National Aeronautics and Space Administration

Measurements of temperature, water vapor, ozone and carbon monoxide from AIRS

Fredrick W. Irion[1] (bill.irion@jpl.nasa.gov), Gregory B. Osterman[1], Eric J. Fetzer[1], Wallace W. McMillan[2] (mcmillan@umbc.edu)

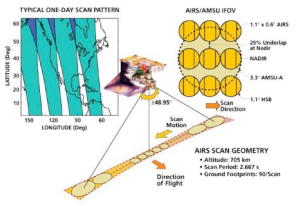
[1]Jet Propulsion Laboratory, California Institute of Technology

[2]University of Maryland, Baltimore County

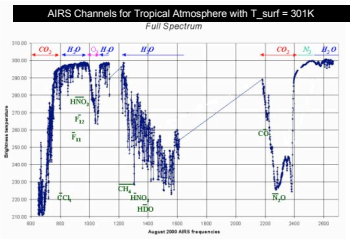
The Atmospheric Infrared Sounder (AIRS) on the EOS-Aqua satellite retrieves temperature, water vapor, ozone, and carbon monoxide profile data from nadir viewing. Combining information from co-located microwave and infrared spectrometry, AIRS retrieves data on ~45 km diameter footprints, under up to 80% cloudy conditions. We describe retrievals and sensitivities using the upcoming Version 5 processing scheme which can be of use to local air quality monitoring and modeling efforts.

AIRS on Aqua

- Nadir sounder with co-located microwave and infrared spectrometers.
- AMSU microwave information is used to produce first guess on temperature profile.
- 2378 IR channels allocated within 3.7 to 4.6 μm, 6.2 to 8.2 μm and 8.8 to 15.4 μm.
- Approximately 324,000 day-and-night observations on ~45 km horizontal footprint.
- AIRS spectral resolution $\lambda/\Delta\lambda$ = 1200.
- Primarily designed for water vapor and temperature retrieval, but ozone can be retrieved in 9.6 μm band and carbon monoxide in the 4.7 μm band.



Nine AIRS footprints (each at ~15 km footprint) are combined in a regression algorithm to produce a cloud-cleared spectrum (~45 km footprint).

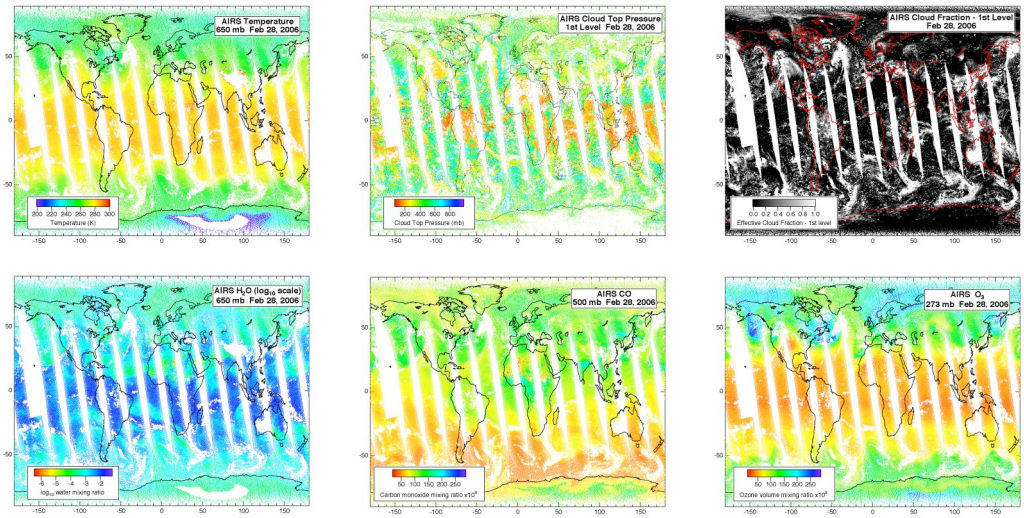


Ref: Aumann, H. H. et al., AIRS/AMSU/HSB on the Aqua mission: Design, science objectives, data products, and processing systems, *IEEE Trans. Geosci. Remote Sensing, 41,* 253-264, 2003.

Global temperature, cloud and species retrieval

- Vertical temperature resolution is ~ 1 km.
- Vertical water vapor resolution is ~ 2 km.
- Approx 0.4 - 1.2 pieces of information for CO, with best sensitivity around 500 mb in mid-latitudes and tropics.
- Sensitivity to ozone from stratosphere to ~ 300mb.
- Cloud field (on two layers) is reported as cloud-top pressure on AMSU footprint (~45 km) and effective cloud fraction over AIRS footprints (~15 km).

Product	RMS Requirment	Current Estimate	Validation Status
Std Geophys Products (Level 2,3)			
Cloud Cleared IR Radiance	1.0 K	<1.0 K	Val1
Sea Surface Temperature	0.5 K	1.0K	Val1
Land Surface Temperature	1.0 K	N/A	Beta
Temperature Profile	1 K / km	1K / km	Val3
Water Vapor Profile	15% / 2km	15% / 2km	Val3
Total Precipitable Water	5%	5%	Val3
Fractional Cloud Cover	5%	TBD	TBD
Cloud Top Height	0.5 km	TBD	TBD
Cloud Top Temperature	1.0 K	TBD	TBD
Total Ozone Column	-	5%	Val3
Ozone Profile (250 mb – 70 mb)	-	20%	Val2
Carbon Monoxide	-	15%	Val2
Methane	-	2%	Val2



Data shown are either type 0 quality (“best”) or type 1 quality (“good”).