Aircraft-Based Validation of Ozone Column for AURA Satellite Mission

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One of the objectives for Earth Observing Systems (EOS) Aura Mission is to determine recovery of the ozone layer. For the Aura mission to be a success an accurate validation of the product is required. There are several satellite total ozone algorithms being implied to satellite ozone measurements (including Ozone Monitoring Instrument (OMI), SCanning Imaging Absorption SpectroMeter for Atmospheric CHartographY (SCIAMACHY), Global Ozone Monitoring Experiment (GOME), etc.). In general, satellite algorithms agree well with each other and with ground-based instruments in the low and middle latitudes, however, they exhibit large differences in the Polar Regions, particularly at solar zenith angle (SZA) larger than 80 degrees. Fairbanks based TOMS-3F (Total Ozone Measurements by Satellites, Sondes, and Spectrometers at Fairbanks) validation campaign in 2002 had showed that the direct-sun Dobson/Brewer techniques work well only up to about 70 degrees SZA. Atmospheric and instrumental scattered light becomes a problem at larger SZAs. Currently, there are no good ground-based algorithms that work at larger SZAs. In this paper we present an algorithm that has been applied to spectrally-resolved actinic flux measured in the Polar-AVE (Aircraft Validation Experiment) campaign to derive accurate estimates of partial ozone column above and below the aircraft at SZAs ranging between 70 and 86 degrees. (Figure 1) The CAFS (CCD, or charge-coupled device, Actinic Flux Spectroradiometer) instrument is operated by ARIM/NCAR (Atmospheric Radiation Investigation and Measurement group at the National Center for Atmospheric Research). Algorithm exploits traditional Brewer/Dobson direct sun method to derive TO column from actinic flux data. Moreover, a combination of CAFS spectral measurements (equivalent to Brewer CD-pair method) minimizes cloud or aerosol interference, as well as sensitivity of measurement to the albedo of underlying surface. The first version of the algorithm had been successfully applied to CAFS measurements at high sun conditions during the Aura Validation Experiment (AVE-Houston). However, at low sun conditions actinic flux measurements become more sensitive to the vertical ozone distribution and needs to be spectrally adjusted.

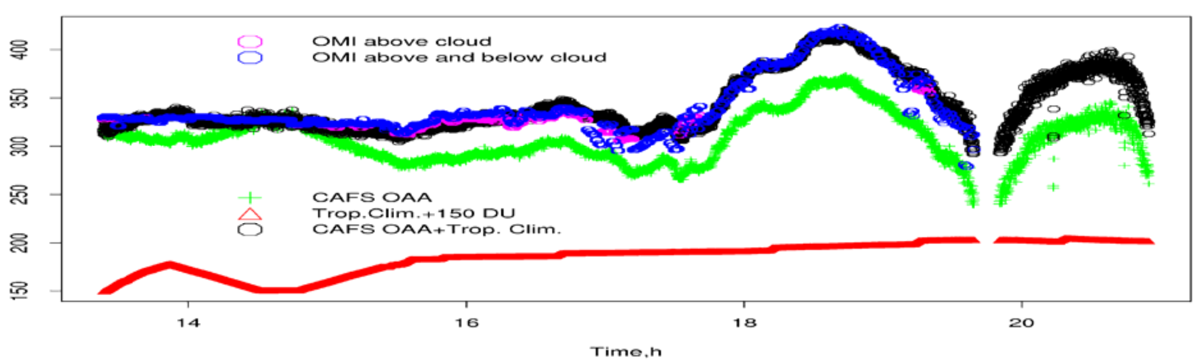

Figure 1. Validation of the Aura/OMI derived ozone column (blue) during January 29, 2005 along the satellite track. CAFS measurements above the DC-8 aircraft level are shown in green. Ozone climatology below the aircraft is shown in red. Combined CAFS ozone (black) agrees well with OMI data over wide range of spatial and temporal variability observed in total ozone column.