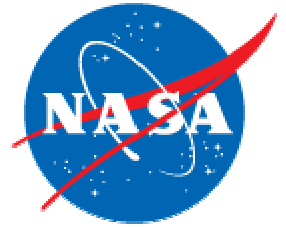


National Aeronautics and Space Administration



Studying the Subvortex in the Lowermost Stratosphere Using New Trace Gas Measurements from Aura MLS

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Aura Science Team Meeting

3 October 2007

Pasadena, CA

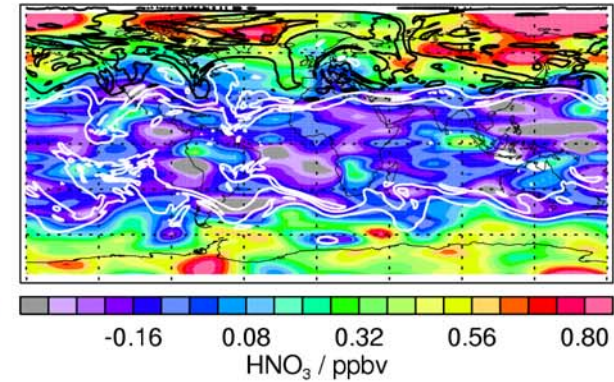
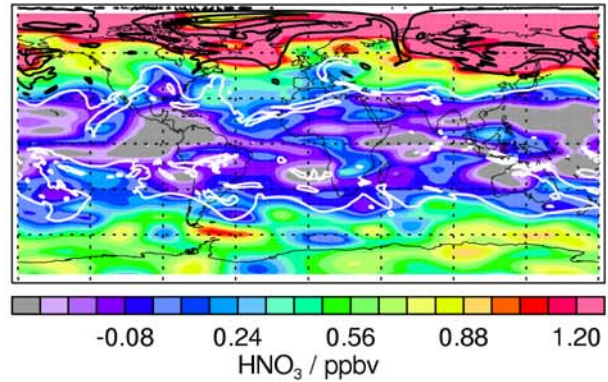
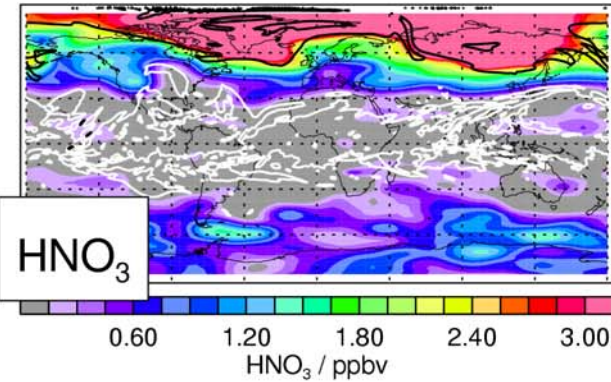
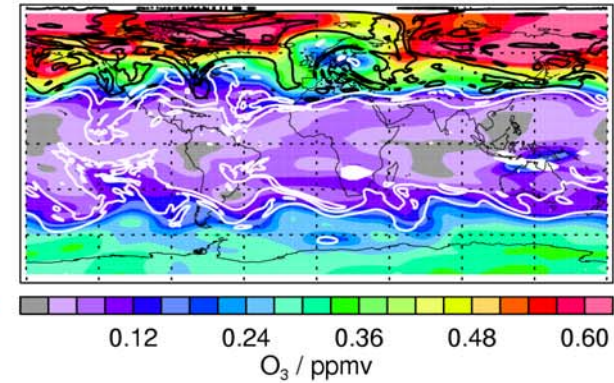
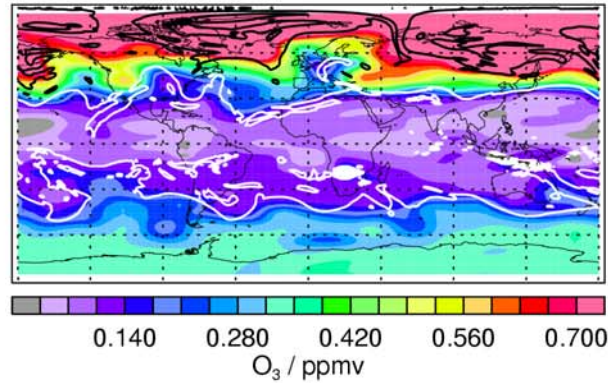
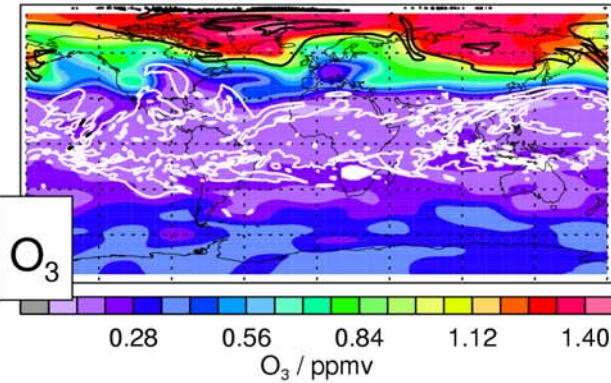
- ✦ The **Microwave Limb Sounder (MLS)** provides daily global profiles of several key species useful for studying the upper troposphere (UT) and lowermost stratosphere (LMS):
 - ⑦ H_2O
 - ⑦ CO , O_3
 - ⑦ HNO_3 ⇐ New in UTLS in Version 2.2 (v2.2) MLS data
- ✦ We use v2.2 MLS data and GMAO GEOS-5 analyses to explore:
 - ⑦ Chemical processing in and springtime dispersal of chemically-processed air from the **subvortex** (~350-400 K)
 - ▲ “**Subvortex**” ≡ the portion of the polar vortex at levels where lower latitudes are in the troposphere
 - ⑦ Mixing of stratospheric and tropospheric air in the UTLS, particularly in the region between the subvortex and the tropopause transport barriers
 - ⑦ Seasonal evolution and interannual and interhemispheric variability in trace gases in the LMS (v1.5 MLS data)

15 Jan 2006

390 K, ~121 hPa, ~13 km

370 K, ~147 hPa, ~12 km

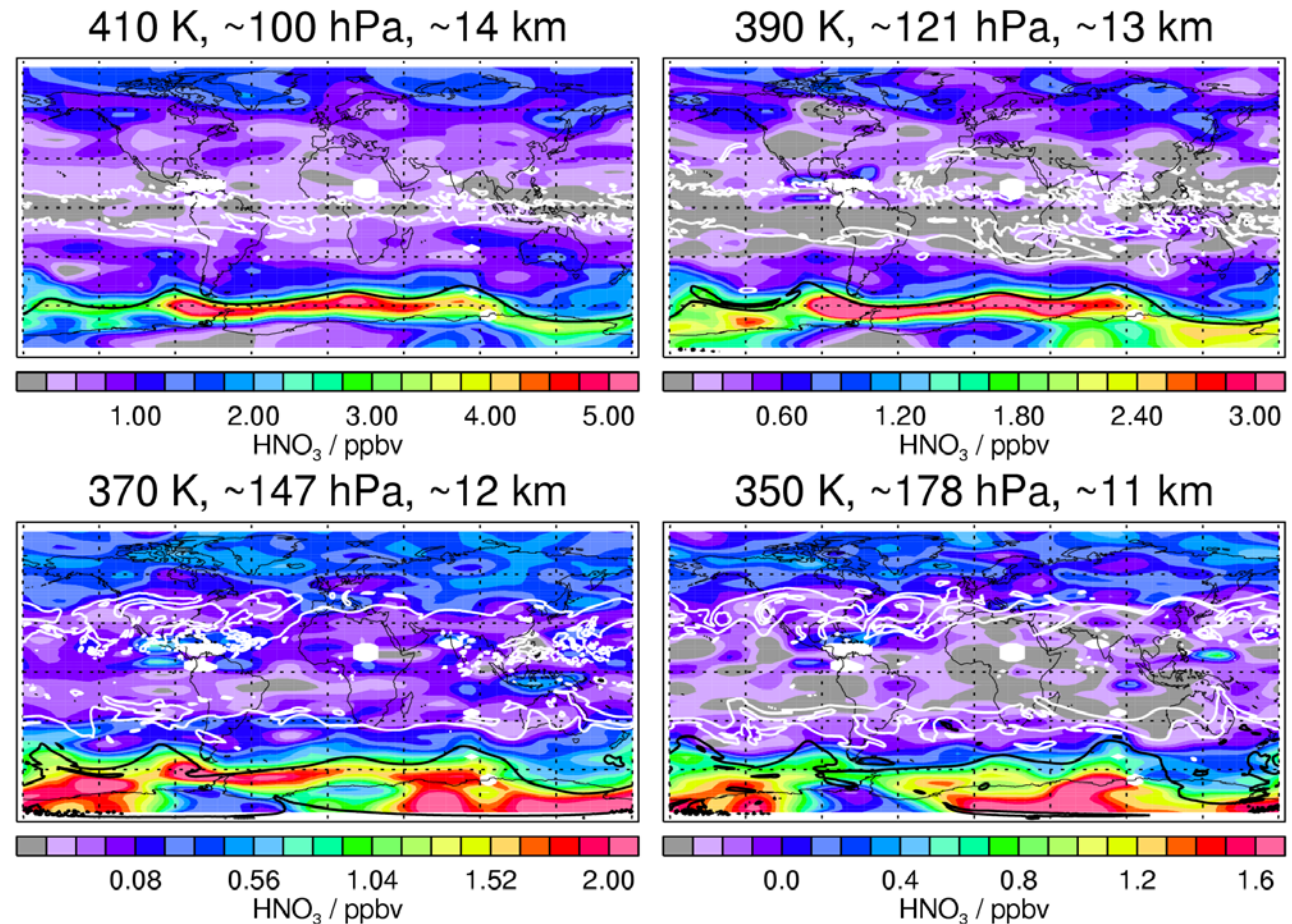
350 K, ~178 hPa, ~11 km



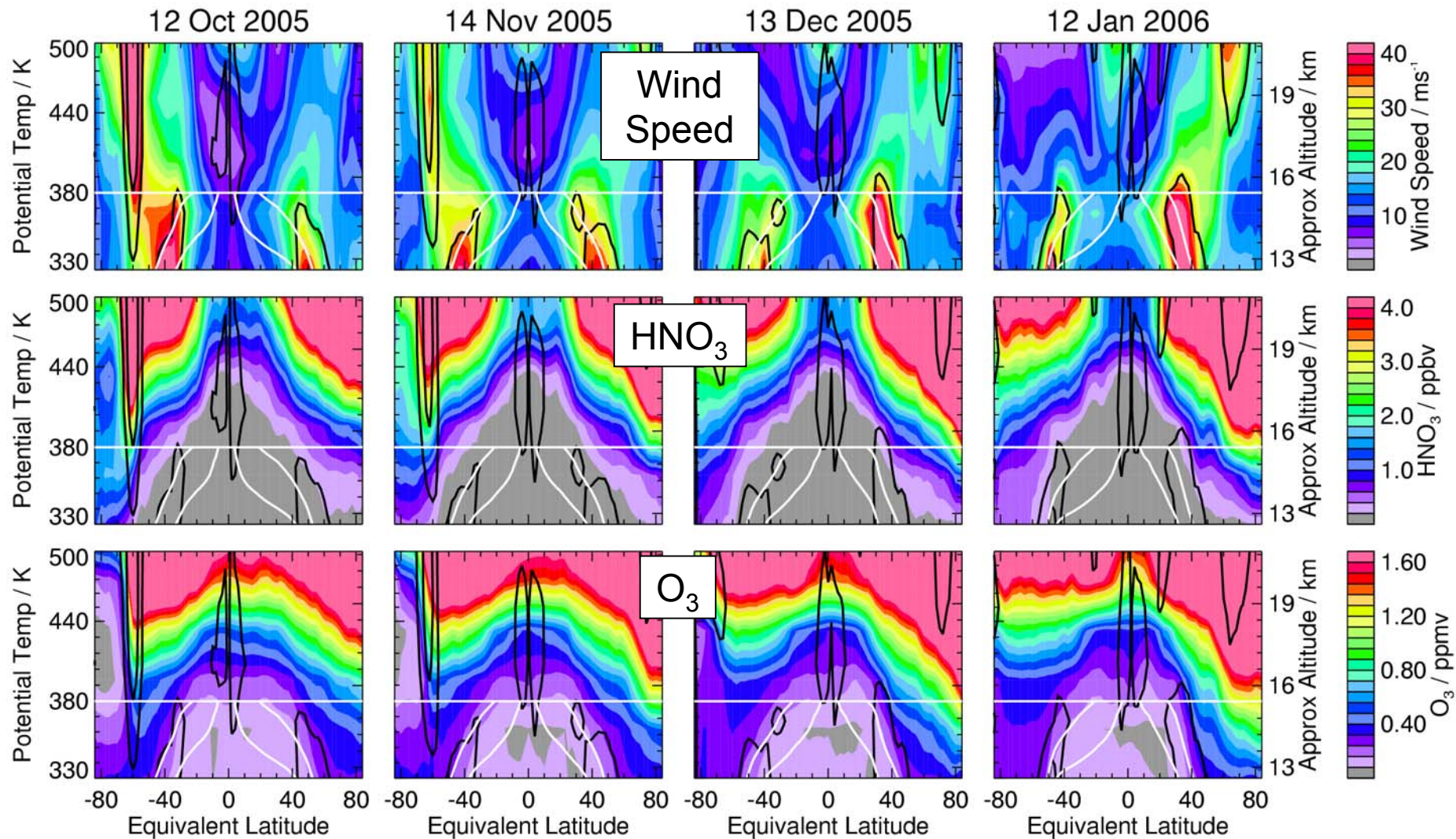
- ✦ Many features are persistent throughout the LMS; in particular, two troposphere-to-stratosphere transport events near 0° longitude in each hemisphere are evident down to at least 350 K
- ✦ Because of differences in tracer gradients, some features show up better in different species at different levels

- ◆ MLS HNO₃ shows denitrification in the SH subvortex down to 350 K
- ◆ MLS O₃ also shows chemical loss in subvortex
- ◆ Dispersal of chemically-processed air from the subvortex may significantly affect midlatitude LMS composition

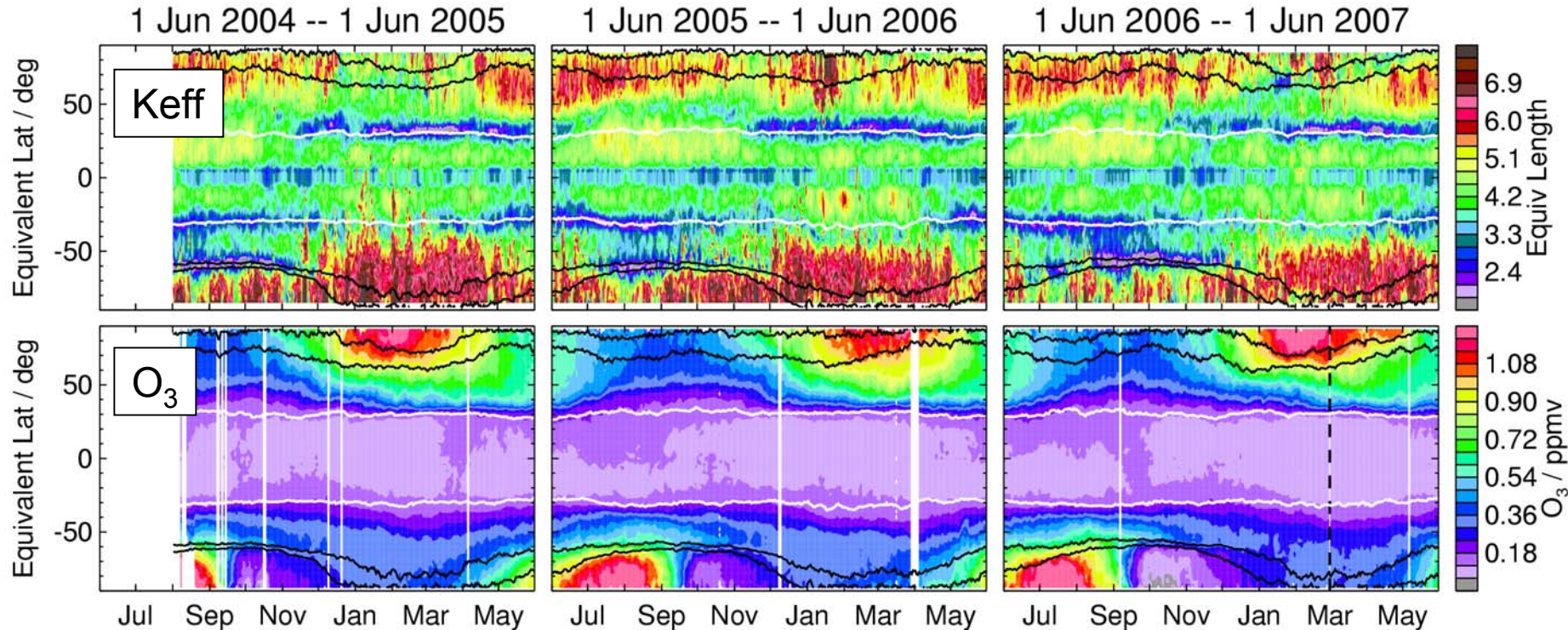
20 Sep 2005



Synoptic Subvortex/UTLS Structure in SH Spring/Summer 5



- ◆ In SH winter, the major transport barrier is the subvortex; by mid-December, it is the subtropical jet / tropopause



- ◆ v1.5 MLS data until March 2007, v2.2 data thereafter
- ◆ Effective diffusivity (K_{eff}) gives a measure of the degree of mixing: low values indicate transport barriers, high values indicate strong mixing
- ◆ The tropopause and subvortex transport barriers, their seasonal patterns, interannual and interhemispheric variability, and evidence of mixing and stratosphere-troposphere exchange are clearly seen in MLS O_3 data

- ✦ The release of MLS v2.2 data provides new opportunities for comprehensive studies of the LMS, particularly the subvortex:
 - ⑦ v2.2 HNO₃ extends into the UTLS and exhibits strong gradients across the subvortex boundary and the tropopause
 - ⑦ MLS O₃, CO, and H₂O are also very useful for studying this region
- ✦ Specifically, we used MLS v2.2 data and GEOS-5 analyses to examine:
 - ⑦ Quasi-isentropic troposphere-to-stratosphere and stratosphere-to-troposphere exchange events
 - ⑦ Dispersal of chemically-processed air from the subvortex
 - ⑦ Mixing of stratospheric and tropospheric air in the UTLS
 - ⑦ Seasonal evolution and interannual and interhemispheric variability of the subtropical jet / tropopause and subvortex transport barriers
- ✦ Observed changes in trace gases are consistent with the evolution of transport barriers as diagnosed from meteorological analyses