Validation of Stratospheric Ozone Observed by the Atmospheric Trace Molecule Spectroscopy (ATMOS) Experiment During 1992

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Abstract

Stratospheric ozone measurements made by the Atmospheric Trace Molecule Spectroscopy (ATMOS) experiment from onboard the Space Shuttle during the period 8-16 April 1992 are compared with other space-based remote sensing measurements.

Summary

Measurements of stratospheric ozone were made by the Atmospheric Trace Molecule Spectroscopy (ATMOS) experiment from onboard the Space Shuttle during the period 8-16 April 1992. The precision and accuracy of the measurements are discussed in the context of establishing the accuracy and compatibility of the measurements relative to other space-based measurements of ozone. Coincident measurements were obtained from the Stratospheric Aerosol and Gas Experiment (SAGE) II instrument onboard the Earth Radiation Budget Satellite (ERBS) and three instruments, the Microwave Limb Sounder (MLS), the Cryogenic Limb Array Etalon Spectrometer (CLAES), the Halogen Occultation Experiment (HALOE) onboard the Upper Atmospheric Research Satellite (UARS). Three of the instruments, ATMOS, SAGE-H and MLS are demonstrated to bc consistent to within ±10% over the altitude range between 100 hPa and 0.5 hPa (approximately 20 to 60 km), with ATMOS and MLS displaying a zero mean bias and a root mean square deviation (rms) of 3% and SAGE-H displaying an essentially systematic bias of -5% over the majority of the altitude range, except for below 30 hPa where SAGE-II displays a large positive systematic bias due to the effect of the aerosol attenuation resulting from the Mt. Pinatubo volcanic eruption in 1991. The comparison with HALOE indicates that ozone levels observed by ATMOS are systematically higher than HALOE by 5 to 25% with a clear gradient in the differences; in contrast the comparison with CLAES displays differences of as much as ± 30% with no obvious systematic scaling possible. Comparisons are evaluated in two separate schemes, by geographical coincidence and through zonal averages which illustrate the limitations of both schemes. Latitudinal and longitudinal variation are used to assess the sensitivity of the ATMOS measurements and to confirm the precision and accuracy, which should be less than 4 % and 10% respectively.