

A Global Perspective of SAGE III ISS Aerosol Observations

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Stratospheric aerosol remains a topic of intense research for the characterization of atmospheric processes and radiative transfer considerations in climate modeling. Described by Solomon and Coauthors (2011) as “the persistently variable ‘background’ aerosol layer,” the existence of a long-lived and replenished layer of evolving aerosol in the stratosphere is a topic of continued investigation into the size distribution, scattering, absorption, number density, and composition of these ‘background’ aerosol. The infrequent injection of large aerosol loading events adds additional complexity to the composition and characteristics of aerosol in the stratosphere. The Stratospheric Aerosol and Gas Experiment III (SAGE III) on the International Space Station (ISS) is part of the fifth set of instruments in the lineage of the original Stratospheric Aerosol Measurement (SAM) begun in 1976 as part of the Apollo-Soyuz Test Project. SAGE III ISS provides highly stable retrievals of atmospheric transmission which are inverted for number densities of atmospheric constituents including ozone, aerosol, nitrogen dioxide, and water vapor from the upper troposphere to the upper stratosphere and mesosphere. In its first year on orbit, SAGE III ISS has observed the evolution and dispersion of aerosol injected by North American wildfires into the stratosphere, measured through cross-sections of polar vortex filaments spun off by the transition to Antarctic summer, and compared well against other existing aerosol satellite observations. SAGE III ISS’s predecessor, SAGE II forms part of the basis of the Global Space-based Stratospheric Aerosol Climatology (GloSSAC) (Thomason and Coauthors, 2018), and it is believed that the addition of the SAGE III ISS dataset will provide insight of at least similar value. Additions to the SAGE III ISS instrument include nine reported aerosol channels, a spectrometer of configurable sensitivity to wavelengths between 280 and 1020 nm, and lunar occultation and limb scattering science collection modes. A collection of observations covering over a year of data taken by SAGE III ISS are presented in a global context. These observations are further contextualized by comparison with other satellite-based observations. These data provided by SAGE III ISS perform a crucial role in stratospheric aerosol observation and continue a legacy of instruments that have served as standards in the atmospheric science community.

Key words: SAGE, aerosol, global, occultation, satellite

References

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