ATS/CIRA Colloquium

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The stratospheric aerosol layer: uncertainties in our understanding and consequences for climate change and geoengineering

Hosted by Thomas Birner

Thursday, May 2, 2013

ATS room 101; Discussion will begin at 3:30pm
Refreshments will be served at 3:00pm in the weather lab

Stratospheric aerosols are important climate forcers as they reflect a part of the incoming solar radiation, thereby cooling the earth surface and troposphere, and absorb a part of the outwelling terrestrial radiation, thereby heating the stratosphere. In addition they are im-portant players in stratospheric ozone chemistry as they reduce the abundance of strato-spheric nitrogen oxide radicals. Volcanic eruptions can modulate the stratospheric aerosol surface area density, which is a measure of these radiative and chemical effects, by more than an order of magnitude. Here I present a new record of size distributions and radiative properties of stratospheric aerosols from 1960 to 2011. The data set uses the newest ver-sions of satellite algorithms, which differ significantly from previously used versions. It hing-es on the SAGE II extinction data at four wavelengths, termed SAGE_4λ.
The acid test for the new data record is the comparison with the 1991 Pinatubo eruption, the best characterized large eruption (Arfeuille et al., 2013). The new data presents a signifi-cantly improved version of satellite data and points to bad short-comings in the old SAGE data set and derived quantities used so far in climate model assessments. An application in the global chemistry-climate model (CCM) SOCOL suggests that SAGE_4λ indeed reduces the infrared absorption in the tropical tropopause region, leading to a better agreement with the post-volcanic temperature record at these altitudes. Conversely, SAGE_4λ does not im-prove the exaggerated aerosol-induced stratospheric heating in the lower stratosphere (≥ 20 km), as it was found in recent GCM and CCM intercomparisons. I will discuss these weak-nesses and the consequences for the climate modeling community. I will end on the ques-tion what this development means for judging potential solar radiation management measures, which aim at avoiding extreme climate change.

Arfeuille, F., B.P. Luo, P. Heckendorn, D. Weisenstein, J. X. Sheng, E. Rozanov, M. Schraner, S. Brönnimann, L.W. Thomason, and T. Peter, Uncertainties in modeling the stratospheric warming following Mt. Pinatubo eruption, Atmos. Chem. Phys. Discuss., 13, 4601–4635, 2013.

Link to colloquium videos and announcement page: http://www.atmos.colostate.edu/dept/colloquia.php