ARM-AERI Ozone Retrievals for AURA Tropospheric Ozone Validations

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Utilize Spectral Downwelling Radiance Available Continuously at the ARM AERI sites to Validate TES Tropospheric Ozone Retrievals

- **Tropospheric ozone retrieved from AERI spectra utilizing the 9.6 μm ozone band**
- **Validation of ozone products from TES and OMI on AURA and AIRS on AQUA**
- **ARM Sites: Southern Great Plains, North Slope Alaska, Tropical Western Pacific**

ARM-AERI NSA Ozone Retrieval Example

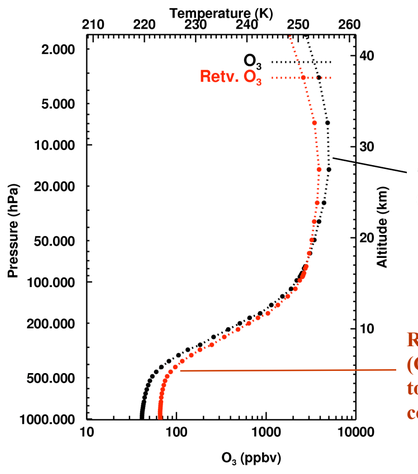
Observations

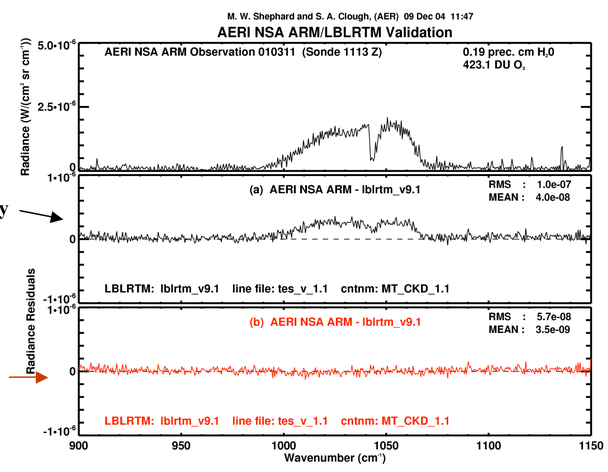
AERI ARM North Slope of Alaska, Barrow Alaska (March 11, 2001)

- downwelling radiation at the surface with a spectral resolution of 0.48 cm^{-1}
- dry water vapor case (0.19 prec. cm)
- ARM radiosonde profile launched at 11:13 GMT with tower temperatures replacing the sonde values in the lower 50m
- AFGL sub-arctic winter climatology O_3 profile scale to the TOMS total column ozone amount

Remarks

- The retrieved ozone profile minimized the residuals in the 9.6 micron-ozone band (980-1080 cm^{-1}) to the noise level
- Ozone retrieval produced two pieces of information:
  - tropospheric column amount (Ref: 16 DU -> Retv: 29 DU)
  - improved profile information in the upper troposphere/lower stratosphere



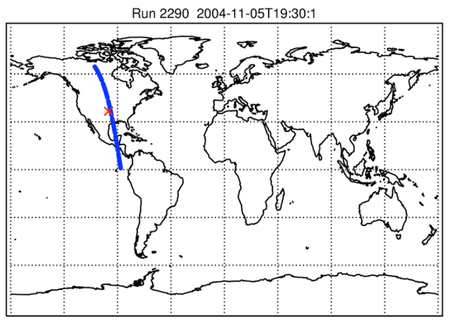


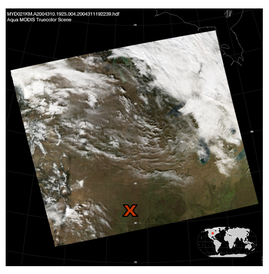
Top panel is the observed AERI spectral radiance.

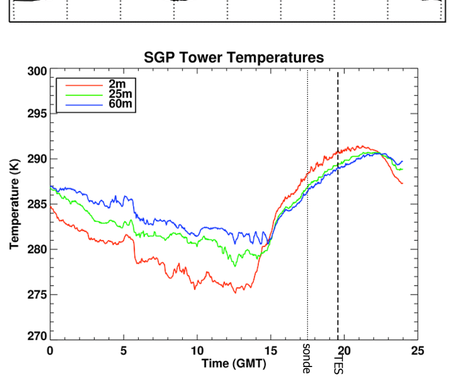
(a) AERI – LBLRTM using the TOMS Scaled O_3 Climatology

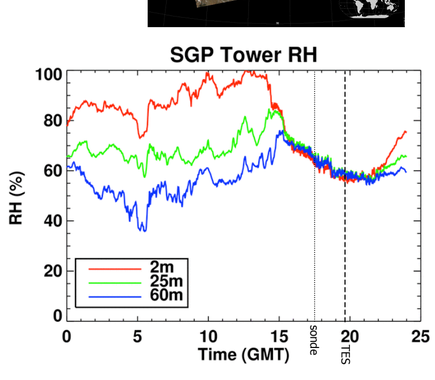
(b) AERI – LBLRTM using the Retrieved O_3

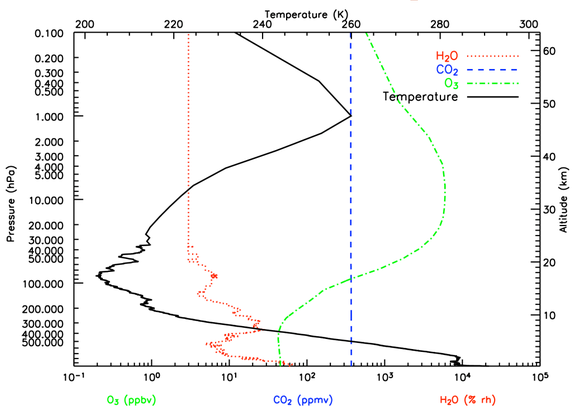
Preliminary TES/AERI SGP Case Study

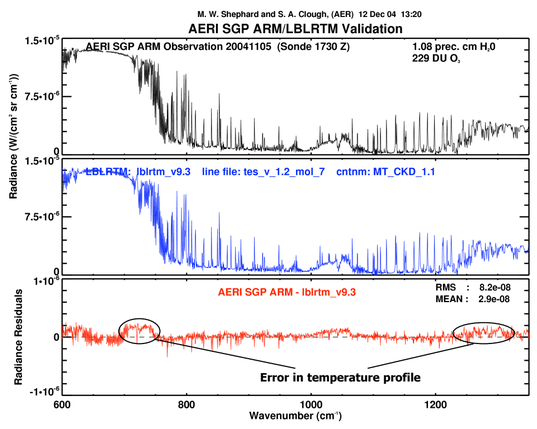








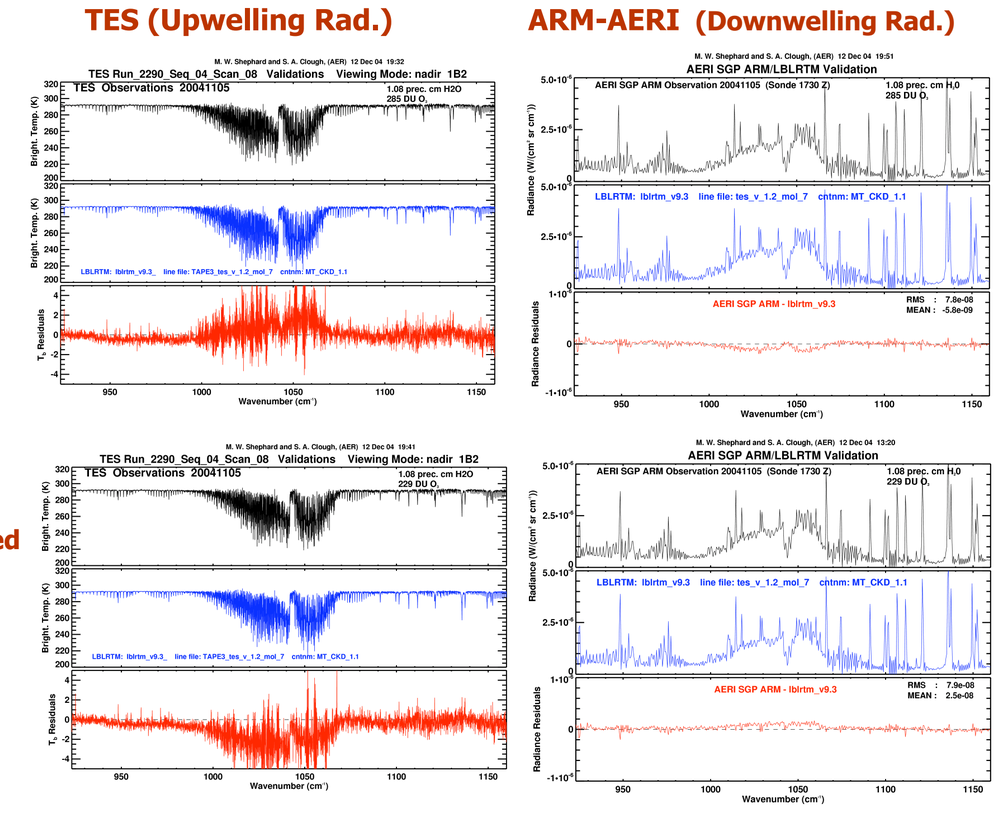




Observations

- **TES**
  - nadir upwelling radiance with spectral resolution of 0.06 cm^{-1}
  - November 05 2004 at 19:40 GMT over ARM SGP
- **ARM SGP**
  - AERI downwelling radiance with a spectral resolution of 0.50 cm^{-1} (19:40 GMT)
  - Time series of ARM SGP tower measured temperature and relative humidity at 2m, 25m, and 60m heights for November 05, 2004.
  - input Radiosonde ARM profile observations of temperature and H_2O (17:30 GMT)
    - radiosonde water vapor was scaled by the MWR
    - GMAO temperatures added to the top of the radiosonde profile
    - GMAO profiles of CO_2 and O_3
    - The bottom of the sonde was modified to match the tower measurements
- **MODIS True-color Scene**
  - indicating that the area around the SGP site is cloud-free at this time

Line-by-line Ozone Sensitivity Study



Issues Being Investigated

- **LBLRTM-AERI Offset and Applied Correction During this Time Period**
  - larger than normal residuals offset reaching 2.0e-7 W/(cm^2 sr cm^{-1}) in the window regions
  - presently working with University of Wisconsin on the issue
  - influence the AERI ozone retrieval
- **Non-coincident ARM Radiosonde Launches with TES Overpasses**
  - working with ARM to incorporate the new Merged Sounding product
  - ARM Merged Sounding product will be very useful under conditions when the TES overpass of the ARM sites are not coincident with the 4 daily ARM radiosonde launches
  - need to get the temperature profile correct before performing an ozone retrieval
- **TES Calibration**
  - preliminary TES measurements
    - TES Science Team is improving the L1B calibration

Future Work

- Further analyze the TES nadir radiances
- Incorporate the coincident SHIS aircraft AVE under-flights
- Correct for the AERI offset and the temperature profile and then perform an AERI tropospheric ozone retrieval
  - similar to the example presented for the ARM NSA on March 11, 2001
- Compare retrieved TES and AERI tropospheric ozone column amounts over the ARM sites
- Comparisons with planned ozone launches at the ARM sites will provide more detailed error analysis