Determination of Total Column Ozone at the South Pole with Measurements from the NSF UV Spectroradiometer: Comparison with CMDL/Dobson and NASA/TOMS Measurements, and Effect of Ozone Profiles on Ozone Retrievals

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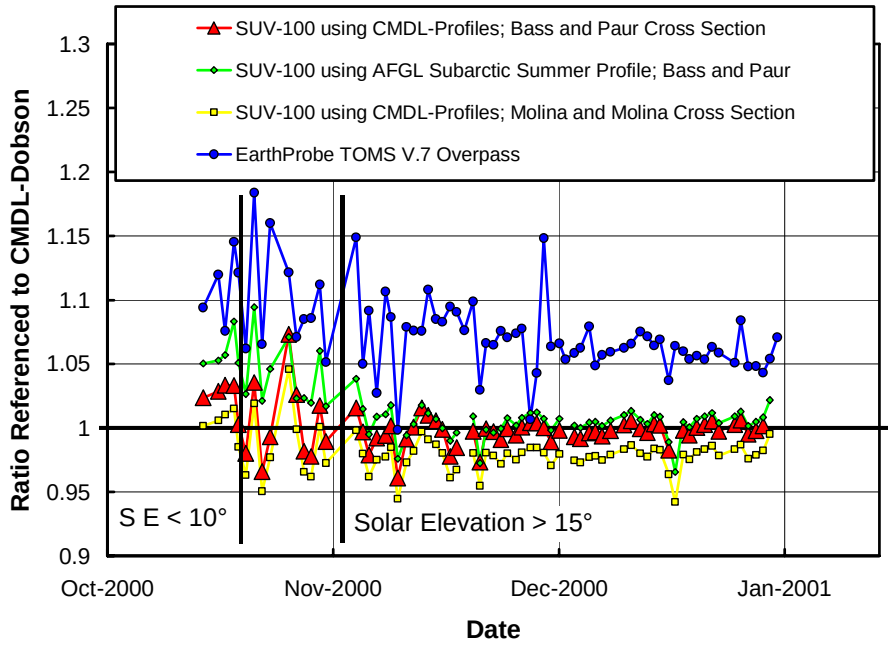
Global solar UV measurements performed with a high-resolution spectroradiometer (SUV-100) located at the South Pole are used to determine total column ozone. The UV spectroradiometer is part of the National Science Foundation's Office of Polar Programs (NSF/OPP) UV monitoring network. The measured spectra are compared with results of the radiative transfer model UVSPEC/libRadtran. When correcting SUV-100 UV measurements for the cosine error of the entrance optics, measurement and model agree to within ±5% in the UV-A and visible for solar elevations greater than 10°. By adjusting various model input parameters, the deviation of measurement and model in the UV-B is minimized, resulting in a value for total column ozone. Model input parameters include total column ozone, ozone cross-section, as well as temperature and ozone profiles. For solar elevations higher than 15°, ozone values derived with this method are 0.3 ± 0.9% lower than ozone values reported by the Dobson ozone spectrophotometer operated by CMDL at the South Pole (red triangles in figure below). For solar elevations below 15°, ozone and temperature profiles become critical. When profiles from CMDL ozone sondes are implemented in the model, ozone values calculated from SUV-100 spectra measured in the second half of October 2000 (solar elevations between 10° and 15°) are 0.3 ± 2.4% lower than Dobson measurements. When the Air Force Geophysics Laboratory (AFGL) standard profile for subarctic summer is used instead, the retrieved ozone values become 4.0 ± 2.6% higher than the Dobson measurements for the same solar elevation range (green diamonds). Calculations with the Molina and Molina rather than the Bass and Paur ozone cross section give generally 2% lower ozone values (yellow squares). Ozone measurements of NASA's Earth Probe Total Ozone Mapping Spectrometer (NASA/TOMS) are generally 5-10% higher at the South Pole than SUV-100 derived ozone values, consistent to the bias seen between CMDL/Dobson and NASA/TOMS (blue circles). The results show that SUV-100 based ozone retrievals may complement Dobson measurements for the validation of NASA/TOMS measurements at high latitude sites.



Ratio of total-column ozone from various sources referenced to CMDL Dobson measurements. Ozone values derived from SUV-100 measurements agree best with CMDL Dobson measurements when actual ozone profiles and the Bass and Paur ozone cross section are used in the retrieval algorithm.