Composition and sources of aerosol in the upper troposphere/lowermost stratosphere

Valentina Aquila[1,2], Peter Colarco[2], Anton Darmenov[3], and Mian Chin[2]

[1]*GESTAR/Johns Hopkins University, Baltimore, MD, USA*
[2]*NASA Goddard Space Flight Center, Laboratory for Atmospheric Chemistry and Dynamics, Greenbelt, MD, USA*
[3]*NASA Goddard Space Flight Center, Global Modeling and Assimilation Office, Greenbelt, MD, USA*

Satellite derived time-series of lower stratospheric aerosol extinction showed an increase by ~7%/year starting from about 2000. This increase has been attributed mostly to a series of relatively small tropical volcanic eruptions. The detection of a region of enhanced aerosol extinction over Asia during the monsoon period (Asian tropopause aerosol layer, or ATAL), however, suggests that convective lifting of tropospheric aerosol can also be an important source of aerosols in the lower stratosphere.

We present an assessment of the composition and sources of aerosols in the lower stratosphere from model results by the Goddard Earth Observing System Chemistry Climate Model (GEOSCCM), coupled to the GOCART aerosol model. To ensure the highest similarity to the observed meteorology, we run GEOSCCM in replay mode, i.e. using the MERRA reanalysis meteorology. Our simulation span the period from 2000 to present, and includes natural and anthropogenic emissions of precursor gases and tropospheric aerosols (sulfate, black carbon, organic carbon, dust, and sea salt), volcanic sulfate emissions, and stratospheric sulfate aerosol resulting from the photolysis and oxidation of carbonyl sulfide (OCS). By separately tracking aerosol sources, we calculate the partitioning of stratospheric aerosol between anthropogenic and natural sources, and the contribution to the stratospheric sulfate loading of volcanic eruptions, transport of tropospheric sulfate, and OCS chemistry.