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The UARS Microwave Limb Sounder version 5 dataset: Theory, characterization and validation

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Summary

This paper describes version 5 (v5) of the data from the Microwave Limb Sounder (MLS) on the Upper Atmosphere Research Satellite (UARS). The v5 data represent for most species a signifi cant improvement on earlier versions of the MLS dataset. V5 includes observations of temperature, geopotential height, ozone and water vapor in the stratosphere and mesosphere; stratospheric nitric acid, chlorine monoxide and methyl cyanide; and water vapor in the upper troposphere. The data are output on a vertical grid with twice the vertical resolution of previous MLS datasets over most of the vertical range (now being 6 surfaces per decade change in pressure, $\sim$2.5 km), though the true resolution of the information represented is typically somewhat coarser than this. For each species produced in v5 the paper gives details of the estimated accuracy, precision and vertical resolution of the data. Comparisons with other datasets are shown where available.

Improvements in temperature include greater vertical resolution and fewer 'spikes'. V5 also includes an empirical retrieval of mesospheric temperature, but this is considered a research product. The ozone data from v5 are generally better than in version 4: agreement with the SAGE datasets is better, and the vertical resolution is higher (though this comes at the cost of somewhat more noise). As with previous versions, 205 GHz ozone data are considered superior in the stratosphere, but 183 GHz ozone data are more useful in the mesosphere. The improvement in vertical resolution is seen to have a particularly positive impact on the chlorine monoxide data, which better describe the peak in enhanced chlorine monoxide (see fi gure.) The use of day/night differences is still recommended for quantitative studies of MLS chlorine monoxide data. The paper also describes the fi rst global stratospheric observations of methyl cyanide.

The nitric acid data in v5 are shown to be biased because of the neglect in the v5 algorithms of emission from an excited nitric acid state. A correction is described and the corrected data are available as version 6. For water vapor (both in the upper troposphere and the stratosphere and mesosphere) the paper describes alternative versions of MLS data that are considered preferable to the v5 dataset.

All of these data are available at the Goddard Space Flight Center Distributed Active Archive Center. A supplement to the paper describes the methods used to produce the v5 data, including details of the forward model and the retrieval algorithms. The supplement also describes more detailed studies and comparisons of the v5 data.

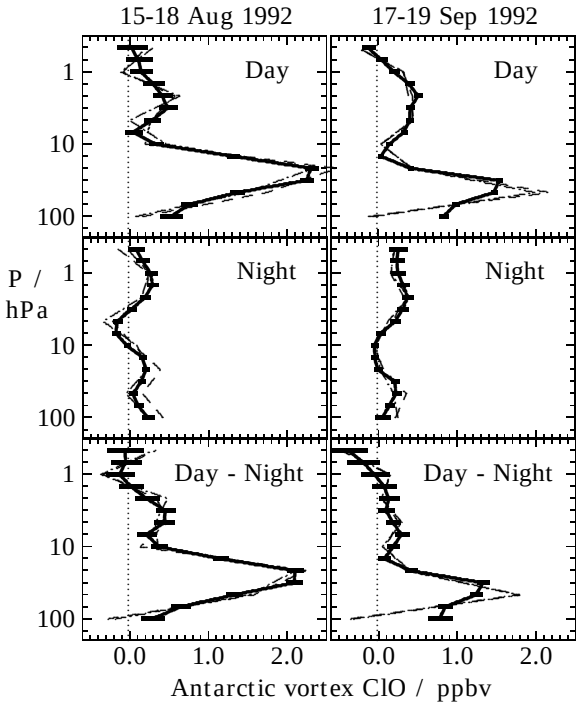

Figure 8. Average of ClO retrievals from measurements made in the 1992 Antarctic winter vortex at locations of greatest ClO enhancement in the lower stratosphere. Solid thick lines are v5 data with horizontal bars indicating the $\pm 1\sigma$ predicted precision of the averages; dash-dot-dash are v4 and dashed are v3 (in places these merge). The August 15–18 measurements (left panels) were made at 70°–80°S and 120°W–90°E: 'Day' is for sza $< 87°$, and the average of 25–26 (depending upon data version) individual profiles; 'Night' is for sza $>100°$, and the average of 95–96 profiles. The September 17–19, 1992, measurements (right panels) were made at 75°–80°S and all longitudes: 'Day' is for sza $< 90°$, and the average of 151–155 profiles; 'Night' is for sza $> 95°$, and the average of 75 profiles.