Stratospheric Sulfur and its Role in Climate (SSiRC) data project

Claudia Timmreck

The project serves as a virtual working place for stratospheric sulfur simulations which will be provided and carried out in the frame of the WCRP-WMO Stratospheric Sulfur and its Role in Climate (SSIRC) activity.

The stratospheric aerosol layer is a key element in the climate system. It affects the radiative balance of the atmosphere directly through interactions with solar and terrestrial radiation, and indirectly through its effect on stratospheric ozone. Because the stratospheric aerosol layer is prescribed in many climate models and Chemistry-Climate Models (CCMs), model simulations of future atmospheric conditions and climate generally do not account for the interaction between the sulfur cycle and changes in the climate system. The present understanding of how the stratospheric aerosol layer may be affected by future climate change and how the stratospheric aerosol layer may drive climate change is, therefore, very limited. A sound understanding of the processes that determine the background state and variability of the stratospheric aerosol layer is a prerequisite for assessing its future development, and for determining the possible potential for and risks of an artificial enhancement of it (solar radiation management/ geoengineering). Since the Mt. Pinatubo eruption in 1991, the mid-stratosphere has not been disrupted by a major volcanic eruption, although several minor eruptions have affected the lower stratosphere. This provides an opportunity to study the variability of the stratospheric aerosol layer during a time of relative volcanic quiescence.

In order to address these issues, a new SPARC initiative on Stratospheric Sulfur and its Role in Climate (SSiRC) has been established in late 2012. The purposes of SSiRC include: (i) providing a coordinating structure for the various individual activities already underway in different research centers; (ii) encouraging and supporting new instrumentation and measurements of sulfur containing compounds, such as COS, DMS, and non-volcanic SO2 in the UT/LS globally; and (iii) initiating new model/data inter-comparisons. SSiRC is expected to feed into the GeoMIP activity as it deals with more fundamental questions relating to sulfur and aerosols in the stratosphere, while GeoMIP will use the outcomes to better understand its own results.

Model intercomparison studies will entail the investigation of key processes that control the sulfur flux from the upper troposphere to the stratosphere as well as an assessment how climate change and changing emissions of SO2 and COS can alter the stratospheric sulfur budget and microphysical processes (nucleation, particle growth, sedimentation). Sensitivity experiments with well defined emission scenarios for moderate and large volcanic eruptions with comparisons to existing observational datasets (e.g., Pinatubo, Nabro) and for an artificially perturbed stratospheric aerosol layer are planned to understand the radiative effects of disturbances of the aerosol layer and related temperature changes.

Reference:

SPARC Newsletter 39 (2012), p. 37: Stratospheric Sulphur and its Role in Climate (SSiRC), by M. Rex, C. Timmreck, S. Kremser, L. Thomason, J.-P. Vernier