



# AIRS Level 2 Status



## ITSC XIII

October 31, 2003

Montreal, Canada

Sung-Yung Lee(\*), Evan Fishbein, Thomas Hearty,  
Evan Manning, Edward Olsen  
Jet Propulsion Laboratory  
California Institute of Technology  
\* [Sung-Yung.Lee@jpl.nasa.gov](mailto:Sung-Yung.Lee@jpl.nasa.gov)



# Introduction to AIRS



- AIRS is a facility instrument on EOS Aqua
- AIRS is a grating spectrometer covering 650 to 2650 waver number, 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.



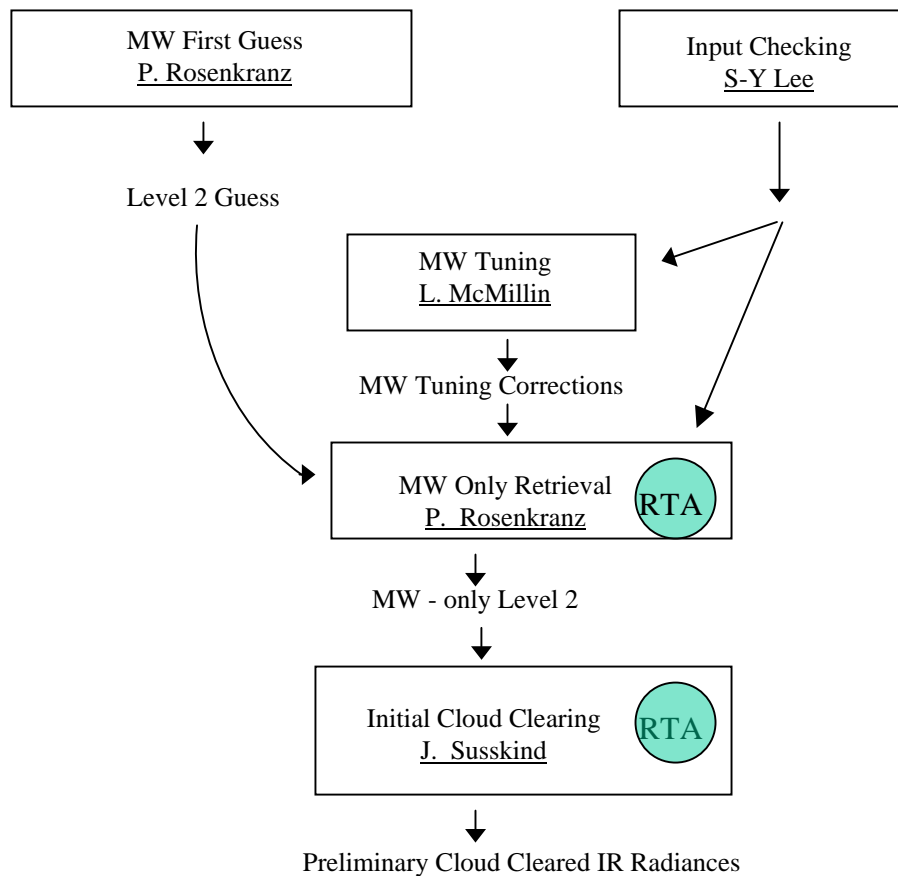
## Main Contributors of Level 2 Algorithm



- 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.

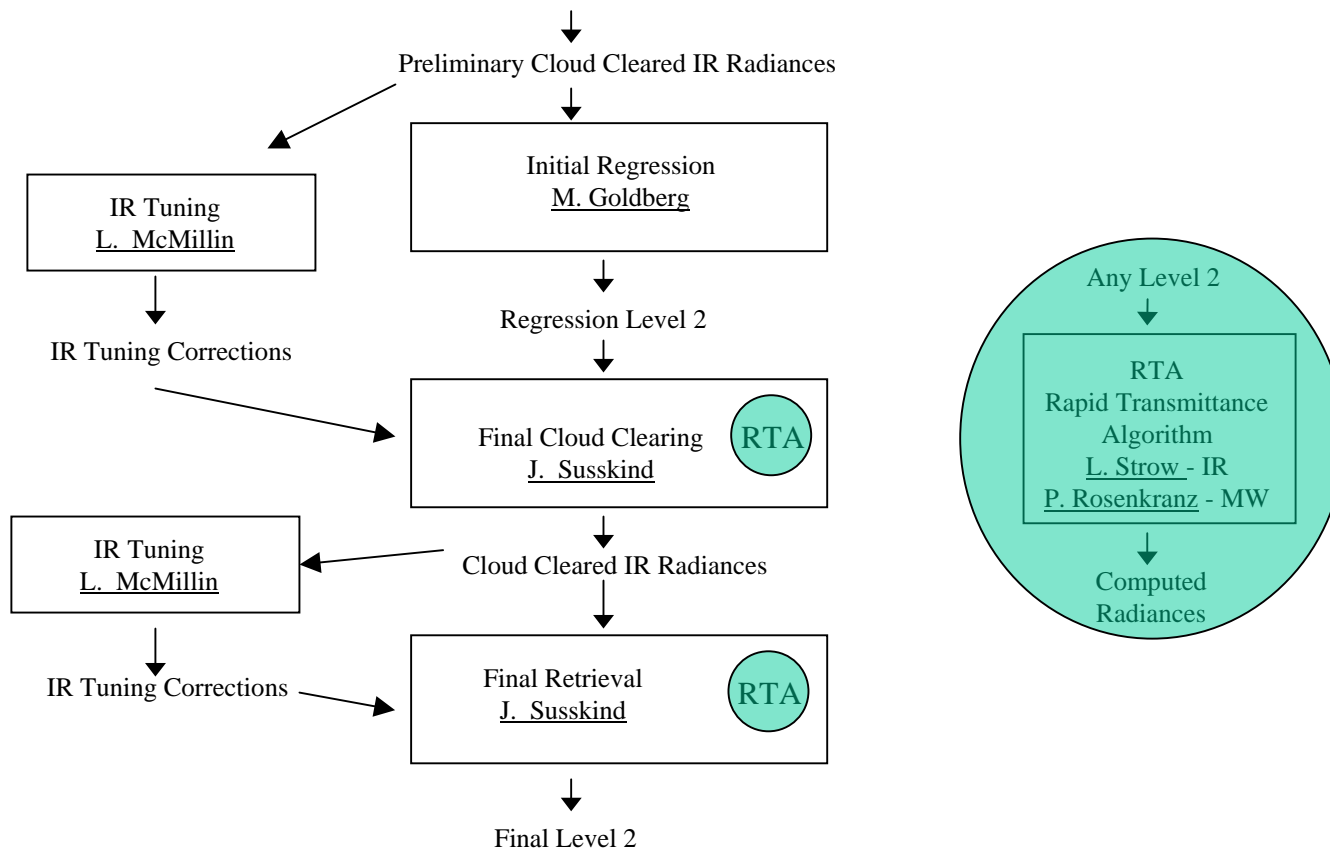


# AIRS Level 2 Data Flow (1)



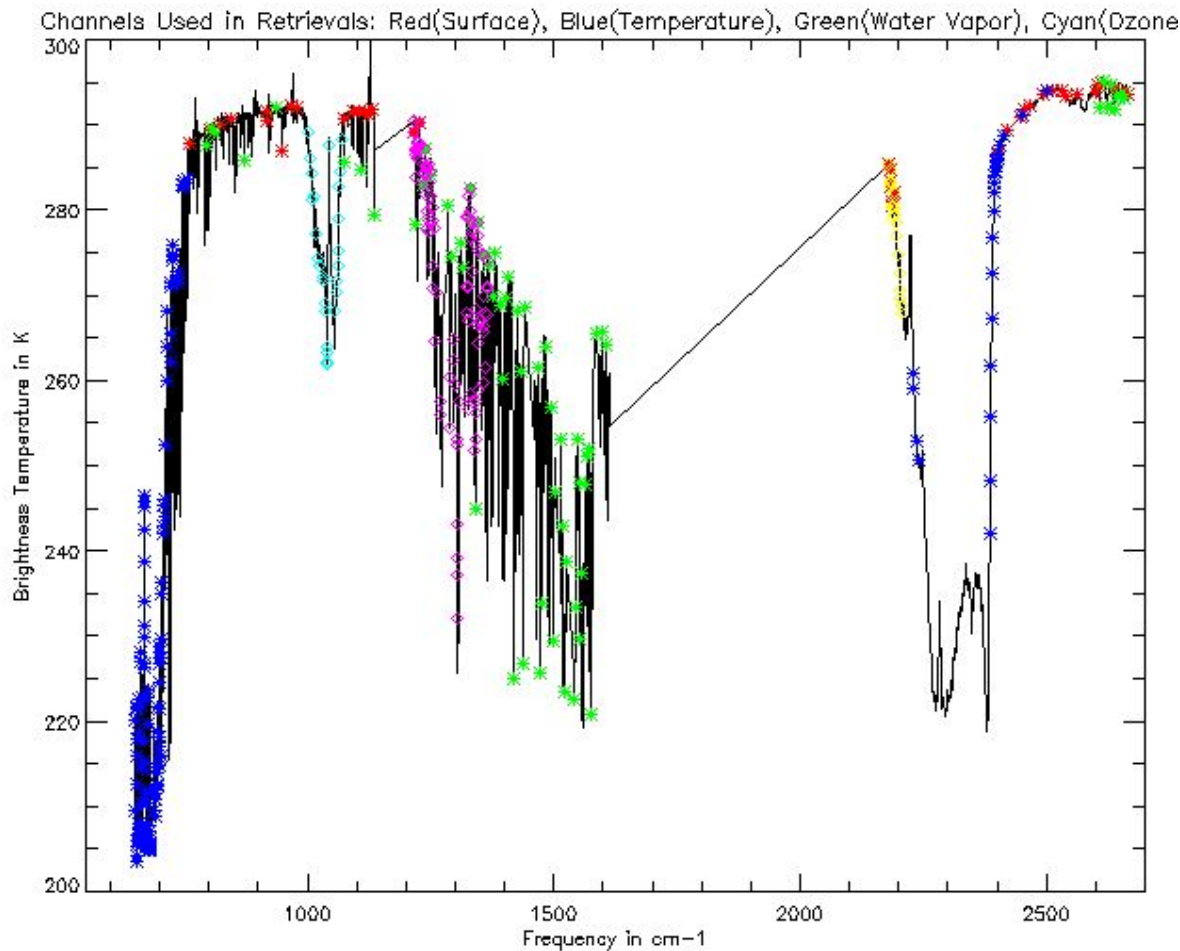


## Data Flow (2)





# 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

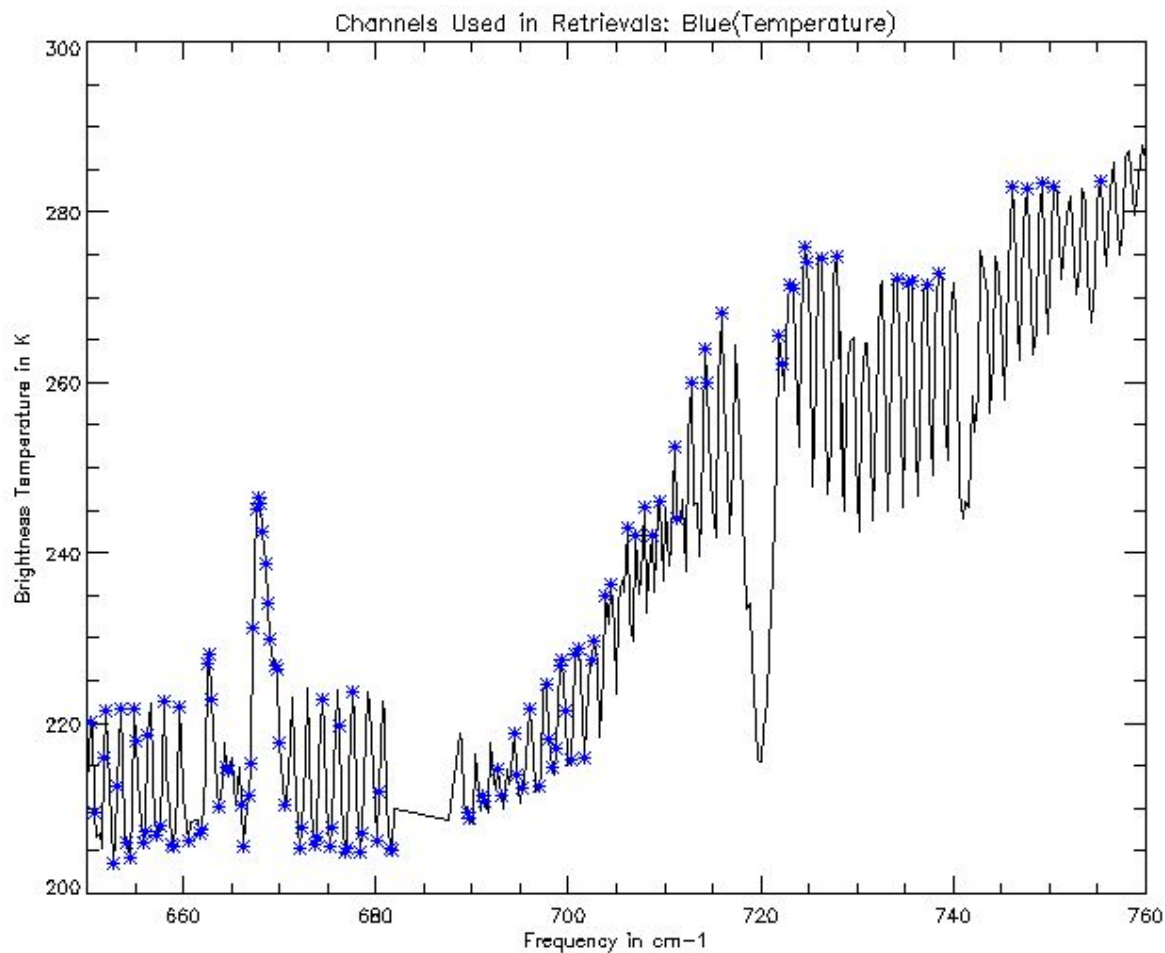
- Ozone Sounding Channels: Cyan

- Methane Channels: Magenta

- CO Channels: Yellow



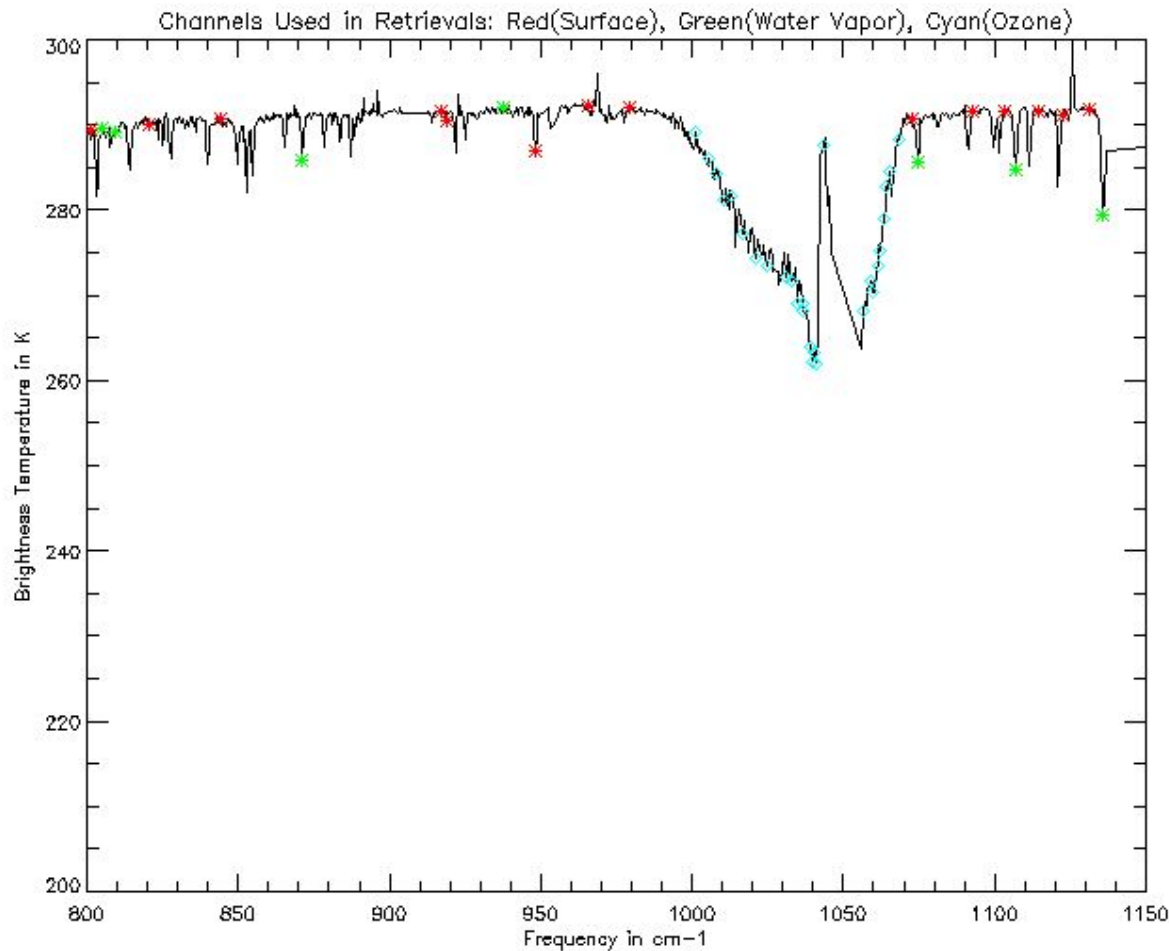
# 15 Micron CO2 Channels



- 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

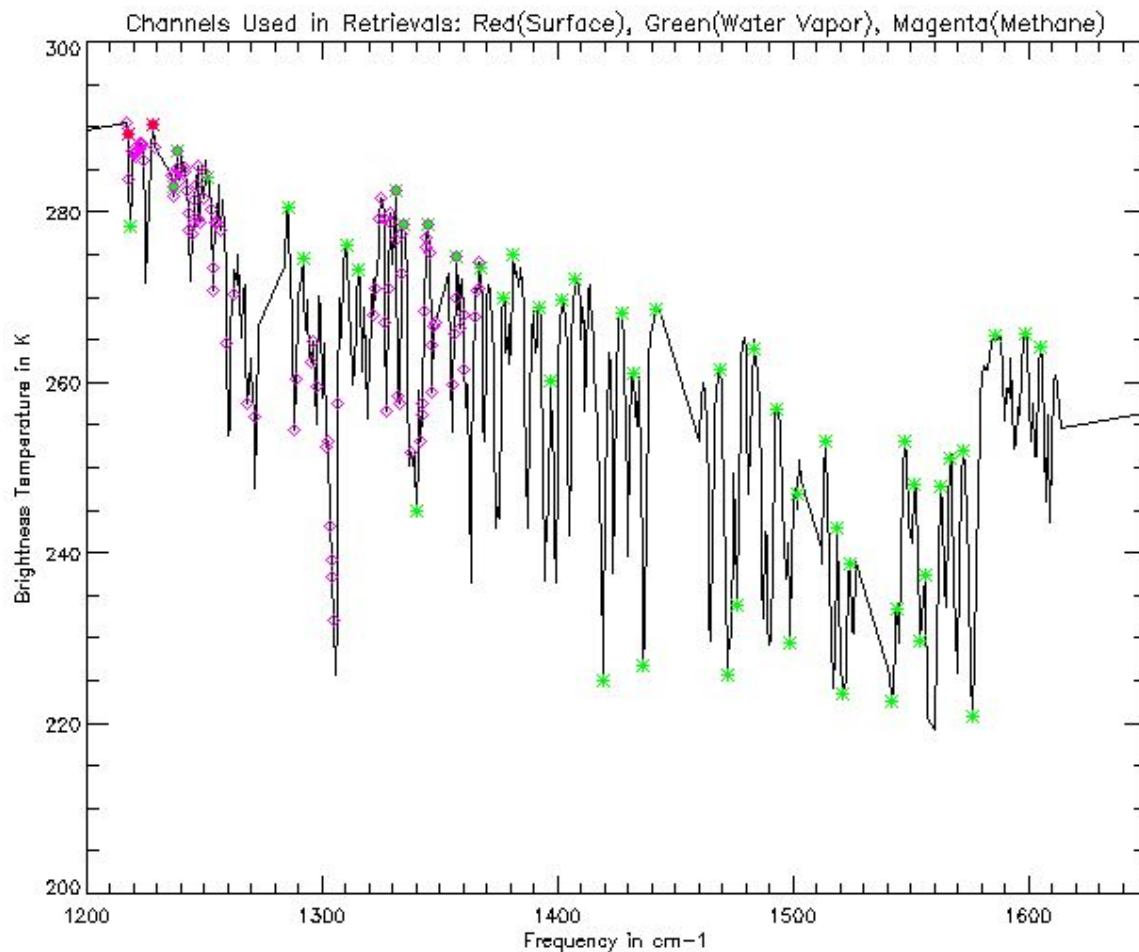


- Temperature Sounding Channels: Blue
- Water Vapor Sound Channels: Green
- Window Channels: Red
- Ozone Sounding Channels: Cyan
- Methane Channels: Magenta
- CO Channels: Yellow





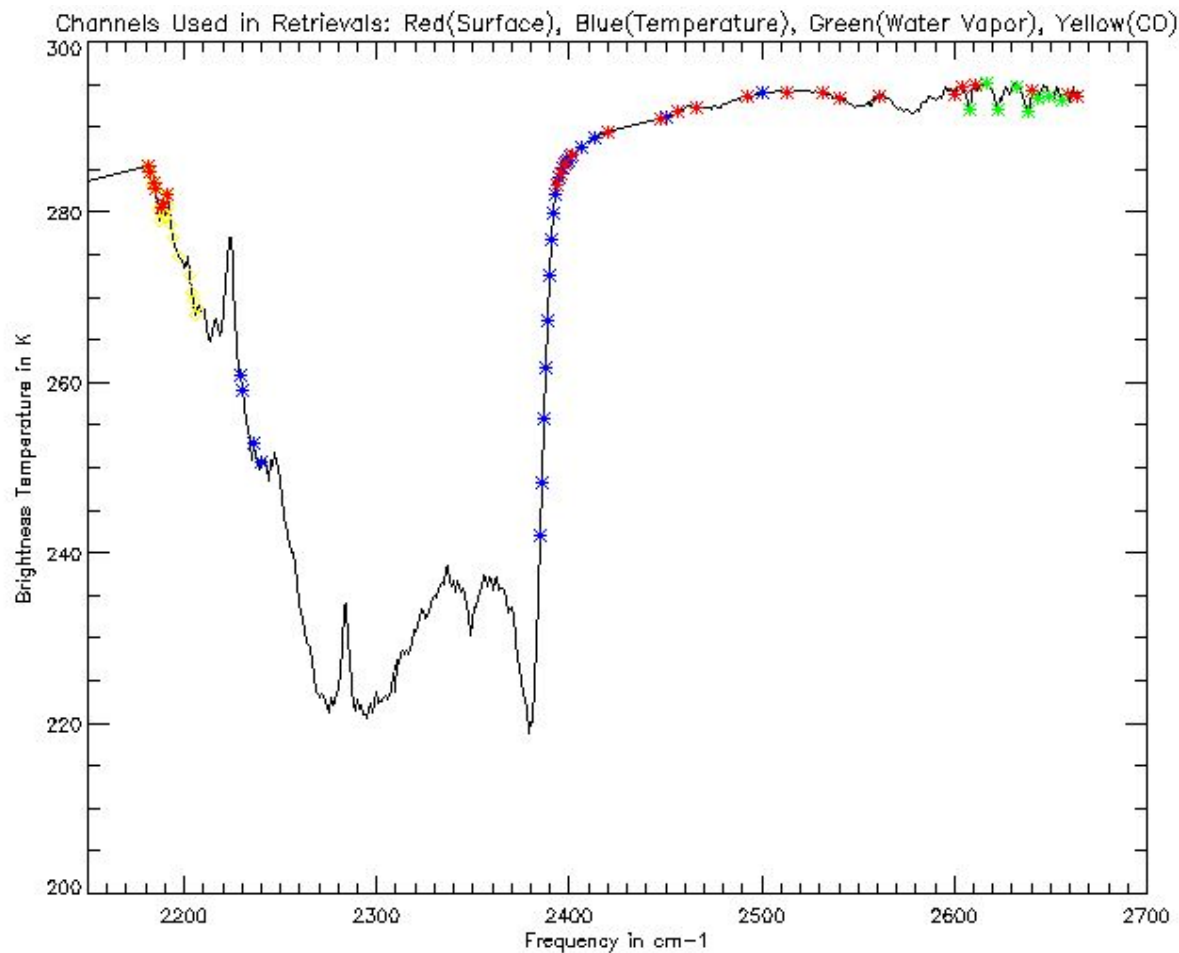
# Water Band Channels



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



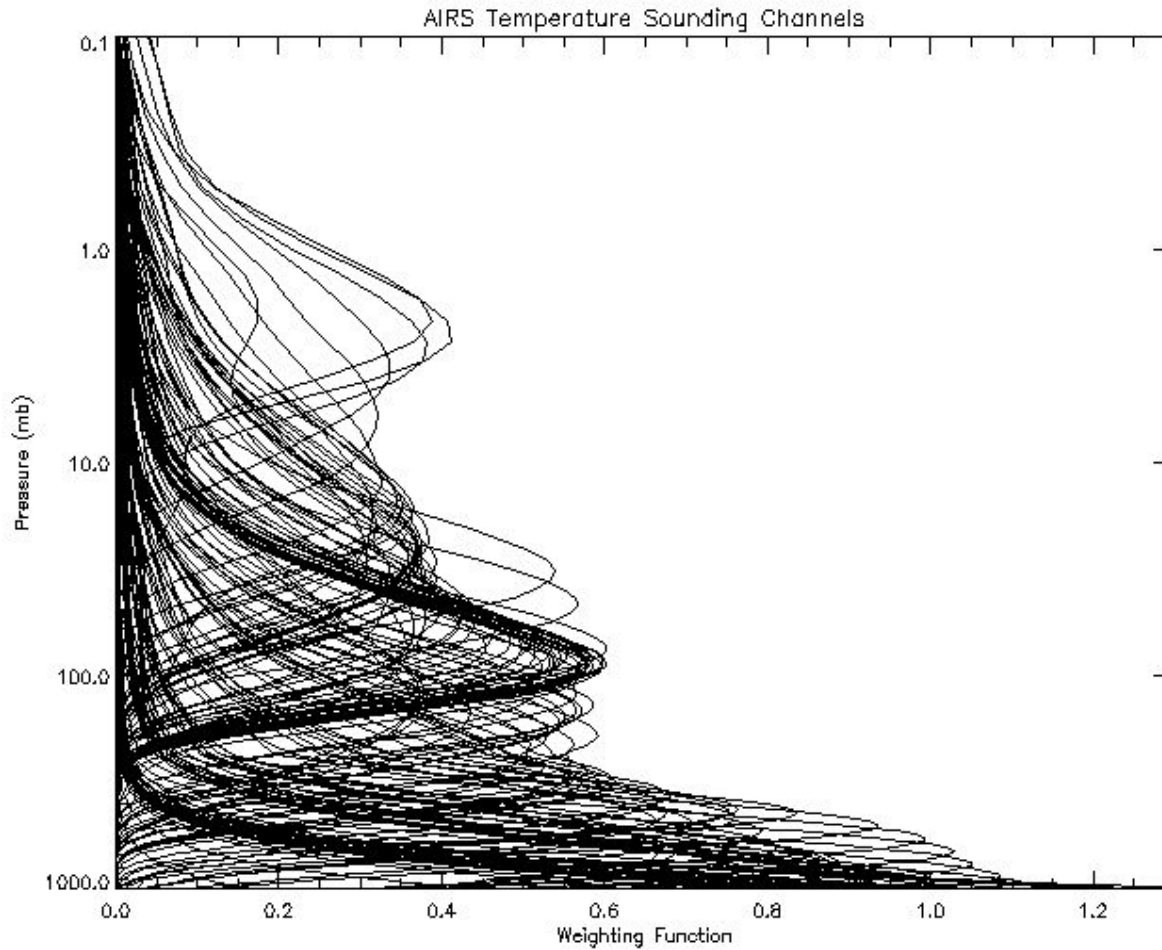
# Shortwave Channels



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



# Temperature Weighting Functions

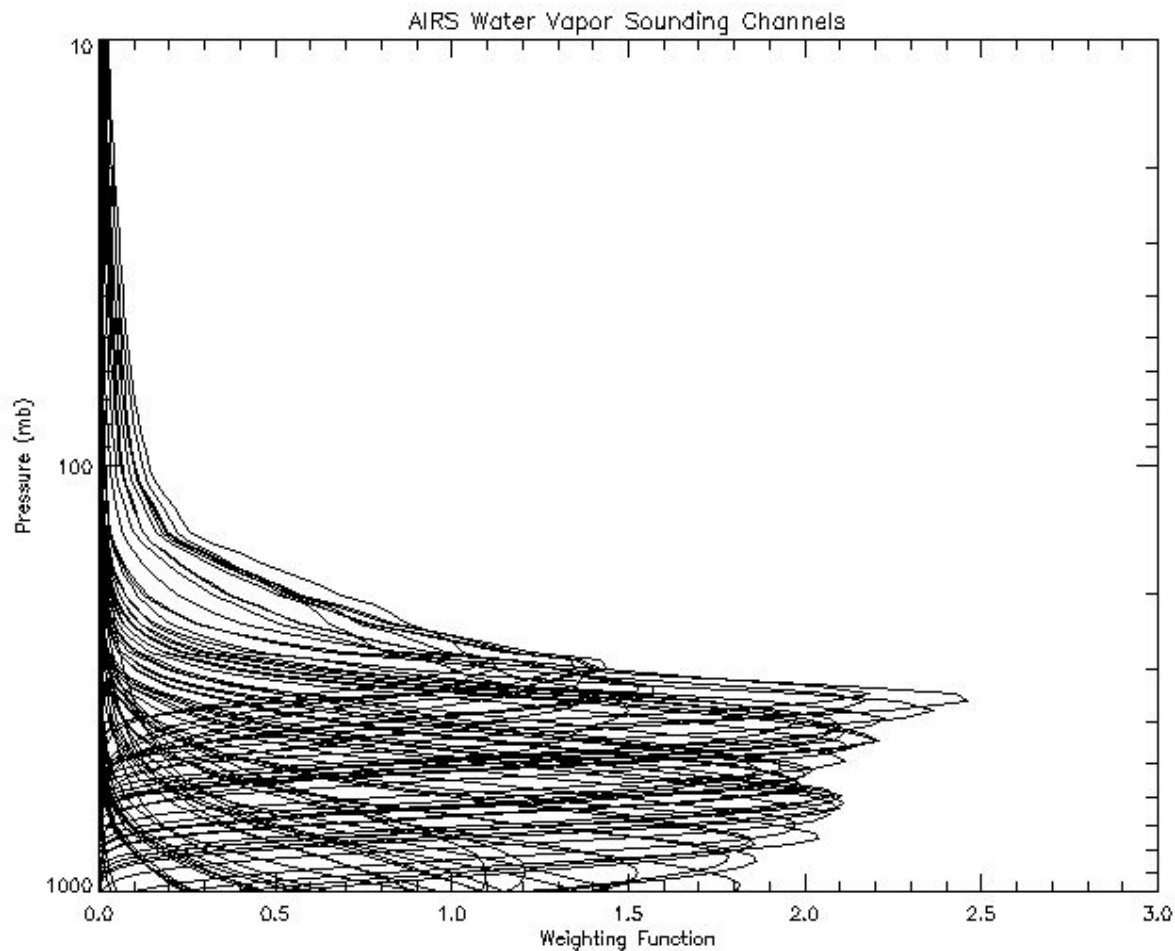


- AIRS radiances are sensitive to temperature at about 0.5 mb

- 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



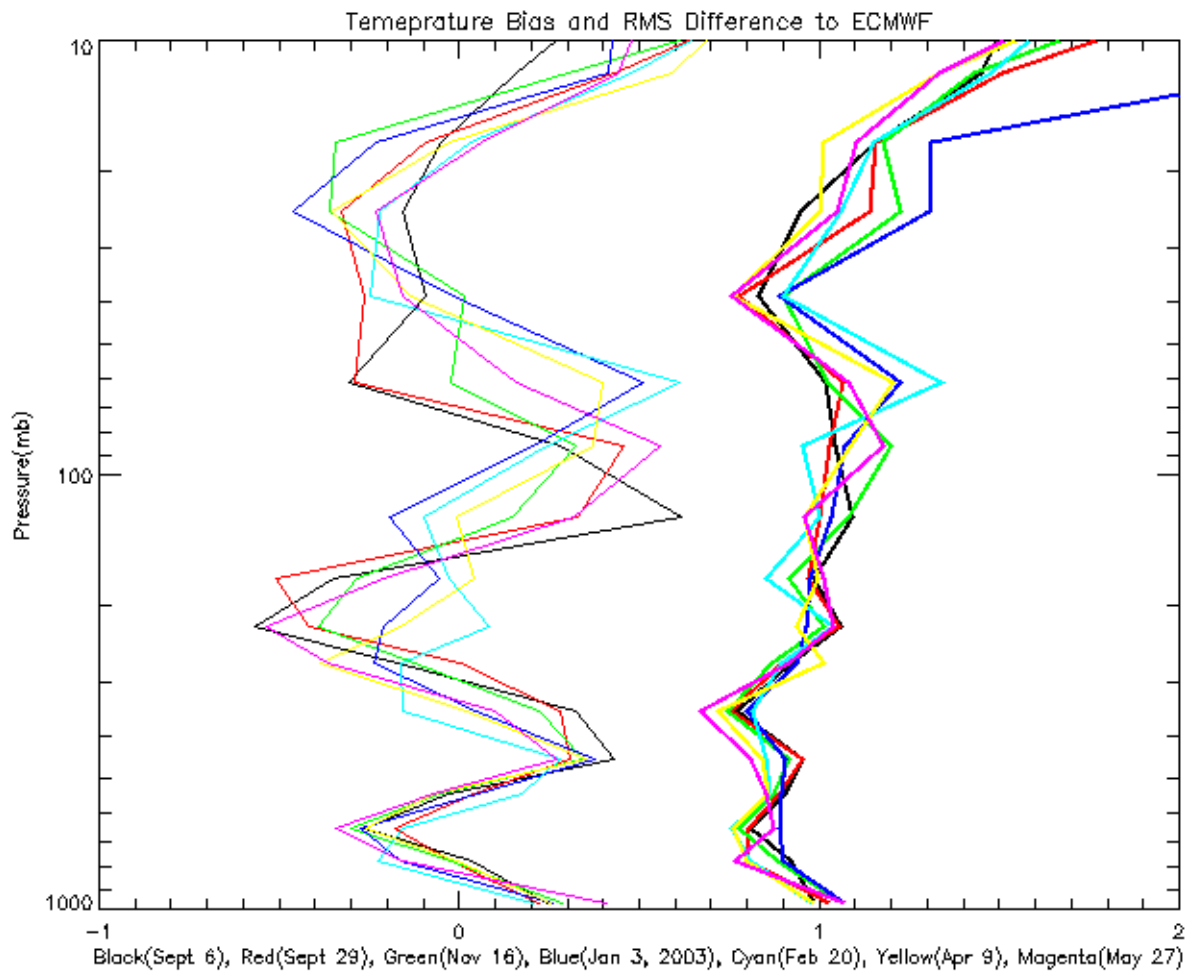
# Public Release of AIRS Level 2 Data



- 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  $\text{cm}^{-1}$
- Documentation
  - [http://daac.gsfc.nasa.gov/atmodyn/airs/airs\\_documentation.html](http://daac.gsfc.nasa.gov/atmodyn/airs/airs_documentation.html)
- Points of Contact
  - Atmospheric Dynamics Data Support Team at [atmdyn-dst@daac.gsfc.nasa.gov](mailto:atmdyn-dst@daac.gsfc.nasa.gov)
  - Dr. Edward Olsen at [Edward.T.Olsen@jpl.nasa.gov](mailto:Edward.T.Olsen@jpl.nasa.gov)
- Software for direct downlink data will be made available soon



# 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

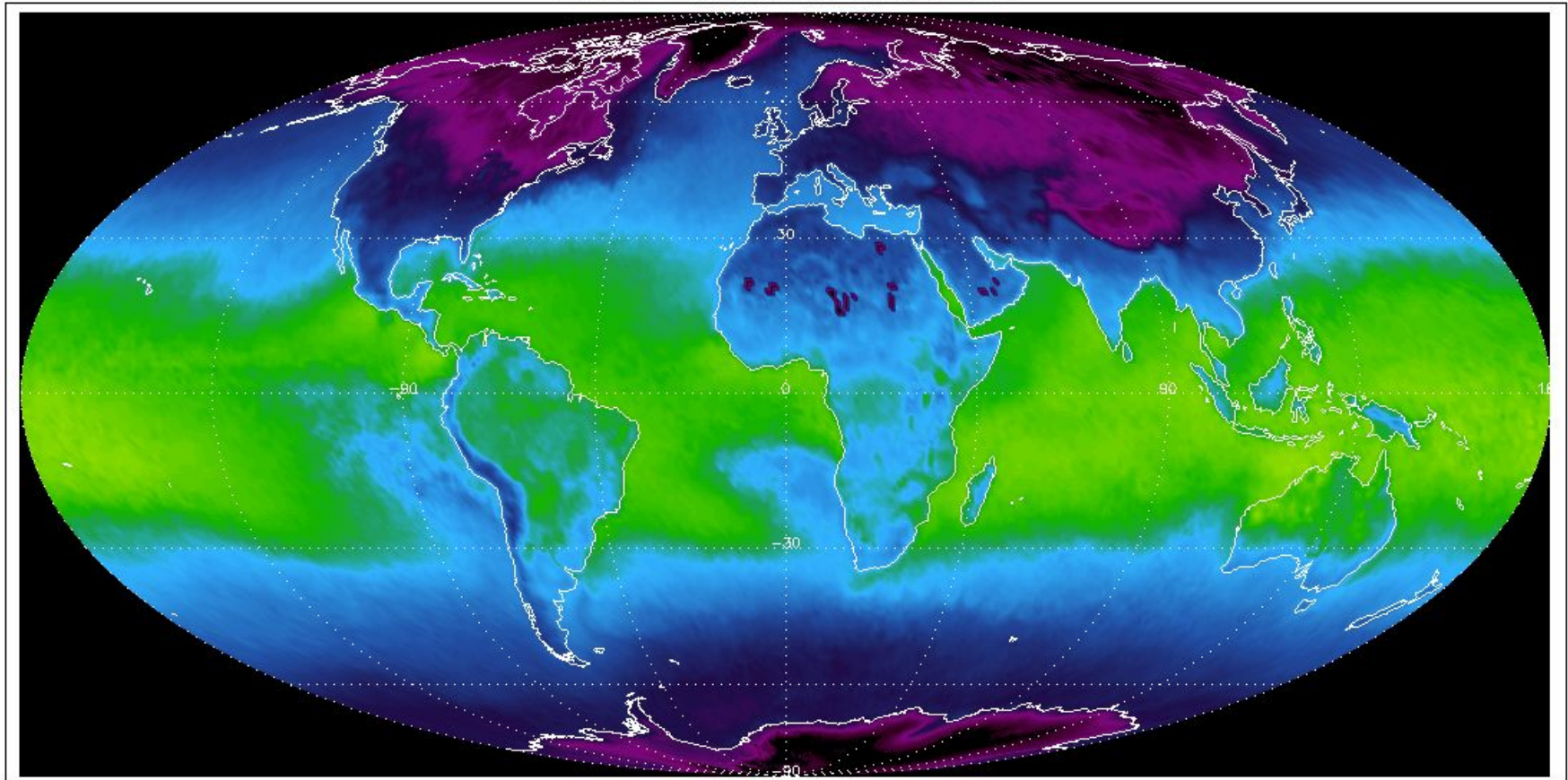




# Monthly Mean Surface Skin Temperature Descending Orbits - January 2003



Mean Total SST for Descending orbits of Q1/2003



October, 2003

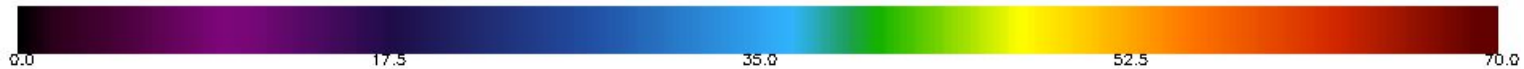
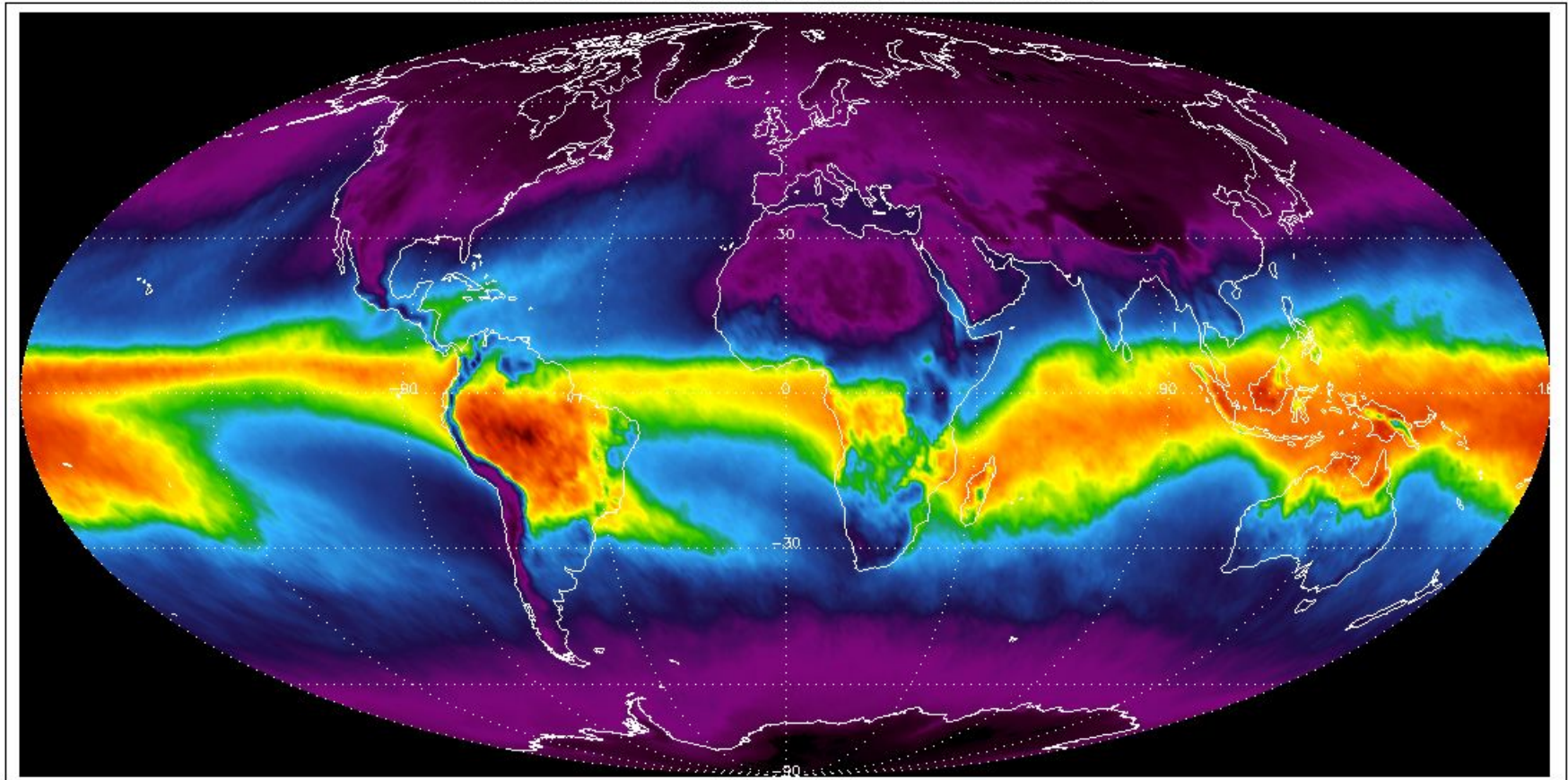




# Monthly Mean Total Precipitable Water Vapor Descending Orbits - January 2003



Mean Total Precipitable Water Vapor for Descending orbits of 01/2003



October, 2003

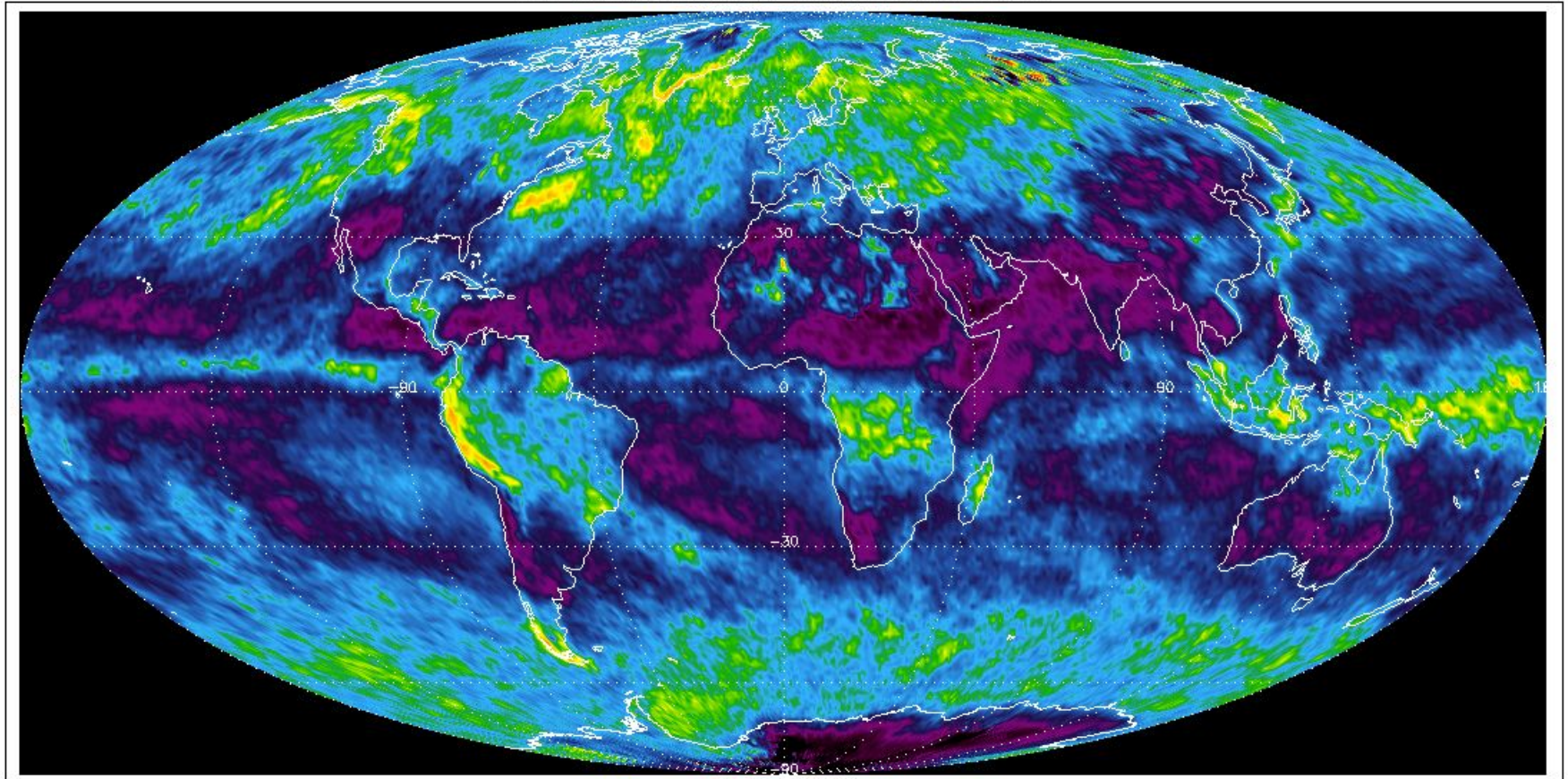




# Monthly Mean Cloud Fraction Ascending Orbits - January 2003



Mean Total Cloud Fraction for Ascending orbits of 01/2003



October, 2003

