A New View of Polar Processing: 
First Results from the Microwave Limb Sounder on Aura

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- EOS MLS is providing an extensive dataset on polar processes affecting stratospheric ozone, including the first simultaneous daily global maps of ClO and HCl, along with N$_2$O, HNO$_3$, H$_2$O, O$_3$, and temperature.

- We present MLS observations from the 2004 Antarctic late winter/early spring period, with a focus on chlorine and its influence on ozone.

- Results shown here are from preliminary data processing algorithms; refinements to the retrieval code are currently being implemented, and most data products will be improved in the next version, to be released in early 2005.

- Meteorology of the 2004 Antarctic winter:
  - Lower stratospheric minimum temperatures were mostly below the climatological average until MLS entered routine science operations in mid-August, after which they remained near average values.
  - Temperatures in the lower stratosphere rose rapidly starting in mid-September.
  - Maximum potential vorticity (PV) gradients indicate that the lower stratospheric vortex was much stronger than usual throughout the period observed by MLS.
There is very good correspondence in the vertical extent of depleted HCl and enhanced ClO during the time of peak chlorine activation.

HCl has recovered and nearly all ClO has disappeared above 500K by 1 October, although weak enhancement persists at lower altitudes.

Contrasting the two O₃ panels illustrates the development of the lower stratospheric ozone hole over the month of September.
In the vortex core:
✧ ClO values continue to increase until early September, after which they decline rapidly;
✧ Rapid HCl recovery begins in mid-September;
✧ O₃ loss accelerates in late August and levels off in early October.

Closer to the vortex edge:
✧ ClO mixing ratios are lower and are relatively constant in mid-August, decreasing thereafter;
✧ HCl recovery starts earlier and is more gradual;
✧ O₃ loss appears to be less severe.
Short data gaps are filled by running the daily averages through a Kalman smoother; paler colors denote regions where data are sparse or missing.

The timing and horizontal extent of chlorine activation are consistent in the ClO and HCl fields.

Inside the vortex, ozone abundances steadily decline until almost all ozone at this level has been chemically destroyed by mid-October.
The HCl and ClO fields provide a consistent picture of the vertical extent of active chlorine and the timing of chlorine deactivation.

The downward progression of the peak in the ClO profile in late winter has been observed previously in both UARS MLS and ground-based data.

Summary: The suite of MLS polar process measurements will be very valuable in detailed process studies in both the Antarctic and the Arctic.