositions and sources
- Anthropogenic impact on stratospheric aerosol trends
- Radiative forcing due to stratospheric aerosols
Stratospheric Aerosol Composition

Observations of the chemical composition of stratospheric aerosol particles

D. M. Murphy, K. D. Froyd, J. P. Schwarz and J. C. Wilson

Q.J.R.M.S. 2014, DOI: 10.1002/qj2213

Measurements using the PALMS instrument provide the most complete chemical speciation of lower stratospheric aerosols to date.

Composition and Source? Primarily Sulfate Formed in the Stratosphere
Stratospheric Aerosol Variability

Recent anthropogenic increases in SO$_2$ from Asia have minimal impact on stratospheric aerosol

R. R. Neely III,1,2,3 O. B. Toon,1,4 S. Solomon,2 J.-P. Vernier,6,7 C. Alvarez,2,3 J. M. English,4 K. H. Rosenlof,2 M. J. Mills,4 C. G. Bardeen,4 J. S. Daniel,2 and J. P. Thayer9

Aerosol microphysical/GCM modeling demonstrated that trends in stratospheric aerosol can be mostly explained by small volcanic eruptions.

Anthropogenic? Not The Primary Factor
Climate modeling showed that increases in stratospheric aerosol from 2000 counteract ~ 25% of the warming from CO$_2$ during this time period.

Aerosol Contribution to 2000 – 2010 Global Warming Hiatus?

~25% effect
Ongoing Stratospheric Aerosol and SO$_2$ Research

Open issues that would benefit from in-situ measurements:

- Chemistry and microphysics of stratospheric sulfur cycling
- Spatial distribution of volcanic SO$_2$
- Aerosol size distribution as a function of SO$_2$ input

Answers needed to evaluate climate intervention strategies.

- Current CSD development of new in-situ laser induced fluorescence sensor for < 10 ppt SO$_2$. Field test planned for fall 2015.