



Aura Validation Needs: ARCTAS

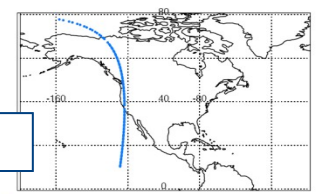
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HIRDLS input for ARCTAS (April 2008)



2006 April 1

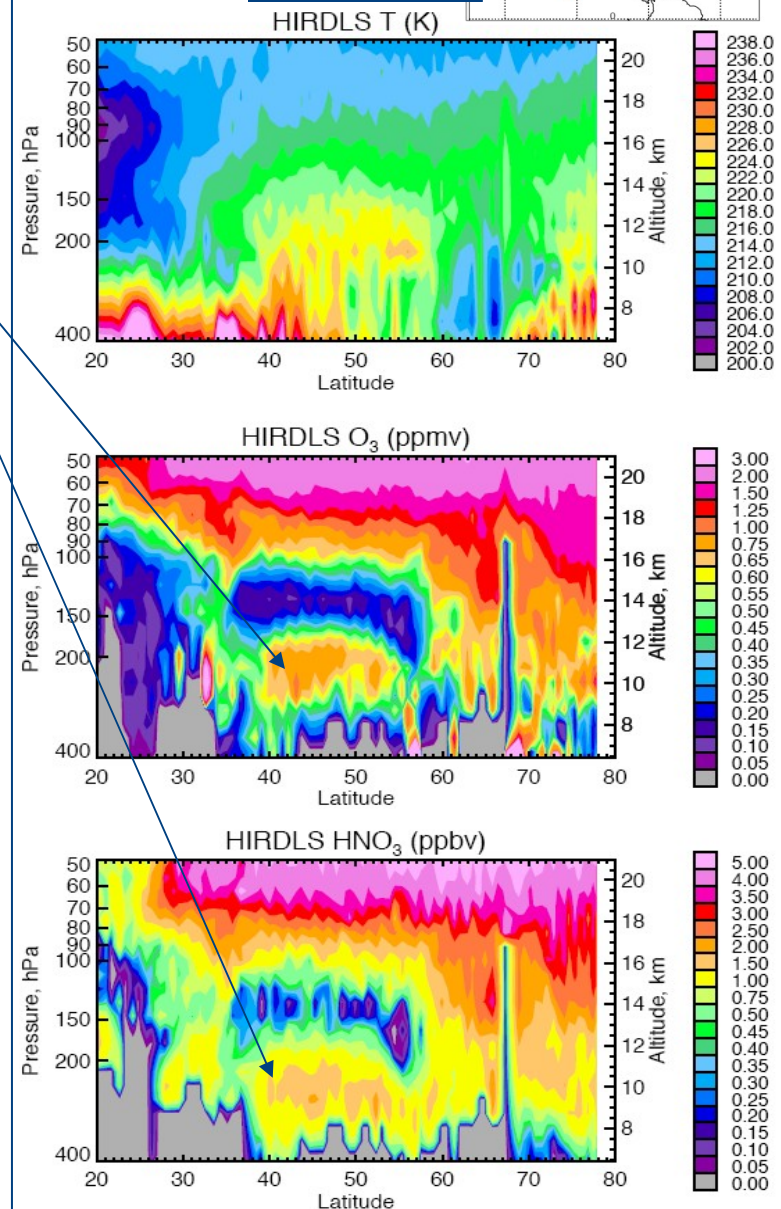
◆ Validation

1) Stratospheric structure near the tropopause (O_3 , T, HNO_3 and cloud-tops) Coincident in-situ and lidar observations of air-mass intrusions through the tropopause (especially in early April) are needed to validate HIRDLS observations of O_3 height, mixing ratio and vertical structure. Strategically located in-situ HNO_3 and temperature profiles are also needed. Lidar cloud-top height measurements will also facilitate validation of a recent HIRDLS-retrieval altitude correction.

2) Aerosol: DIAL lidar observations of smoke plumes in the UT/LS region can be used to validate coincident HIRDLS aerosol observations during ARCTAS. Coincident smoke size distributions (LARGE, SP2) can also be used to calculate the 12 micron extinction in order to validate this HIRDLS product.

◆ HIRDLS Support for ARCTAS

We plan to produce in near-real-time, HIRDLS ~1-km vertical-resolution stratospheric ozone, which may be useful for flight planning.

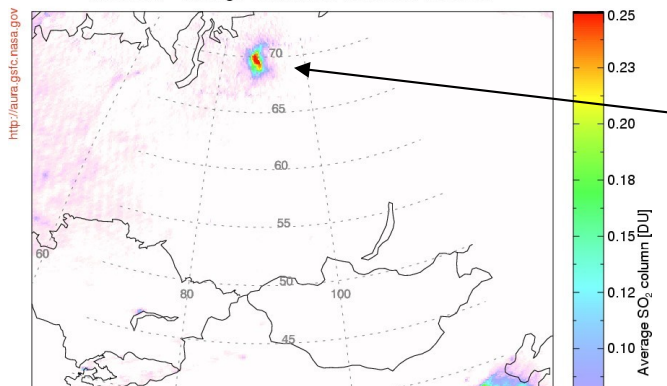


TES Validation Overview for ARCTAS

- Overview:
 - ARCTAS provides the opportunity for validation of TES retrievals over cold surfaces.
 - Retrievals over cold surfaces are currently problematic for TES
- Flight Strategy:
 - Based on lessons learned from INTEX-B, full DC-8 profiles from maximum altitude down to near the surface are ideal for comparing *in situ* data to TES profiles
 - DC-8 flight legs at a constant altitude are useful for comparisons with the DIAL lidar ozone data
 - Clear sky conditions are preferred
- Validation Request
 - Ozone profiles, both remotely sensed (DIAL on DC-8), *in situ* (UCAR NO_y-O₃) and from ozonesondes (ARC-IONS)
 - More validation data profiles for TES methane and carbon monoxide retrievals (DACOM)
 - Characterization of the surface type beneath the aircraft
 - Specifically whether surface type is ice or liquid water
 - This information and how it changes over the course of the mission will help with TES retrievals in the arctic

OMI Validation Goals for ARCTAS

- Objective 1 – resolve remaining differences between OMI-TOMS and OMI-DOAS total column ozone that are observed at high latitudes / high solar zenith angles
 - Use MLS above aircraft + Lidar measurements of ozone between 100 hPa and the ground to derive total column ozone
 - CAFS measurements of total column ozone above aircraft
 - Compare with balloon sonde ozone profiles + climatology
- Objective 2 – validate the OMI trace gas retrievals
 - Measurements of in situ BrO, HCOH, NO₂, and SO₂ in profile - volcanoes in Aleutian Islands, Southern Alaska could be exploited.
- Objective 3 – verify the thickness and altitude of smoke and dust in the Arctic for verification of the OMI aerosol retrieval result
 - Lidar measurements of aerosol from aircraft (and ground if possible)
 - **Vertical profiling of boreal forest fire plumes**



- Norilsk Nickel is one of Russia's heaviest industrial polluters

- Back trajectories from Norilsk might be worth sampling

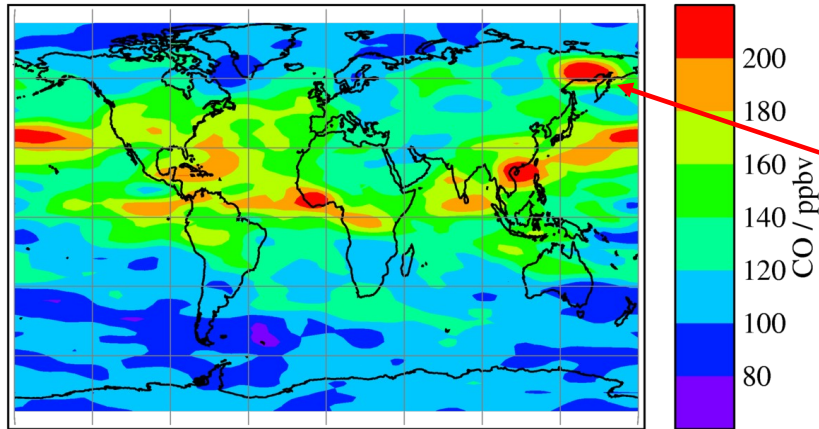


MLS validation and related interests/inputs during ARCTAS

Tropospheric ozone column information

- MLS also plans to produce a Near-Real-Time O₃ product, which when combined with OMI could be useful for flight planning.
- Using OMI total column and MLS column (down to 215 hPa in version 2).

MLS 215 hPa CO 4-6 June 2006 (v2.2)



Note: current (v2) MLS CO data at this height are biased high by ~ factor of 2.

CO (and O₃?) pollution plumes from high lat.
forest fires in summer

- Evidence in past MLS data

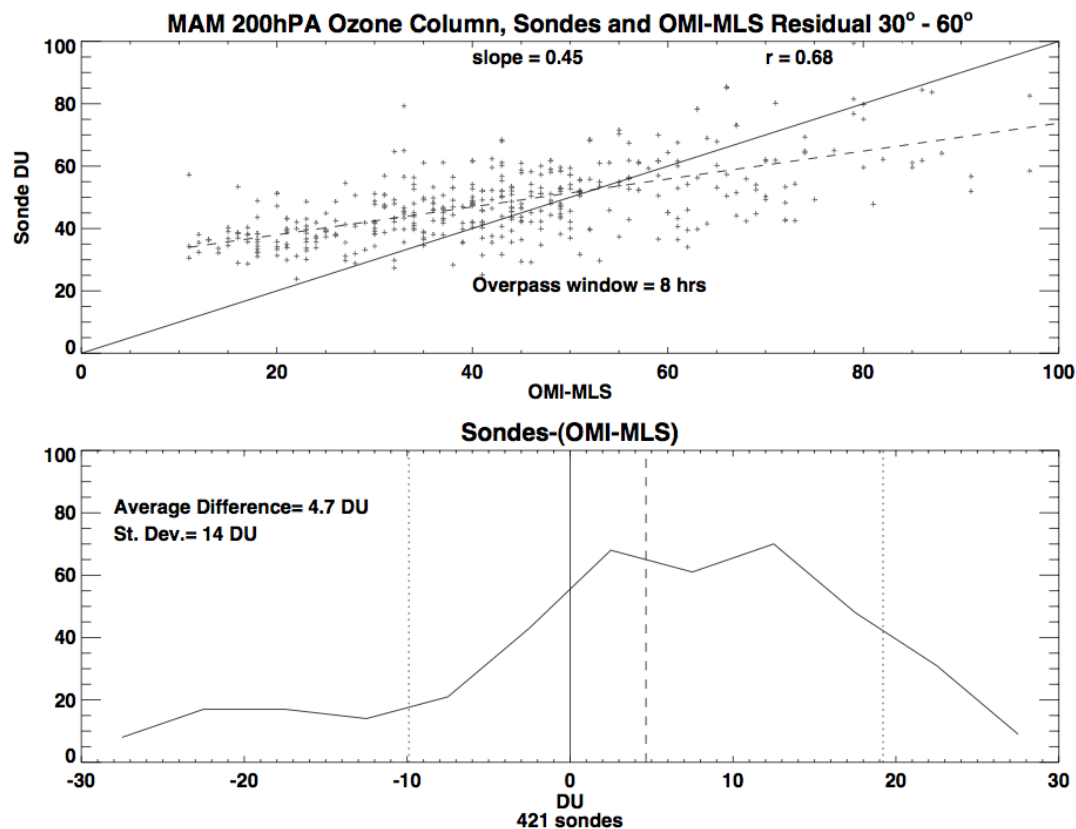
(here, over Siberia, June 2006).

- Such MLS and TES observations will complement aircraft data.

- Validation: Need additional along-track O₃ data
 - using mainly aircraft lidar data, during transits to/from Thule (?).
- O₃, CO, HNO₃ structure near the tropopause is of interest - e.g., as evidence of strat./trop. intrusions.

Ozone Residual (OMI-MLS)

- High latitudes are particularly difficult
 - Low tropopause - MLS data “below” 215 doubtful
 - High zenith angles for OMI



Sondes show less variation in the 200 hPa column than OMI-MLS

How can we improve the residual?

Potential improvements

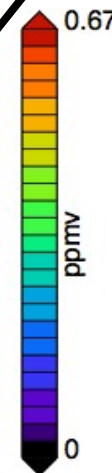
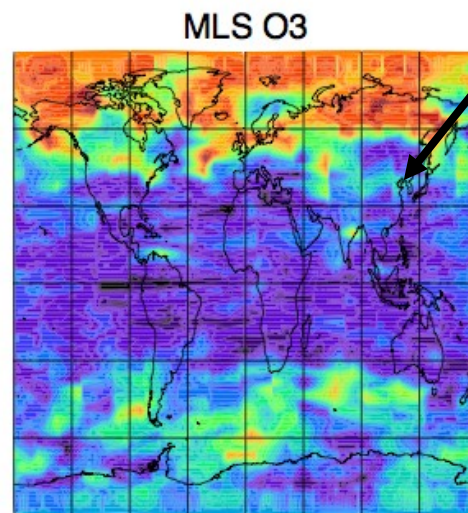
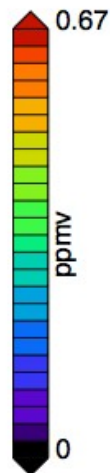
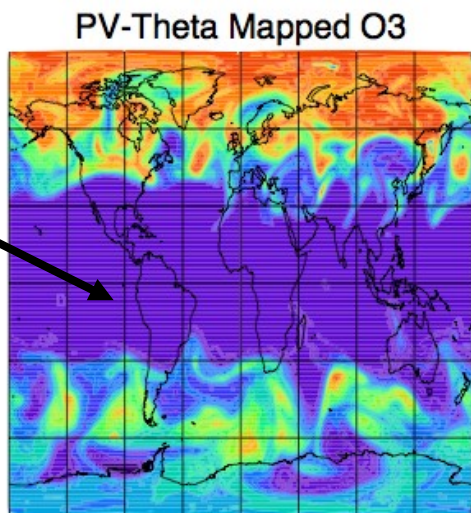
- Input stratospheric data
 - MLS V2.2
 - HIRDLS
- Tropospheric column
 - DOAS vs OMI-TOMS
- Mapping the stratosphere
 - Trajectory transport of MLS measurements
 - PV- Θ Mapping
 - Combination of the above

PV-Theta vs Trajectory method mapping lower stratospheric ozone

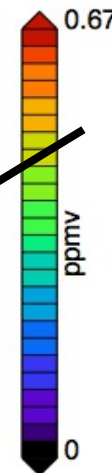
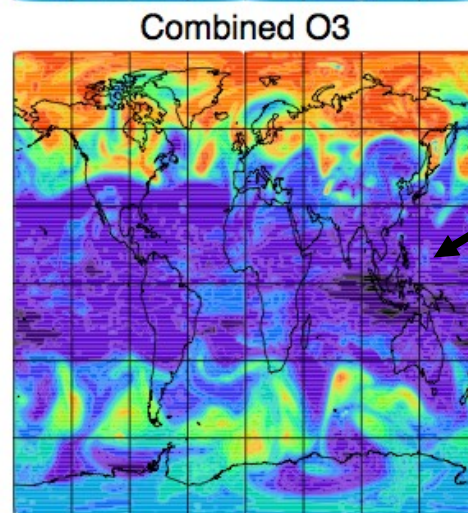
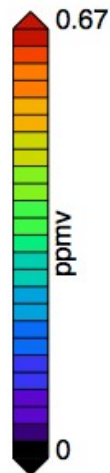
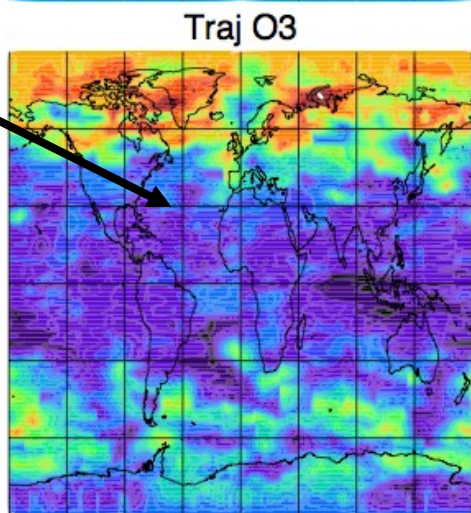
050630 Pressure = 215hPa

Interpolation mapping

PV- Θ
mapping



Trajectory
mapping

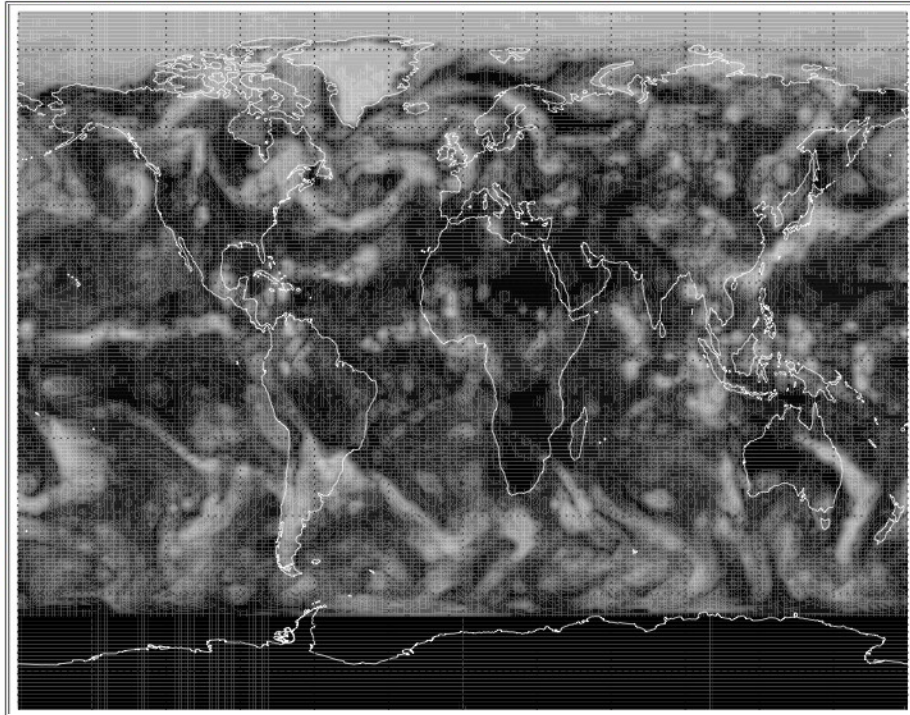


Trajectory
mapping in the
tropics and
PV- Θ in the
extra-tropics

Which method does better?

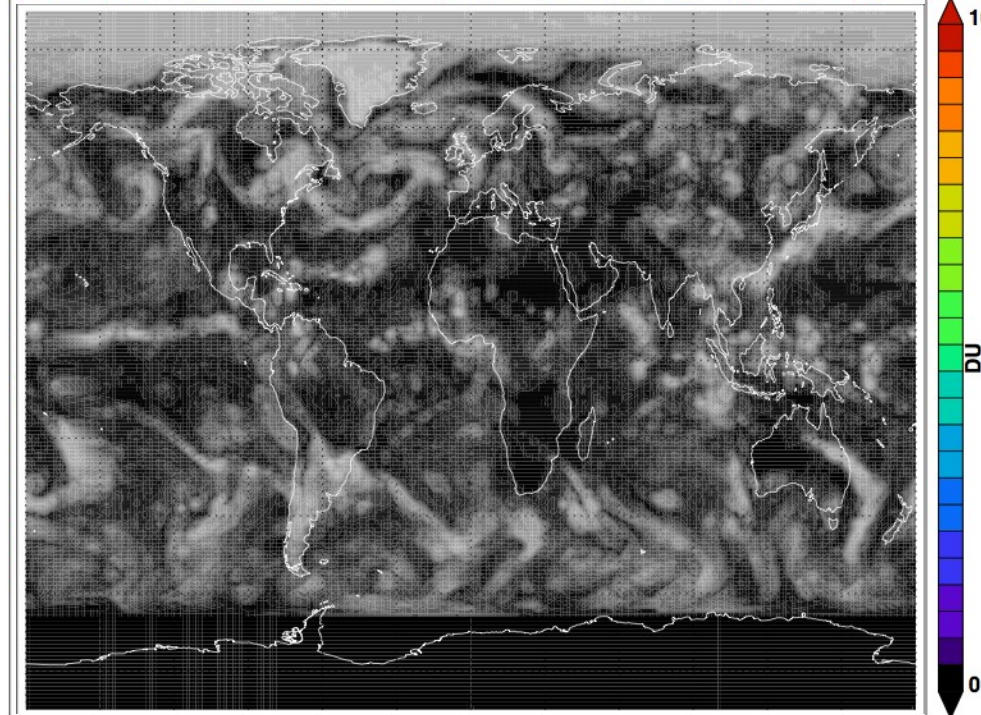
Trajectory only

Tropospheric Ozone Column June 15 2005 using Traj



Combined

Tropospheric Ozone Column June 15 2005 using Traj & PV



Summary

- Flight plans include spirals in clear slowly moving air masses during overpass times - into BL
- Volcanic flights and Norilsk plume intercepts
- Sonde profiles during overpass times
- Ground based instruments
 - Double Brewer in Toronto
 - Herman spectrometer with Native
 - Mount instrument with Native
- What is needed from AVDC?
 - Orbit predicts and overpass times (most satellites)
 - European, Canadian satellite data and Aura data archives - segmented to specific areas
 - <http://avdc.gsfc.nasa.gov/Overview/news.html>
 - Contact Bojan Bojkov (Bojan.R.Bojkov@nasa.gov)