MLS-related Scientific Publication

Scientific Theme: Atmospheric Chemistry

Intercomparison of stratospheric HNO_3 measurements over Antarctica: Ground-based Millimeter-wave versus UARS/MLS Version 5 retrievals Giovanni Muscari, Michelle L. Santee, and Robert L. de Zafra, *J. Geophys. Res.*, **107**(D24), 4809, doi:10.1029/2002JD002546, 2002.

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Summary and MLS contribution

This paper presents the first intercomparison between the two most comprehensive records of gas-phase HNO_3 profiles in the Antarctic stratosphere: measurements from the Microwave Limb Sounder (MLS) aboard the Upper Atmosphere Research Satellite (UARS) and measurements from the Stony Brook Ground-Based Millimeter-wave Spectrometer (GBMS) at the South Pole. The comparison period covers the greater part of 1993 and 1995. Trajectory calculations are used to identify MLS measurements in the 70°–80°S latitude band that sampled air masses also observed by GBMS at the South Pole. An additional screening is performed to select MLS measurements that sampled air parcels with temperatures within 1.5 K of that experienced over the Pole. Quantitative comparisons are made on seven potential temperature surfaces spanning the range ∼19–30 km. Agreement between the MLS and GBMS datasets is generally within ∼1.5 ppbv between 465 and 655 K (∼19–25 km) during a large fraction of the year. Agreement is best during winter and spring and worse during summer and fall, when GBMS measurements can exceed MLS values by ∼1–3 ppbv. Differences occurring in the lower stratosphere during fall probably arise from lack of colocation between the two datasets during a period of strong poleward gradients in HNO_3. MLS HNO_3 abundances are consistently smaller than those from GBMS throughout an annual cycle at 740 and 960 K, where differences can exceed 3 ppbv. This discrepancy is attributed to a low bias in the MLS measurements at these altitudes. Remaining small differences between GBMS and MLS measurements are thought to be due to instrumental and/or retrieval biases. This work benefits society by improving understanding of the quality of measurements of HNO_3, a key player in stratospheric ozone loss processes.

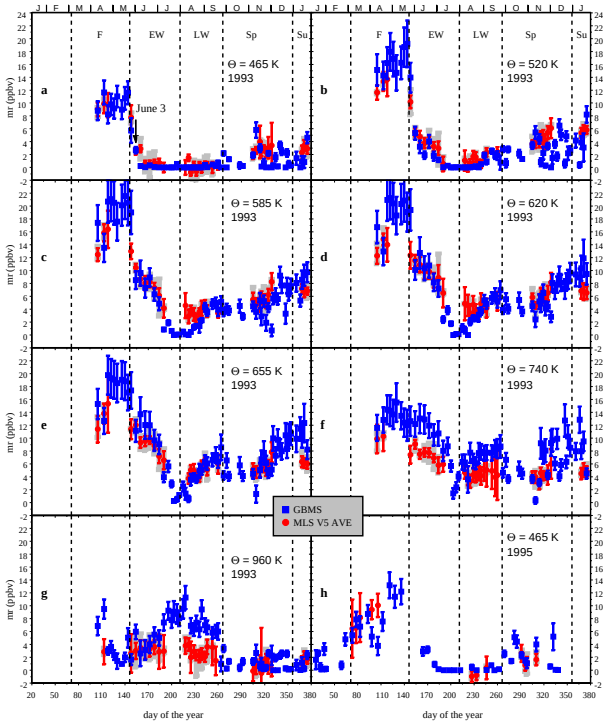

Figure 3. Time series of GBMS data (blue squares) and spatially and temporally averaged MLS corrected version 5 data (MLS V5 AVE, red circles) for 1993 (all levels studied) and 1995 (shown only at 465 K). GBMS error bars include both systematic and random error. MLS V5 AVE red error bars represent the MLS V5 random error propagated through the interpolation and averaging processes, while the grey error bars show the minimum and maximum MLS V5 values used in the computation of each MLS V5 AVE point. Vertical dashed lines mark five "pseudo-seasons" defined in the top panels (fall, F; early winter, EW; late winter, LW; spring, Sp; summer, Su). The months of the year are indicated above the top panels by their initials.