A Fully Operational Near Real-Time AIRS Processing and Distribution System: Level 2 Products
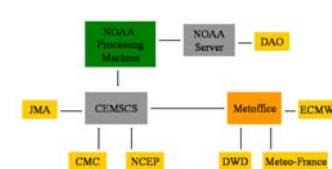
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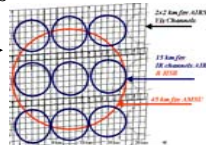[3]QSS Group, Inc, Lanham, MD 20706

Objectives

• Current low spectral resolution sounders, with relatively few spectral bands, are being phased out by advanced high spectral resolution infrared sounders with thousands of narrow spectral bands (channels).

• The Atmospheric Infrared Sounder (AIRS) is the first high spectral resolution infrared sounder data to be routinely distributed to Numerical Weather Prediction (NWP) Centers in near real-time – generally within 3 hours from observation time.

• Demonstrate processing and utilization of high spectral resolution infrared data in preparation for CrIS and IASI.

Atmospheric InfraRed Sounder (AIRS)

• AIRS is a cooled grating array spectrometer.

• Spectral coverage 3.7 to 15.4 microns in 17 arrays with 2378 spectral channels.

• Spectral resolution $v/\Delta v = 1200$, 15 km FOV from 725km orbit.

• AQUA was launched May 4, 2002.

• Primary products: temperature profile (< 1 K accuracy), moisture profile (< 15%) , ozone (< 15 % (layers) and 3 % total).

• Accuracy is achieved in clear, cloud cleared, or above clouds.

• Algorithms developed by AIRS science team.

• Details can be obtained from http://www-airs.jpl.nasa.gov

Current NWP AIRS Products

• Thinned Radiance files (HDF and BUFR):
• Types:
  a) center AIRS fov within every other AMSU-A fov,
     324 AIRS channels + AMSU and HSB (11 MB per orbit)
  b) 281 AIRS channels + AMSU and HSB (8 MB per orbit)
     using same thinning as a)
  c) Same as a) but with all 3 x 3 AIRS fovs.
  d) Full resolution AMSU and HSB
  e) 200 principal component scores using same thinning as a)
  * all include cloud indicator

AQUA AIRS Observed Brightness Temperature, Sept 18th, 2003, Granule-65

Near Real-Time Processing Steps

• NOAA receives raw AQUA data from EOS Data and Operations System (EDOS).
• Process AIRS, AMSU, and HSB data to Level 1B (calibrated and navigated), 35 GB of data per day.
• Subset Level 1B data and convert to BUFR format to enable distribution on a timely basis.
• Send BUFR files to the NOAA/NESDIS Central Environmental Satellite Computer System (CEMSCS) for distribution to the NWP centers.
• Process AIRS, AMSU, and HSB data to Level 2 products, 12 GB of data per day.

AIRS Processing Milestones at NOAA

• . May 4, 2002 – AQUA Launched

• August 7, 2002 – Received Level 0 to Level 1B processing package from JPL.

• August 21, 2002 – delivery of "first look" thinned radiance products to NWP centers, July 20th 2002 data.

• October 9, 2002 – routine distribution of thinned Level 1B radiance products to NWP centers.

• January 22, 2003 – Visible cloud fraction and top of atmosphere albedos have been added to the thinned data sets.

• July 1, 2003 – AIRS Level 2 becomes operational at NOAA.

• September 11, 2003 – HSB processing and distribution is turned off.

• September 16, 2003 – AIRS reconstructed radiances for 324 channels are available on the NOAA server in BUFR format.
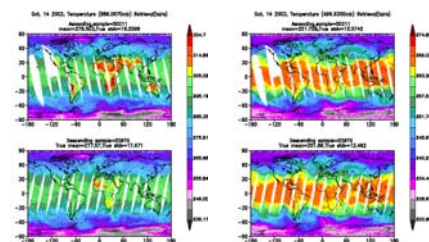
NEW NWP Products

• Thinned Reconstructed Radiance BUFR files (on NOAA server)
• AIRS Thinned Cloud Cleared Radiance BUFR files (2004)
• AIRS Level 2 sounding, surface, and cloud products (2004)
• AMSR-E Level 1B BUFR files (Near Future)
• AMSRE-E Level 2 BUFR files (2004)

Reconstructed and Cloud Cleared Radiances

• Reconstructed Radiances from Principal Component Analysis using 2047 channels. 322 of the 324 channels are reconstructed. Quality flag set indicating the radiances are reconstructed. The same BUFR format as the Level 1B AIRS radiances with one quality flag set.

• Cloud Cleared radiances are produced from the AIRS operational Level 2 code. This science team product will be placed in a BUFR format very similar to the AIRS Level 1B BUFR format.


AIRS Level 2 Variables for Distribution

Air Temperature (100 levels)	Rain Rate
Layer Column Liquid Water (100 layers)	Total Water
Layer Column Water Vapor (100 layers)	Total Ozone
Layer Column Carbon Monoxide (100 layers)	Surface Air Temperature
Layer Column Methane (100 layers)	Surface Skin Temperature
Standard Air Temperature (28 levels)	Microwave Surface Class
Water Vapor Mass Mixing Ratio (28 layers)	Outgoing Longwave Radiation
Ozone Volume Mass Mixing Ratio (28 layers)	Clear Outgoing Longwave Radiation
Column Averaged Carbon Dioxide	Cloud Top Pressure
Microwave Surface Emissivity	Cloud Top Temperature
Infrared Surface Emissivity	Cloud Infrared Emissivity
Infrared Surface Reflectivity	Cloud Infrared Reflectivity
Cloud Fraction	Clear Field of View Flag
Water Vapor Saturation Mass Mixing Ration (28 layers)	

Advanced Microwave Scanning Radiometer – Earth Observing System (AMSR-E)

• AMSR-E is a conically scanning passive microwave radiometer with 12 channels at 6 frequencies.

• 6.925 GHz, 10.65 GHz, 18.7 GHz, 23.8 GHZ, 36.5 GHZ, 89.0 GHZ

• FOVs range from 74 km by 43 km to 6 km by 4 km from a 725 km orbit.

• AQUA was launched May 4, 2002.

• Primary products: rain, ocean and land products listed below.

• Details can be obtained from http://wwwghcc.msfc.nasa.gov/AMSR

AMSR-E BUFR Files

• The AMSR-E BUFR table is available.

• AMSR-E Level 1B data is stored as "Dice" based on the 89 GHz resolution,

• Test AMSR-E Level 1B BUFR files will be ready by the end of November.

• The Level 2 BUFR files will be available in 2004.
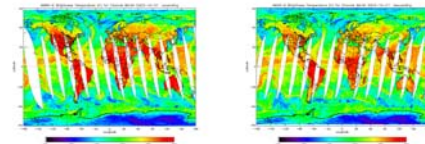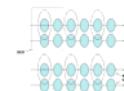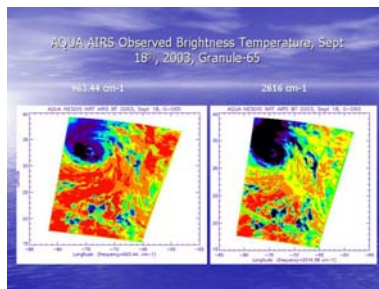

AMSR-E Level 2 Variables

Rain Products:	Rain Rate	
Ocean Products:	Cloud Liquid Water	Total Precipitable Water
	Sea Surface Temperature	Sea Surface Wind
	Sea Ice Concentration	
Land Products	Soil Moisture	Surface Temperature
	Vegetation Water Content	

Processing Hardware

• NASA NPP project has provided to NOAA 96 CPUs (SGI ORIGIN 3800 RS12K) for MODIS and AIRS processing. (64 MODIS ,32 for AIRS, AMSR-E split between the two machines) 8 TB storage
• Server - SGI Origin 3200 dual processor - 6 TB
• 20 RS10K + 32 RS12K CPUs dedicated to AIRS
• At least 7 TB for AIRS