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MEASURING AEROSOL ABSORPTION FROM SPACE USING OMI NEAR UV OBSERVATIONS

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With the deployment of the EOS MODIS (on Terra and Aqua) and MISR (on Terra) instruments, space-based aerosol remote sensing has given a huge leap forward as both the accuracy and spatial coverage of the measured aerosol optical depth have significantly improved relative to previous measurements. The availability of instrumentation specifically designed for aerosol sensing and new algorithmic approaches that make use of spectral and angular information allow the retrieval of aerosol optical depth beyond the dark oceans to most continental areas. The capability of retrieving aerosol optical depth even over the deserts is possible today using a variety of MODIS and MISR techniques. This is one of the most dramatic improvements in this new era of aerosol remote sensing.

In spite of the increased aerosol sensing capability, the quantification of the net effect of aerosols on the radiative transfer balance of the earth-atmosphere system remains a challenge. The long-held view that the effect of aerosols in the global radiative balance was one of just cooling is currently being re-evaluated. Observational evidence as well as important theoretical analyses, indicate that the absorption of solar radiation by soot-containing and organic aerosols may in fact contribute to warming the atmosphere. In addition to the well-documented climate role of aerosol absorption, recent research indicates that absorbing aerosols may also have an effect on the hydrological cycle as it inhibits cloud formation and prevents or delays the onset of precipitation.

The discovery of the capability to detect aerosol absorption from space using near-UV observations was one the most important breakthroughs of the last decade in aerosol remote sensing from space. The technique, developed from analysis of observations by the TOMS instrument has been extensively used for the global mapping of absorbing aerosols. Aerosol absorption can be measured from space in the near UV by taking advantage of the interaction between Rayleigh scattering and particle absorption. The result of this radiative transfer interaction is a unique signal that clearly detects the presence of absorbing aerosols under most observing conditions: clear skies over water and land surfaces (including deserts), mixed with clouds or above them, and aerosols over ice and snow covered surfaces. For soot-containing aerosols, the near-UV aerosol absorption signal is a proxy of an important radiative transfer effect of significance not just in the near-UV but also in the visible and near-IR. The currently deployed observational capability of the A-train that includes radiance measurements from the near-UV (Aura-OMI) to the near-IR (Aqua-MODIS) as well as CALIPSO data, offers a unique opportunity for the synergistic use of satellite observations to characterize aerosol absorption.

In this presentation I will discuss the application of a retrieval method to obtain aerosol absorption using TOMS (Total Ozone Mapping Spectrometer) and OMI (Ozone

Monitoring Instrument) near UV observations over clear areas and discuss the potential of extending this retrieval capability to conditions where the aerosols are mixed with clouds or over snow/ice layers. Plans for the integrated use of A-train observations to quantify aerosol absorption will also be discussed.