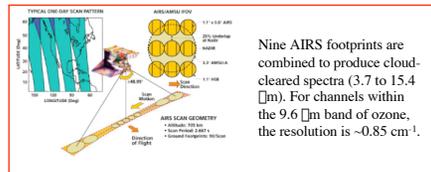


Abstract

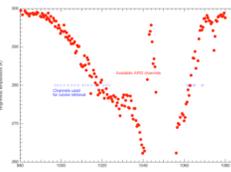
The Atmospheric Infrared Sounder (AIRS) instrument has been operating continuously since May, 2002 on the EOS Aqua platform. Using cloud-cleared thermal radiance spectra observed in the nadir, global measurements of ozone profiles and column densities have been made twice-daily on a ~45 km footprint using the O₃ 9.6 μm band. Comparisons of Version 4 retrievals to tropical ozonesondes reveal upper tropospheric biases similar to those in ECMWF data products, but comparisons to TES results show AIRS has sensitivity to ozone > 100ppbv in the mid-latitude upper troposphere.

AIRS on Aqua

- Nadir sounder with 2378 channels from 3.7 to 15.4 μm
- Approx 324,000 day-and-night retrievals on ~45 km footprint.
- Primarily designed for water vapor and temperature retrieval, but ozone can be retrieved in 9.6 μm band.

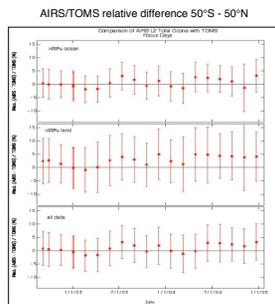


Nine AIRS footprints are combined to produce cloud-cleared spectra (3.7 to 15.4 μm). For channels within the 9.6 μm band of ozone, the resolution is ~0.85 cm⁻¹.

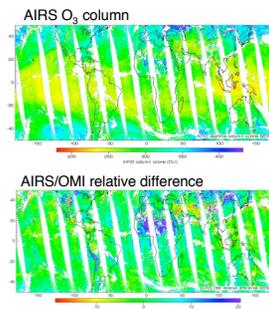


Ref: Aumann, H. H. et al., AIRS/AMSU/HSB on the Aqua mission: Design, science objectives, data products, and processing systems, *IEEE Trans. Geosci. Remote Sensing*, 41, 253-264, 2003.

AIRS/TOMS/OMI comparison

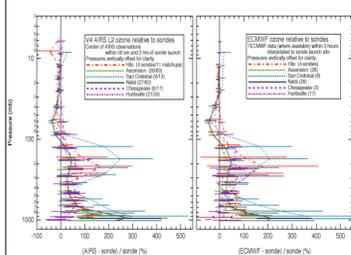


Total column ozone generally compares well with (level 3) TOMS¹ and OMI in tropics and mid-latitudes. Significant differences exist in desert and ice/snow regions. Likely problem is incorrect emissivity input for AIRS.



Ref: (1) McPeters, R. D. et al., "Earth Probe Total Ozone Mapping Spectrometer (TOMS) Data Products User Guide." NASA Technical Publication 1998-206895, NASA Goddard Space Flight Center, Greenbelt MD, 1998.

AIRS/ECMWF/Ozonesonde¹ comparisons



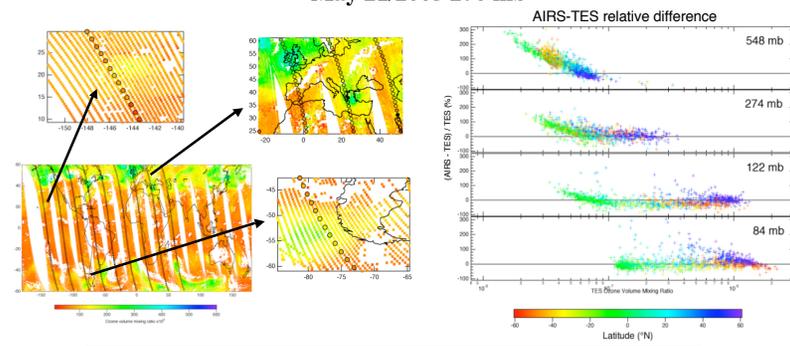
- As a first guess for ozone, AIRS uses a regression scheme² on cloud-cleared spectra trained by ECMWF data.
- Biases noted in ECMWF O₃ profiles, although columns generally compare well to TOMS.³
- AIRS appears to be largely sticking to ECMWF-derived biases where AIRS has lower or no sensitivity. Biases could be affecting retrievals in lower stratosphere where AIRS has sensitivity.

Refs: (1) Includes data described in Thompson, A.M., et al., Southern Hemisphere Additional Ozonesondes (SHADOZ) 1998-2000 tropical ozone climatology I. Comparison with Total Ozone Mapping Spectrometer (TOMS) and ground-based measurements, *J. Geophys. Res.*, 108, doi: 10.1029/2001JD000967, 2003. (2) Goldberg, M. D., et al., AIRS near-real-time products and algorithms in support of operational numerical weather prediction, *IEEE Trans. Geosci. Remote Sensing*, 41, 379-389, 2003. (3) Dethof, A. and E. V. Hölm, Ozone assimilation in the ERA-40 reanalysis project, *Q. J. R. Meteorol. Soc.*, 130, 2851-2872, 2004.

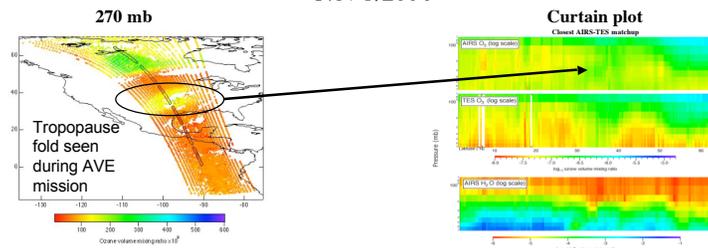
AIRS/TES comparisons

- TES (Tropospheric Emission Sounder) retrieves 1 to 2 pieces of information for ozone on an 8x5 km footprint in the troposphere.¹ Observations are ~20 minutes apart.
- AIRS and TES appear to be in qualitative agreement where AIRS retrieves > 100 ppbv O₃.
- This is in agreement with tropical/sub-tropical in-situ comparisons,² but extended to higher latitudes.
- AIRS can provide context for TES in mid-latitude "hot spots" such as tropopause folds.

May 21/2005 270 mb



Nov 3/2004



Refs: (1) Worden, J., et al., Predicted errors of tropospheric emission spectrometer nadir retrievals from spectral window selection, *J. Geophys. Res.*, 109, doi:10.1029/2004JD004522, 2004. See also H. Worden and J. Logan, TES ozone profiles compared to ozonesondes, Fall 2005 AGU Poster A41A-0010. (2) Gettelman, A., et al., Validation of Aqua satellite data in the upper troposphere and lower stratosphere with in situ aircraft instruments, *Geophys. Res. Lett.*, 31, doi:10.1029/2004GL020730, 2004.

Future Work

- Testing of TES retrievals as training set for regression for AIRS first guess.
- Modification of channel selection to improve sensitivity of AIRS in upper troposphere.

Acknowledgements

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