AIRS Level 2 Status

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Introduction to AIRS

- AIRS is a facility instrument on EOS Aqua
- AIRS is a grating spectrometer covering 650 to 2650 wavenumber, with gaps
  - Nominal Spectral Resolution of 1200 $\nu/\delta\nu$
  - 2378 channels, or spectral samples
  - Spatial resolution of 1.1 degree, 15km footprint at nadir
  - 4 additional VIS/NIR channels at higher spatial resolution
- AIRS operates with microwave sounders AMSU-A and HSB
  - AMSU-A is a copy of NOAA’s microwave sounder
  - HSB is functionally equivalent to NOAA’s humidity sounder AMSU-B
  - The three instruments are synchronized to have 3 by 3 AIRS/HSB footprints within an AMSU footprint
- Level 1b products were made public in early 2003
- Major/Core level 2 products
  - Temperature Profile
  - Water Vapor Profile
  - Surface skin temperature and other surface parameters
  - Cloud fraction and cloud top pressure
- Goddard DAAC is processing level 2 with version V3.0.8
  - Provisionally validated only for ocean profiles between 40N and 40S.
Main Contributors of Level 2 Algorithm

- Phill Rosenkranz of MIT
  - MW only retrieval algorithm and MW Forward Algorithm
- Catherine Gautier of UCSB
  - VIS/NIR algorithm
- Larrabee Strow of UMBC
  - AIRS Rapid Transmittance Algorithm
- Larry McMillin of NOAA/NESDIS
  - Brightness temperature tuning and local angle adjustment
- Mitch Goldberg of NOAA/NESDIS
  - Initial Regression Algorithm
- Joel Susskind of NASA/GSFC
  - Final retrieval algorithm and cloud clearing algorithm
- JPL is responsible for combining these algorithms into a unified team algorithm/software.
AIRS Level 2 Data Flow (1)

- MW First Guess: P. Rosenkranz
- Input Checking: S-Y Lee
- MW Tuning: L. McMillin
- MW Tuning Corrections
- MW Only Retrieval: P. Rosenkranz
- MW - only Level 2
- Initial Cloud Clearing: J. Susskind
- Preliminary Cloud Cleared IR Radiances
Data Flow (2)

Preliminary Cloud Cleared IR Radiances

IR Tuning
L. McMillin

IR Tuning Corrections

Initial Regression
M. Goldberg

Regression Level 2

Final Cloud Clearing
J. Susskind

Cloud Cleared IR Radiances

IR Tuning
L. McMillin

IR Tuning Corrections

Final Retrieval
J. Susskind

Final Level 2

RTA

Any Level 2

RTA Rapid Transmittance Algorithm
L. Strow - IR
P. Rosenkranz - MW

Computed Radiances

J. Susskind
All Level 2 Channels

- Spectrum is an observed profile for a night tropical case
- Temperature Sounding Channels: Blue
- Water Vapor Sound Channels: Green
- Window Channels: Red
- Ozone Sounding Channels: Cyan
- Methane Channels: Magenta
- CO Channels: Yellow
15 Micron CO2 Channels

- Temperature Sounding Channels: Blue
- Water Vapor Sound Channels: Green
- Window Channels: Red
- Ozone Sounding Channels: Cyan
- Methane Channels: Magenta
- CO Channels: Yellow
Longwave Window Channels

Channels Used in Retrievals: Red (Surface), Green (Water Vapor), Cyan (Ozone)

- Temperature Sounding Channels: Blue
- Water Vapor Sound Channels: Green
- Window Channels: Red
- Ozone Sounding Channels: Cyan
- Methane Channels: Magenta
- CO Channels: Yellow
Water Band Channels

- Temperature Sounding Channels: Blue
- Water Vapor Sound Channels: Green
- Window Channels: Red
- Ozone Sounding Channels: Cyan
- Methane Channels: Magenta
- CO Channels: Yellow
Shortwave Channels

- Temperature Sounding Channels: Blue
- Water Vapor Sound Channels: Green
- Window Channels: Red
- Ozone Sounding Channels: Cyan
- Methane Channels: Magenta
- CO Channels: Yellow

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Temperature Weighting Functions

- AIRS radiances are sensitive to temperature at about 0.5 mb
- The weighting functions are computed for US Standard profile
Water Vapor Channels

- AIRS radiances are sensitive to water vapor near 100 mb
Level 2 Files

• One set of files for a granule, 6 minutes of data
  – 45 AMSU scan lines of data, 135 scan line of AIRS/HSB data
  – 240 granules per day
  – All files are in swath format of HDF-EOS
• Level 2 standard file
  – Standard or core products
  – Temperature, Water vapor, and Ozone Profiles at 28 mandatory pressure levels
  – Surface and cloud properties
• Level 2 support file
  – Research products and intermediate products
  – Profiles at 100 pressure levels
  – Dependent on the standard file
    • Not all parameters in standard file are duplicated
• Cloud cleared radiance file
  – Radiances that would have been observed if there was no cloud
  – Available about 60% of AMSU footprints
  – May be available up to 80% cloud fraction.
• Browse Products
  – Raster image for daily maps of various AIRS products
  – Ascending and descending maps
Public Release of AIRS Level 2 Data

- Started in August 2003
  - Old data since September 2002 will be processed

- Level 2 Standard files
- Level 2 Support files
- Level 2 Cloud Cleared Radiance files
- Daily Browse products
  - Ascending/Descending maps at one degree by one degree resolution
  - Cloud Fraction, Surface Skin temperature, Total Precipitable Water Vapor, Total Ozone Burden, Total Cloud Liquid Water, Rain Rate, Emissivities at 800, 1000, 1200, and 2500 cm\(^{-1}\)

- Documentation

- Points of Contact
  - Atmospheric Dynamics Data Support Team at atmdyn-dst@daac.gsfc.nasa.gov
  - Dr. Edward Olsen at Edward.T.Olsen@jpl.nasa.gov

- Software for direct downlink data will be made available soon

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Temperature Statistics vs ECMWF Analysis

- 7 Focus days (normally 48 days apart)
- Stable statistics over 9 months period
Sample Monthly Mean Products

- Simple gridded data based on January 2003 data
  - Separate maps for ascending (day) and descending (night) parts of orbit
  - One degree by one degree resolution
- For these maps, only the second half of RetQAFlag was checked
  - The first byte (bit numbers 8 through 15) was ignored
Monthly Mean Total Precipitable Water Vapor
Descending Orbits - January 2003