Comparison of AROTAL and MLS Data during the PAVE Campaign

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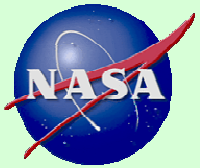
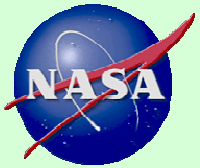


Aura Validation Meeting
September 19, 2005

AROTAL – Airborne Raman Ozone, Temperature and Aerosol Lidar

- ✈ Combines Rayleigh Lidar, Differential Absorption Lidar (DIAL), and Raman DIAL
- ✈ Zenith viewing
- ✈ Transmits 308 and 355 nm radiation (can also transmit 532 and 1064 nm)
- ✈ Receives 308, 332 (N2 Raman from 308), 355, 387 (N_2 Raman from 355)
- ✈ Aerosol Backscatter at 1064 and 532 nm
- ✈ Aerosol Depolarization at 532 nm

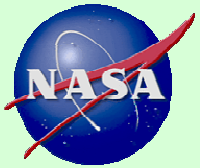
LaRC Data Product
Did not fly during PAVE



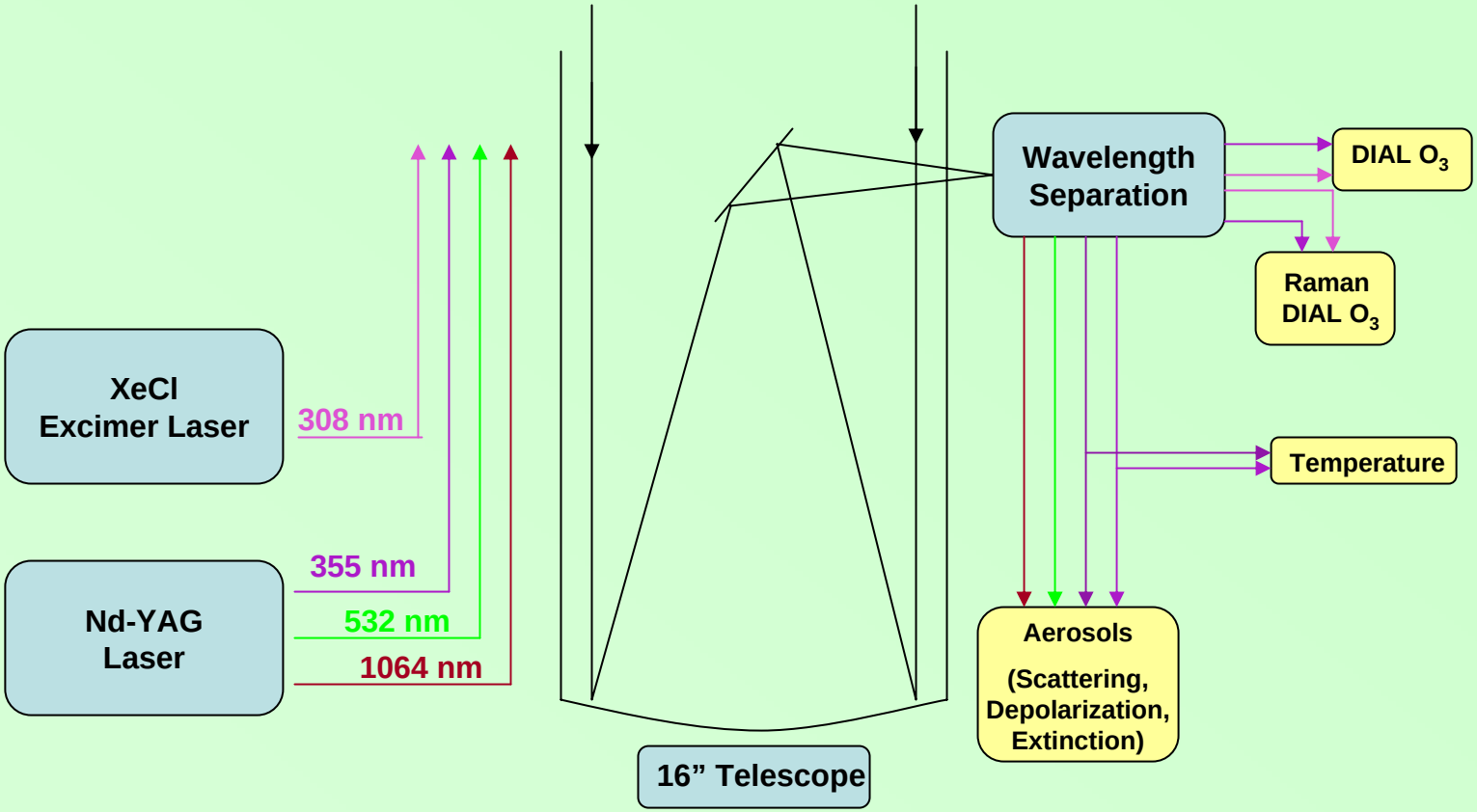
Measurements

- Ozone
  - O_3 proportional to the difference of the slopes of the returns from 308 nm (absorbed by O_3) and 355 nm (not absorbed) – Differential Absorption (DIAL) technique. Ozone retrieved to date at SZA >55°. Top altitude is limited by the SZA.
- Temperature - SZA > 92°
  - 355 nm return is a relative density profile
  - Initialize at high altitude with climatological temperature
  - Integrate downward using Ideal Gas Law to extract temperature
  - Converges in ~2 scale heights.
  - Raman scattering can be used in regions of aerosols or optically thin clouds, but requires SZA >97
- Aerosols from UV Wavelengths
  - Backscatter ratio from ratio of Elastic/Raman
  - Extinction from elastic and Raman returns
  - Klett retrieval with single wavelength

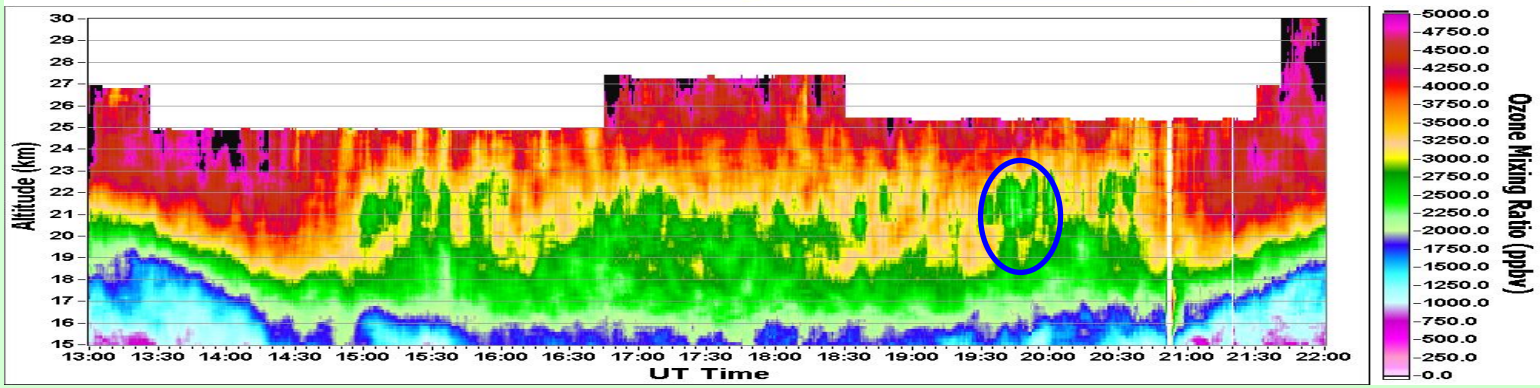
} SZA > 97°

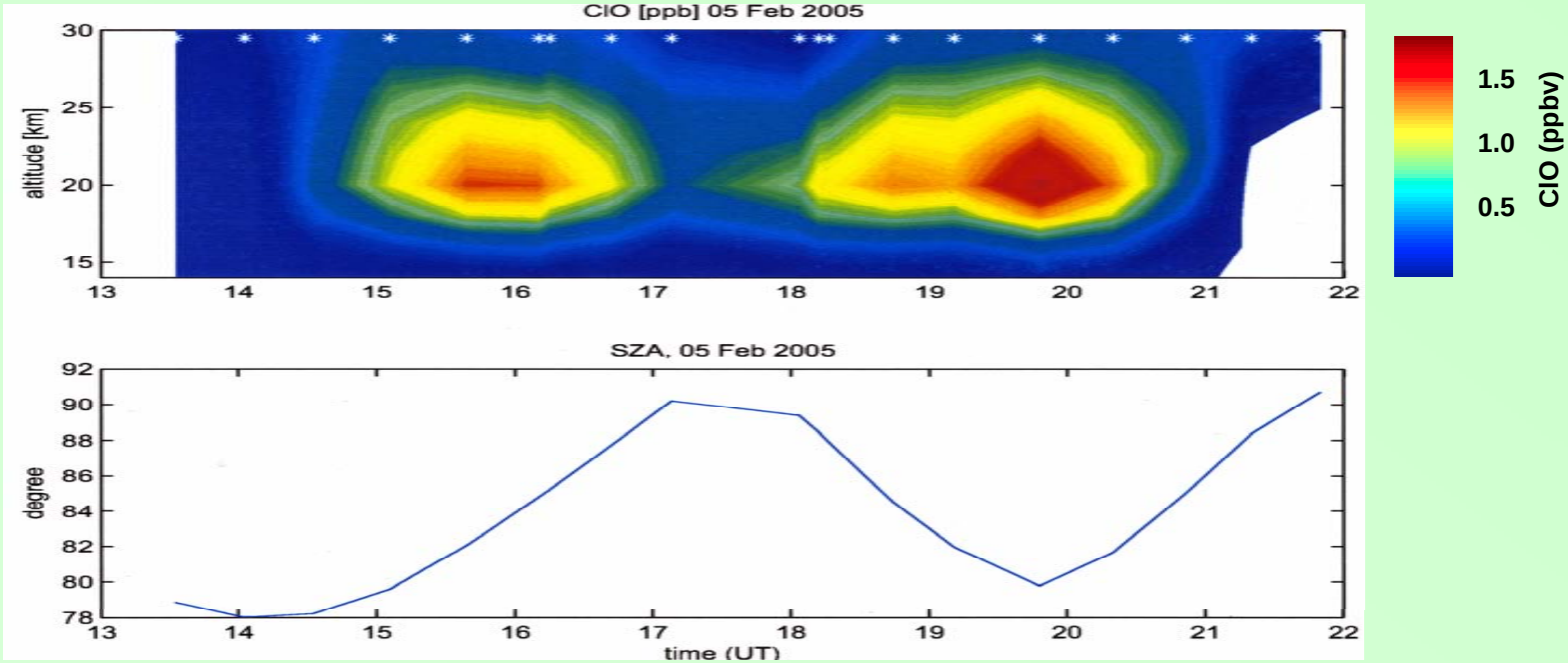


AROTAL Schematic

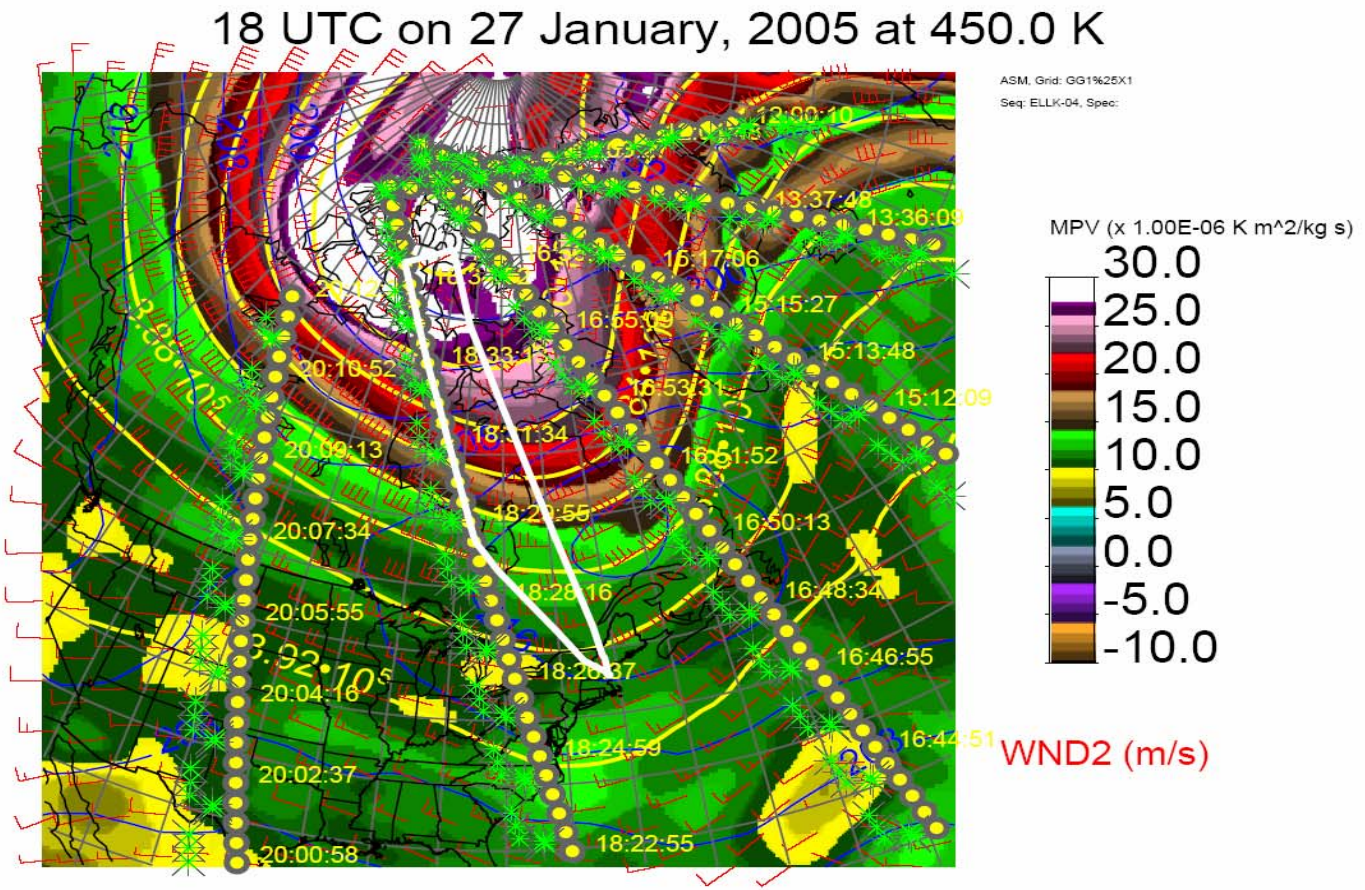


AROTAL – ASUR Feb. 5, 2005

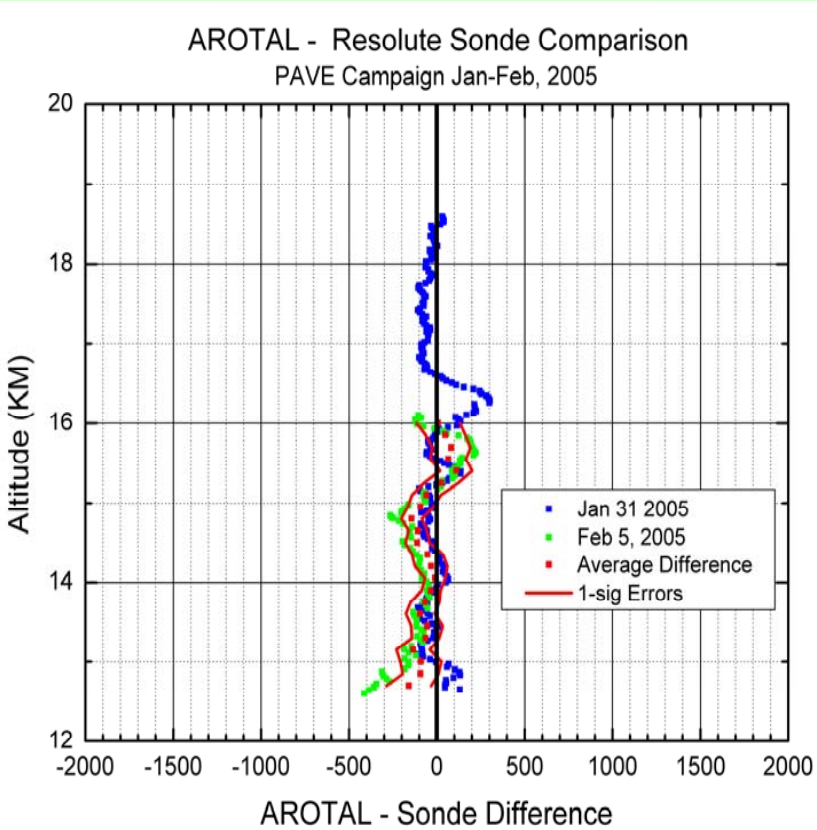


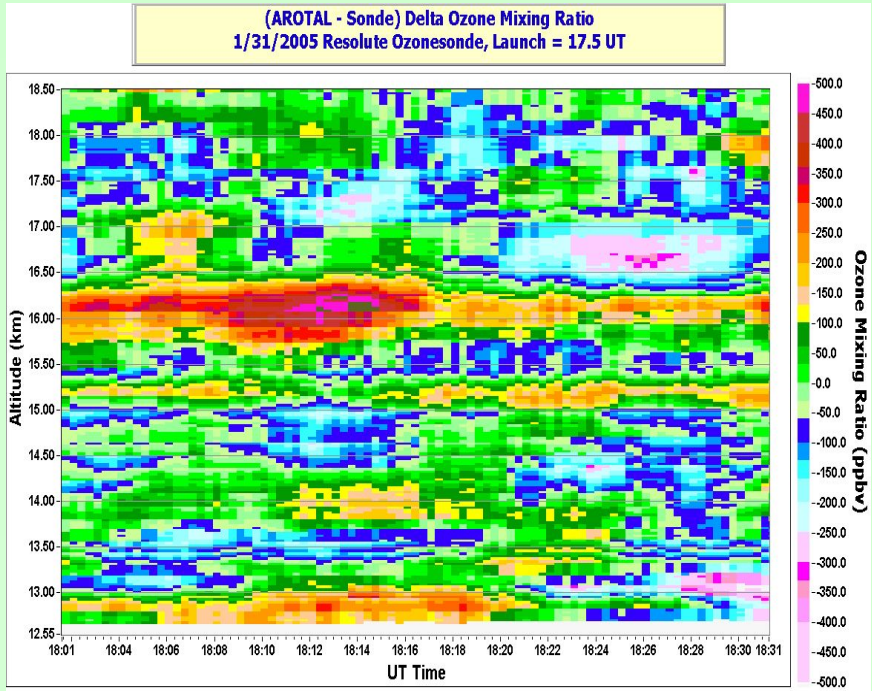


Aura Validation Flight Track

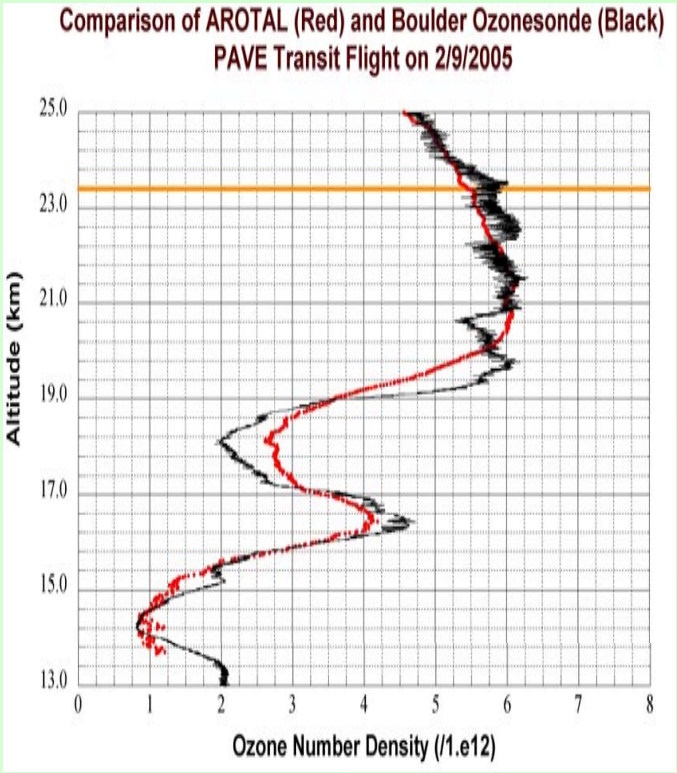


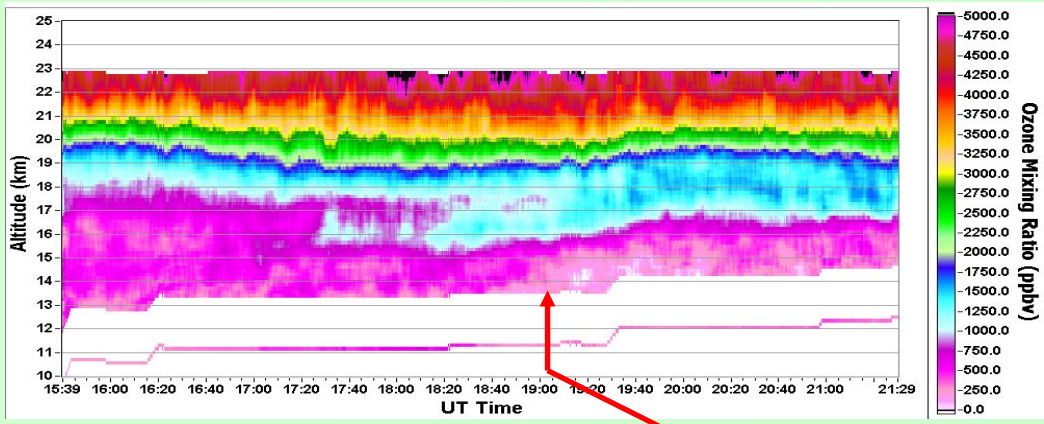
Resolute Sonde Comparison

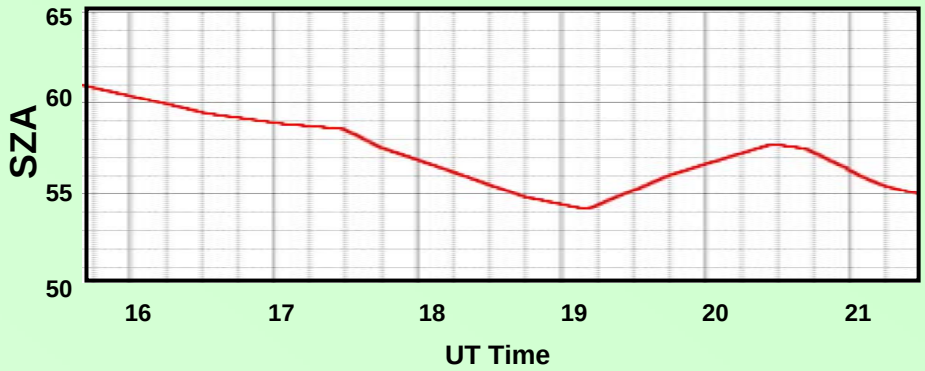




February 9, 2005 Transit Flight

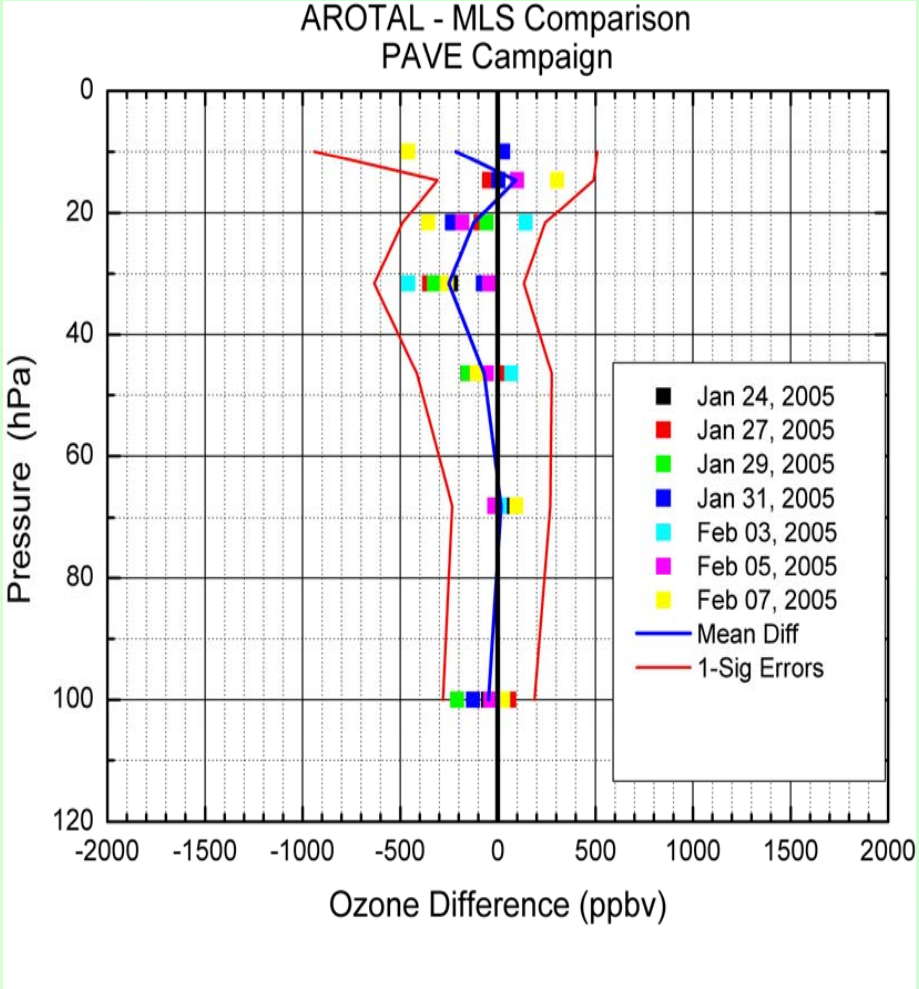






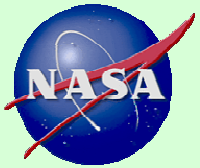
AROTAL – MLS Comparison

- 7 Flights along the MLS flight track
- Used MLS pressure levels
- Each point is an average of many difference profiles (most cases are ~600)
- Comparison Criterion: $\Sigma\Delta lat+\Delta lon \leq 3$ (max distance ~200 km) – only closest point used



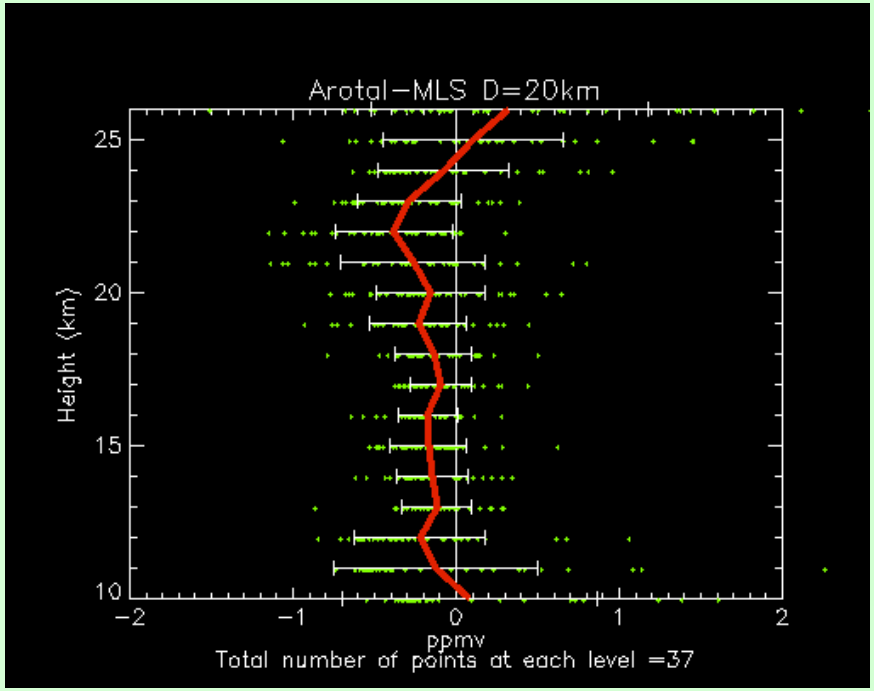
Conclusions

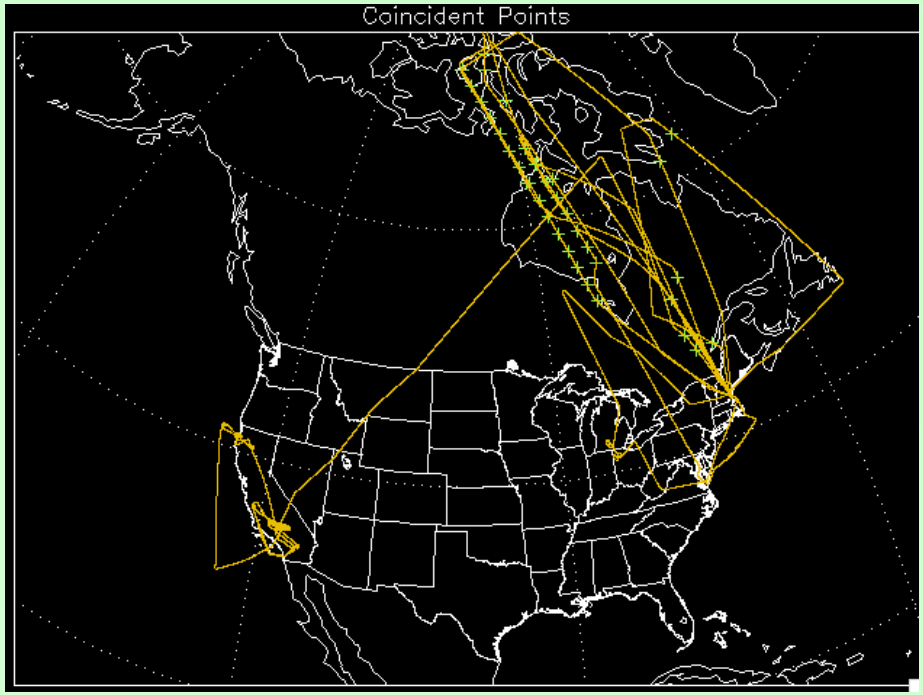
- Comparisons with Sonde data shows good agreement with AROTAL measurements, but there are some issues related to the different sampling by the two techniques.
- Comparison with MLS data shows that the MLS data is in agreement with the AROTAL data, with little or no bias, at all levels which overlap.
- Availability of nighttime flights would increase the number of MLS pressure levels which can be compared, and would also provide temperature measurements for validation of that Aura data product.



AROTAL Comparisons

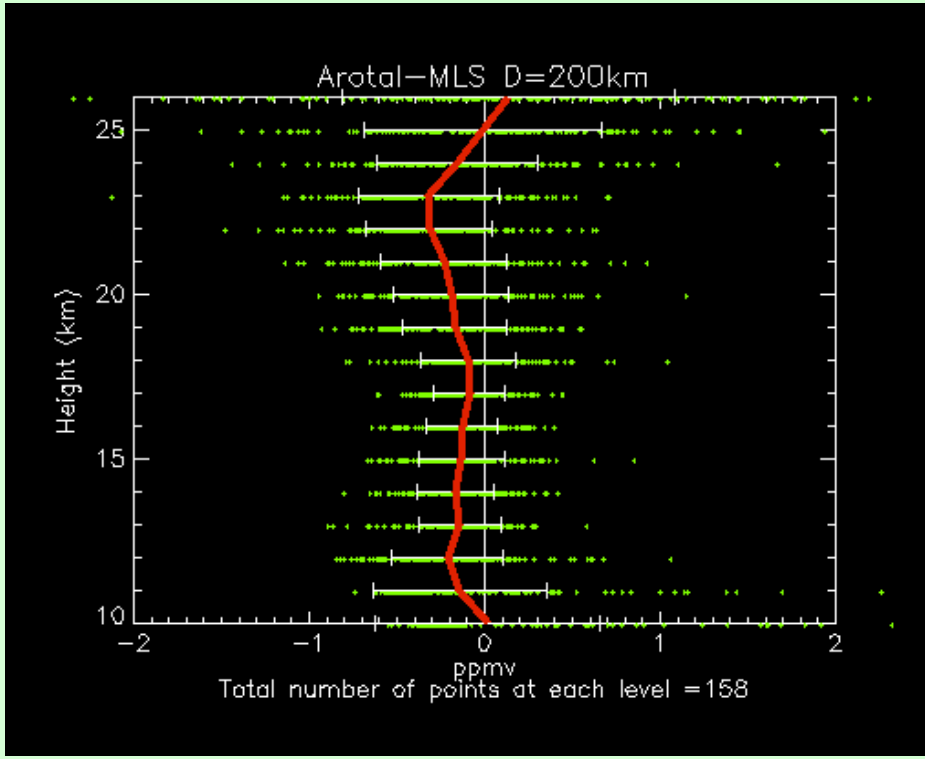
D= 20 km

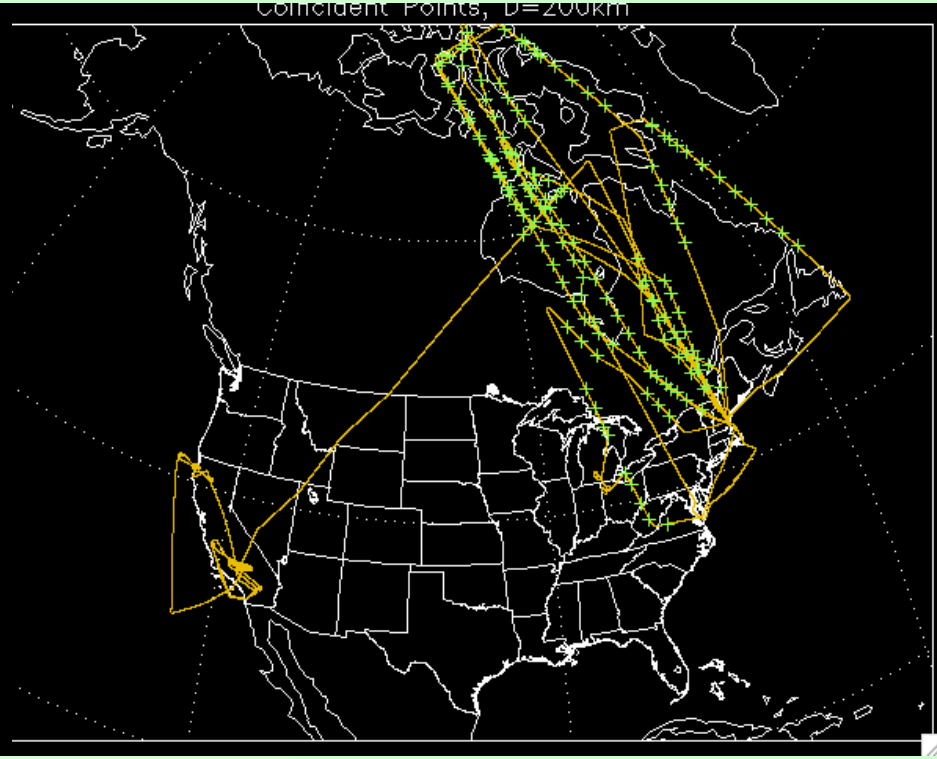




MLS pressure levels are converted to heights using ASM interpolated temperatures. Green crosses show the locations, white bars are standard deviation. Red is the average of the differences. The vertical grid is somewhat arbitrary - both data sets are interpolated onto the grid. The value of D is the maximum distance between an arotal profile and MLS - only the closest profile is used.

D=200km





Small systematic offset of 0.2 ppm is the opposite direction that noted earlier - when the coordinates weren't being treated correctly.