

Satellite remote sensing of clouds and aerosols in the UTLS

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We have developed remote sensing methods that retrieve a variety of information about the atmospheric condensed phase, including particle size distributions, chemical compositions, phases and occasionally particle shapes. The retrieval algorithm uses the mid and nearIR reference extinction spectra of micron-sized aerosol particles in a weighted least squares fit to an observed extinction spectrum. Since the condensed phase spectra depend on the above chemical and physical properties in different ways, it is possible to retrieve these characteristics uniquely if the signal to noise ratio of the measurement is sufficiently high.

We have used this method to analyse the remote sensing measurements of the ACE FTIR spectrometer, which was launched in August 2003 aboard the Canadian SciSat satellite. This instrument records broadband ($750 - 4400 \text{ cm}^{-1}$) high resolution solar occultation spectra with very high sensitivity. Using the rich dataset produced by this instrument, we have concentrated on the analysis of observations from the mid-troposphere to the mesosphere, with a focus on cirrus, polar stratospheric, and polar mesospheric clouds. In this presentation, we will report a comprehensive analysis of approximately 300 northern-hemisphere polar stratospheric cloud observations made during the months of January to March in 2005. The compositions of these clouds were either ice, nitric acid trihydrate or of water-nitric-sulfuric acid ternary mixtures. The clouds had a broad range of size distributions, but the particle sizes of the ice clouds were generally larger than those of the nitric acid containing clouds. We will discuss the chemical and physical properties of the clouds in the context of the atmospheric dynamics and meteorological conditions (especially stratospheric temperatures) during this period, which provide clues to the processes responsible for their formation. The influence of these PSCs on ozone depletion in the Arctic stratosphere during this time period will also be reported.