AIRS Project Status

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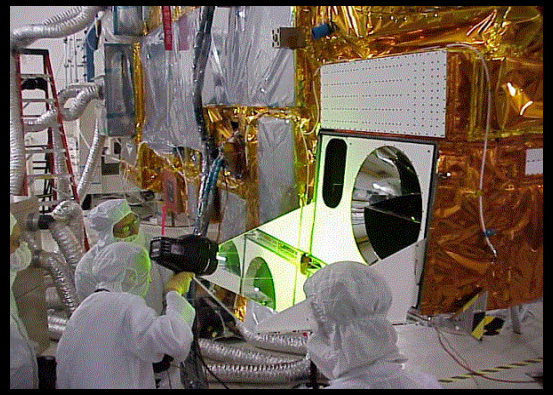
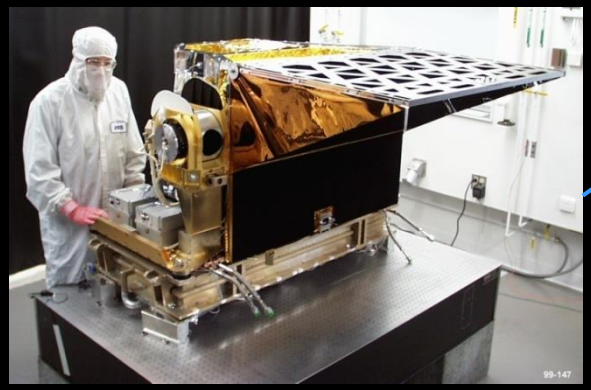
GSICS Annual Meeting (Virtual)

April 1, 2021

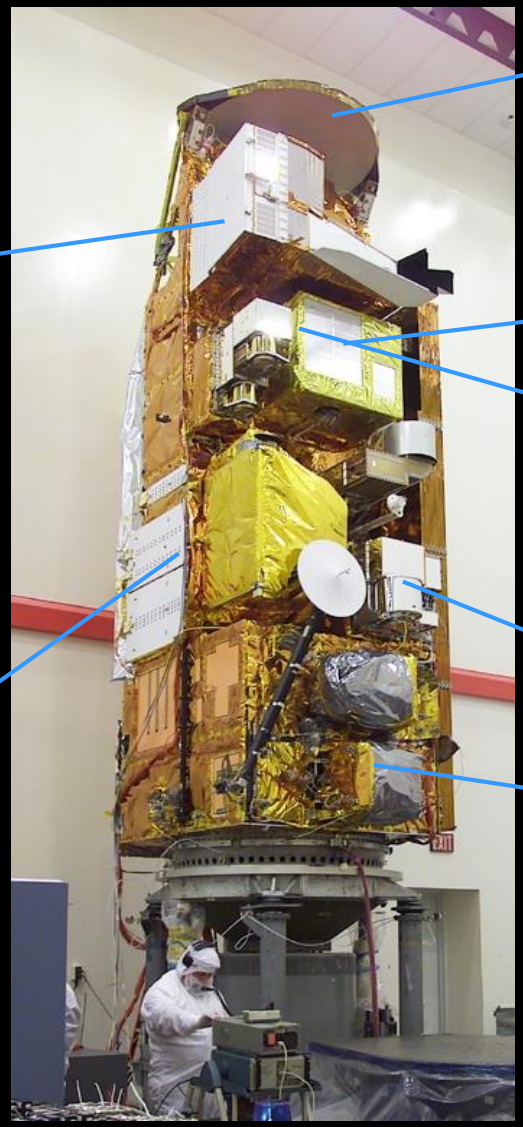
The Aqua Spacecraft
Launched May 4, 2002



Moderate Resolution Imaging Spectroradiometer (MODIS)
GSFC/Raytheon



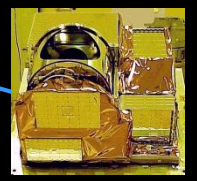
Atmospheric Infrared Sounder (AIRS)
JPL/BAE SYSTEMS



AQUA Spacecraft
GSFC/NGST

Advanced Microwave Scanning Radiometer (AMSR-E)
MSFC/JAXA

Advanced Microwave Sounding Units (AMSU-A/B)
JPL/Aerojet

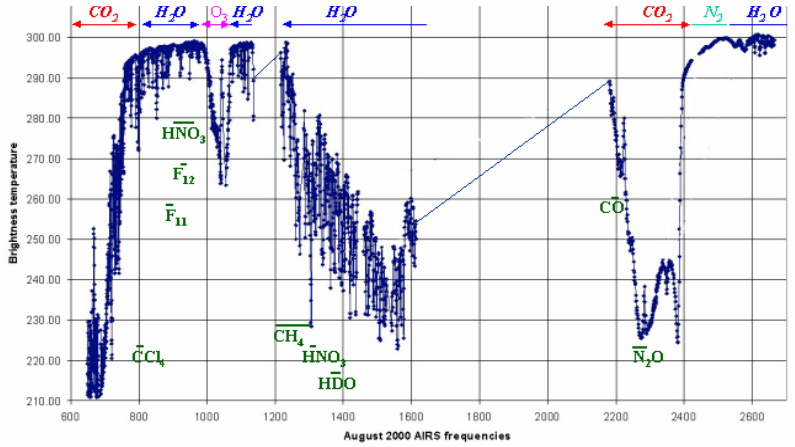


Humidity Sounder from Brazil (HSB)
JPL/Aerojet

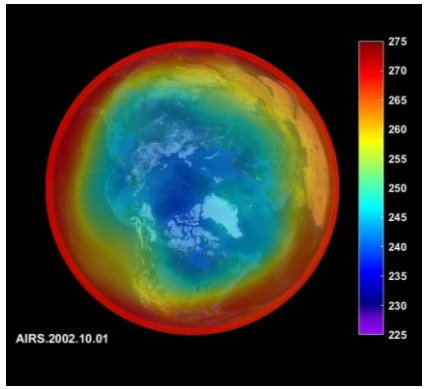
Clouds and Earth Radiant Energy System (CERES)
LaRC/NGST

AIRS Support Earth Science, Applications, and NWP Operations

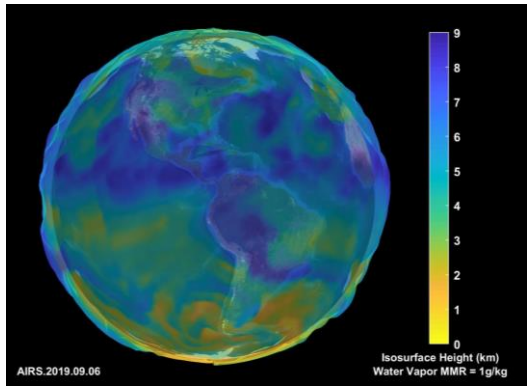
AIRS Spectrum for Tropical Atmosphere with T_surf = 301K



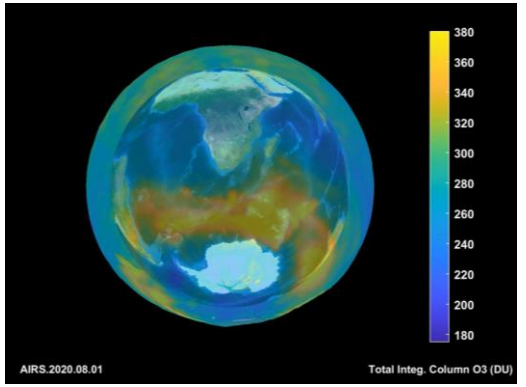
Arctic 600mb Air Temp. 2003-2018 (NASA, AIRS)



Global Daily Water Vapor 2019 (NASA, AIRS)



Antarctic Ozone Hole 2020 (NASA, AIRS)

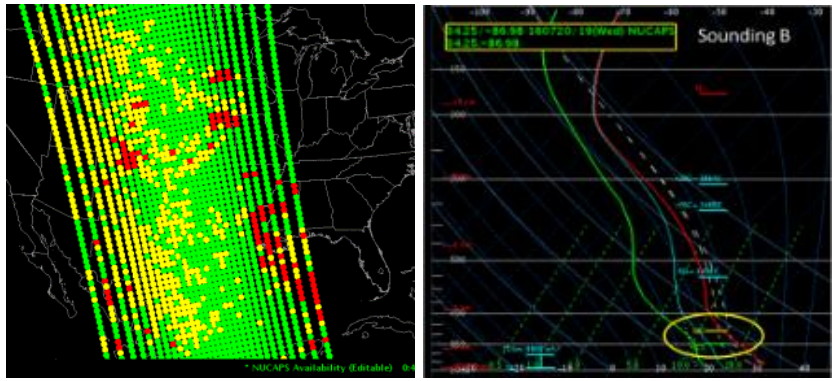


JPL/GSFC

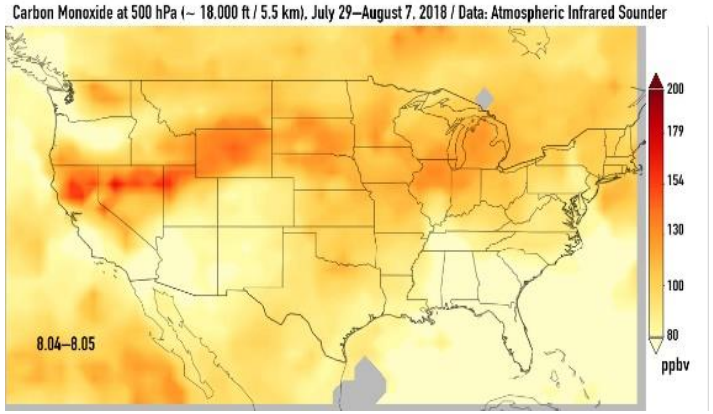
NOAA NESDIS/NCEP

JCSDA

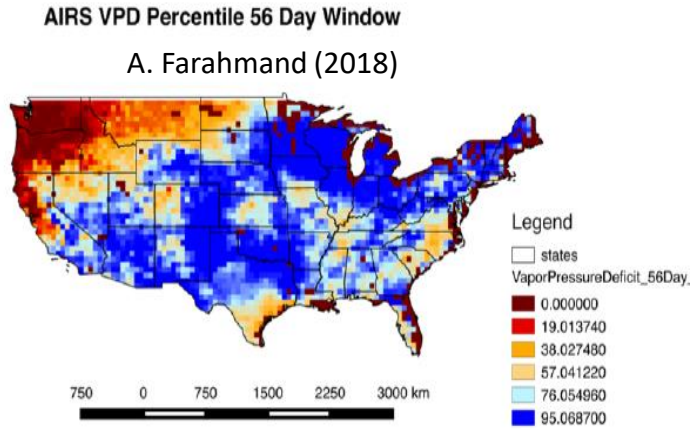
NUCAPS NRT Temperature and Water Vapor Profiles in AWIPS



Mid Tropospheric Carbon Monoxide. August 2018 (NASA, AIRS)

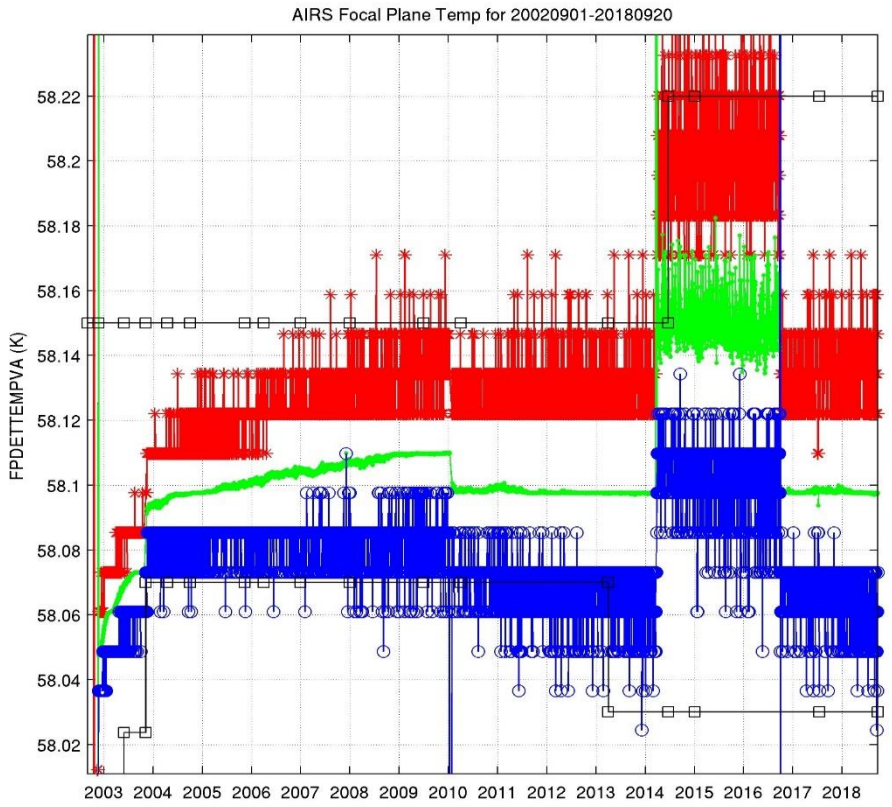


Vapor Pressure Deficit. September 29017 (NASA, AIRS)



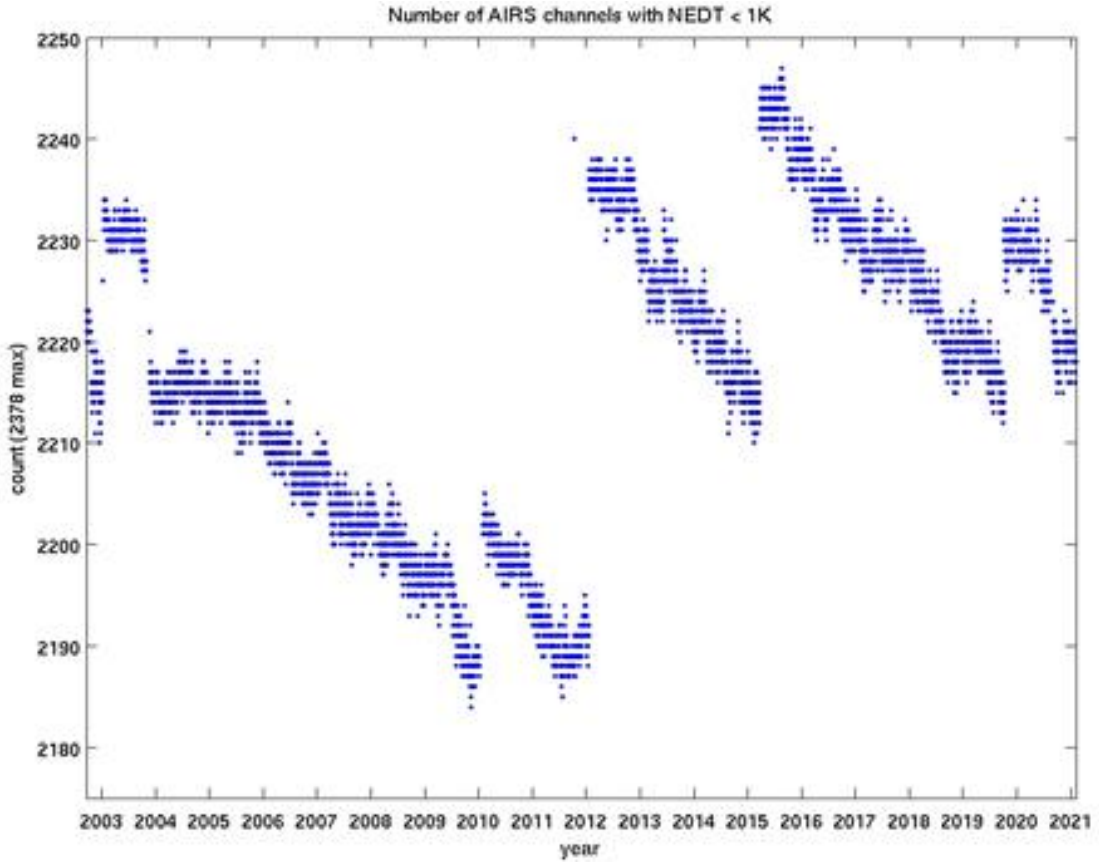
AIRS Remains Healthy

Minimal Trends in Instrument Telemetry



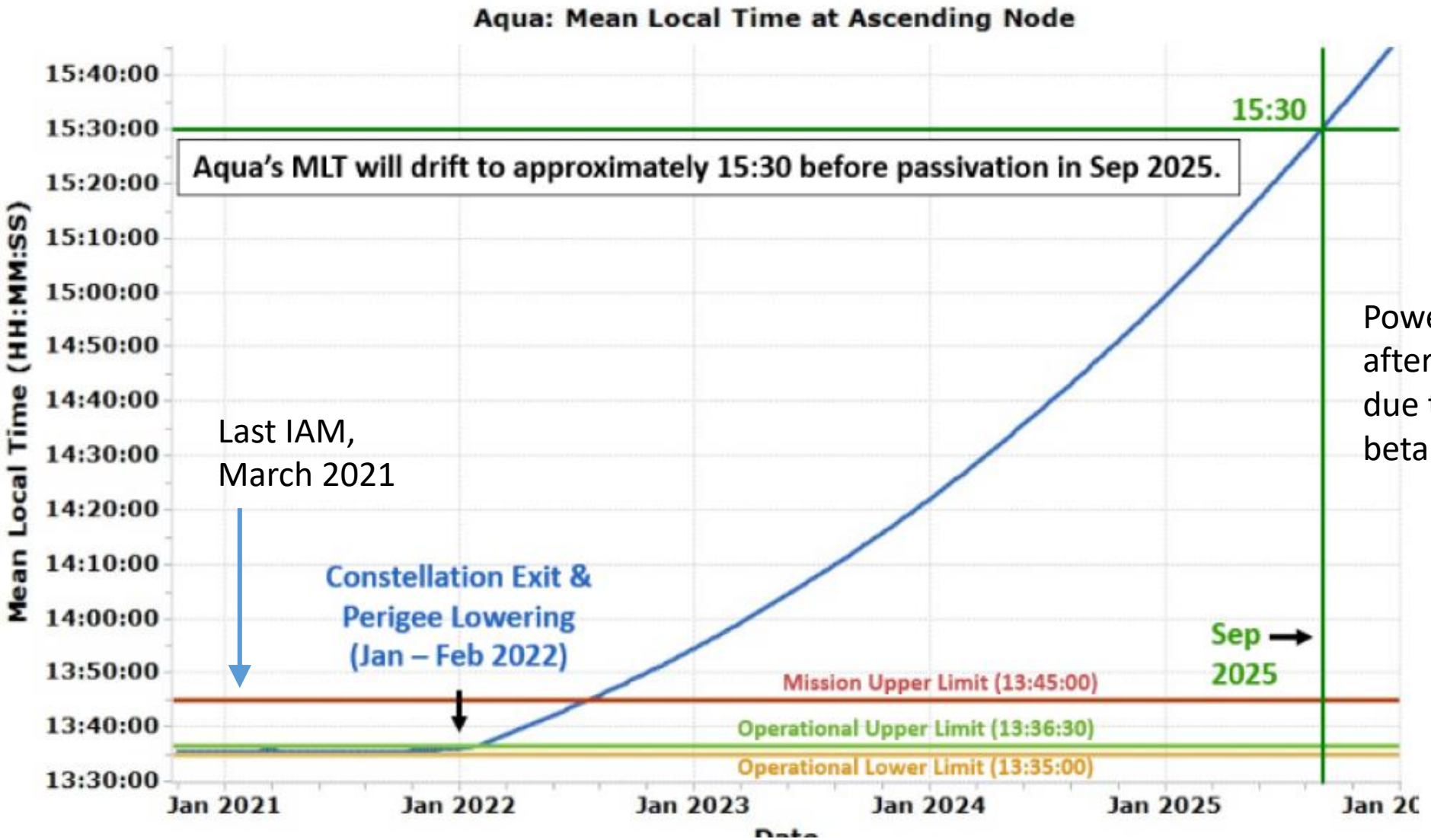
Focal Plane temperature has remained within a 0.25 K range throughout the AIRS mission. Note: Median temperature (green) rose ~0.06 K during 2014-2016 Cooler A anomaly

Detector Operability Maintained Throughout Mission



S. Broberg (JPL)

Aqua to Exit A-Train in Jan/Feb 2022. AIRS Fully Operational till 2025

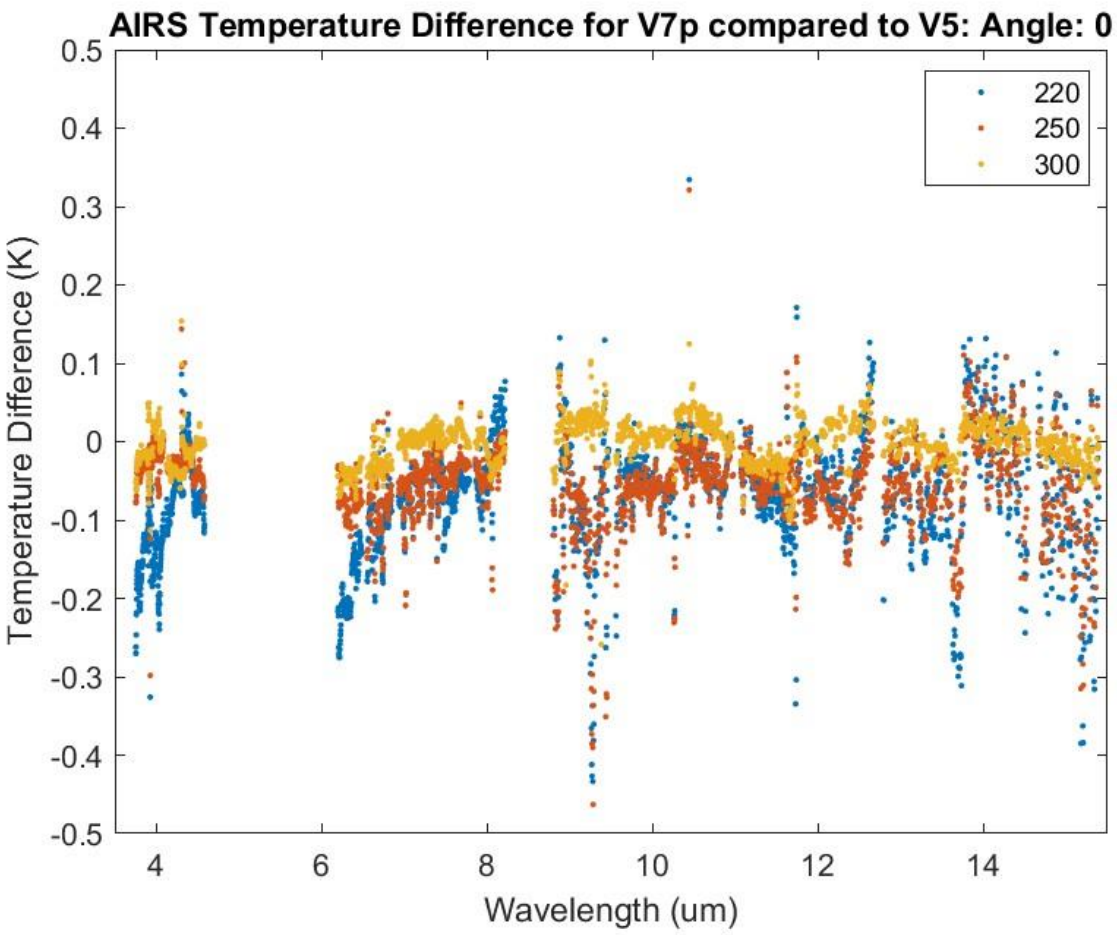


Power Limits after 2025 due to high beta angle

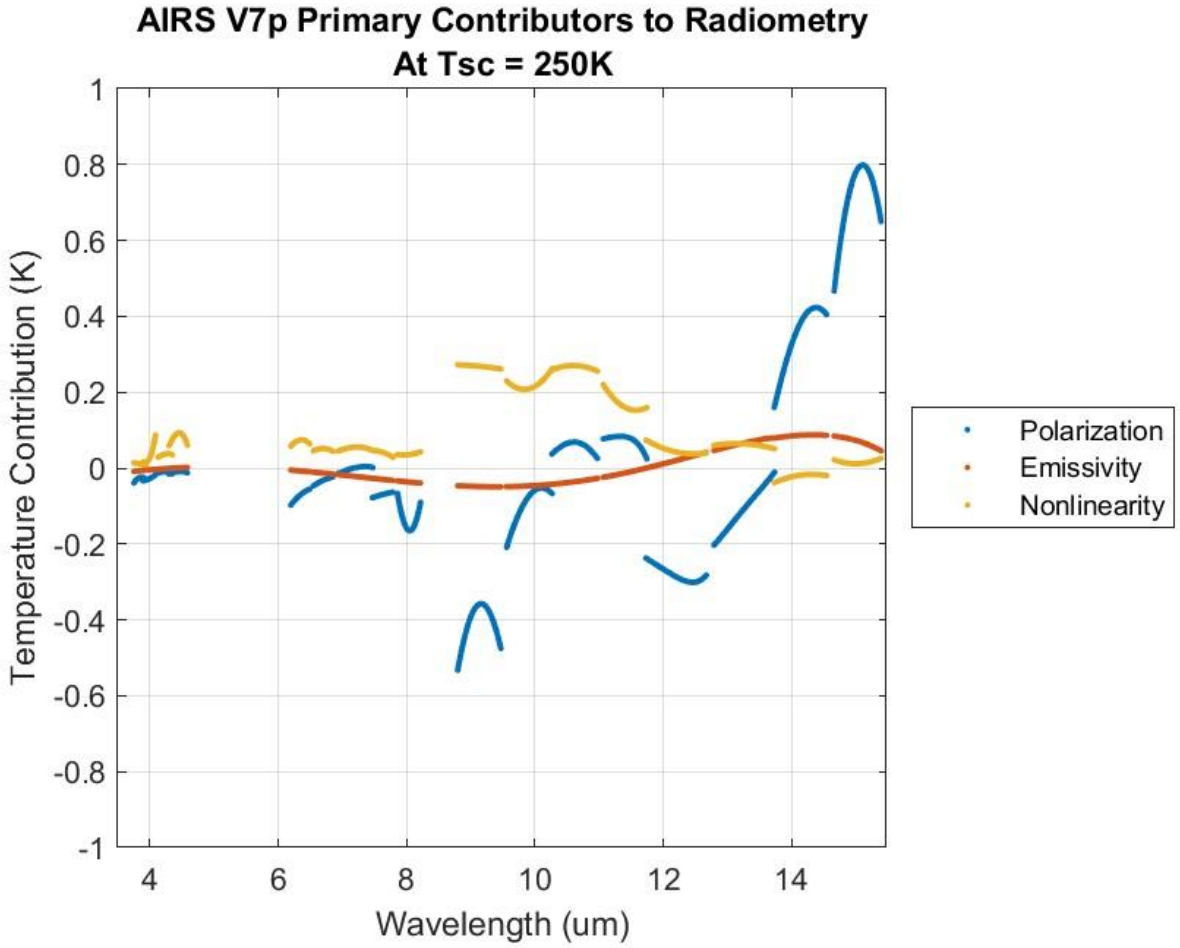
B. Guit (GSFC), Jan 2021

Small Radiometric Update to V7 impacts mostly colder scenes

Version 7 – Version 5



V7 Key Contributors to Radiometry

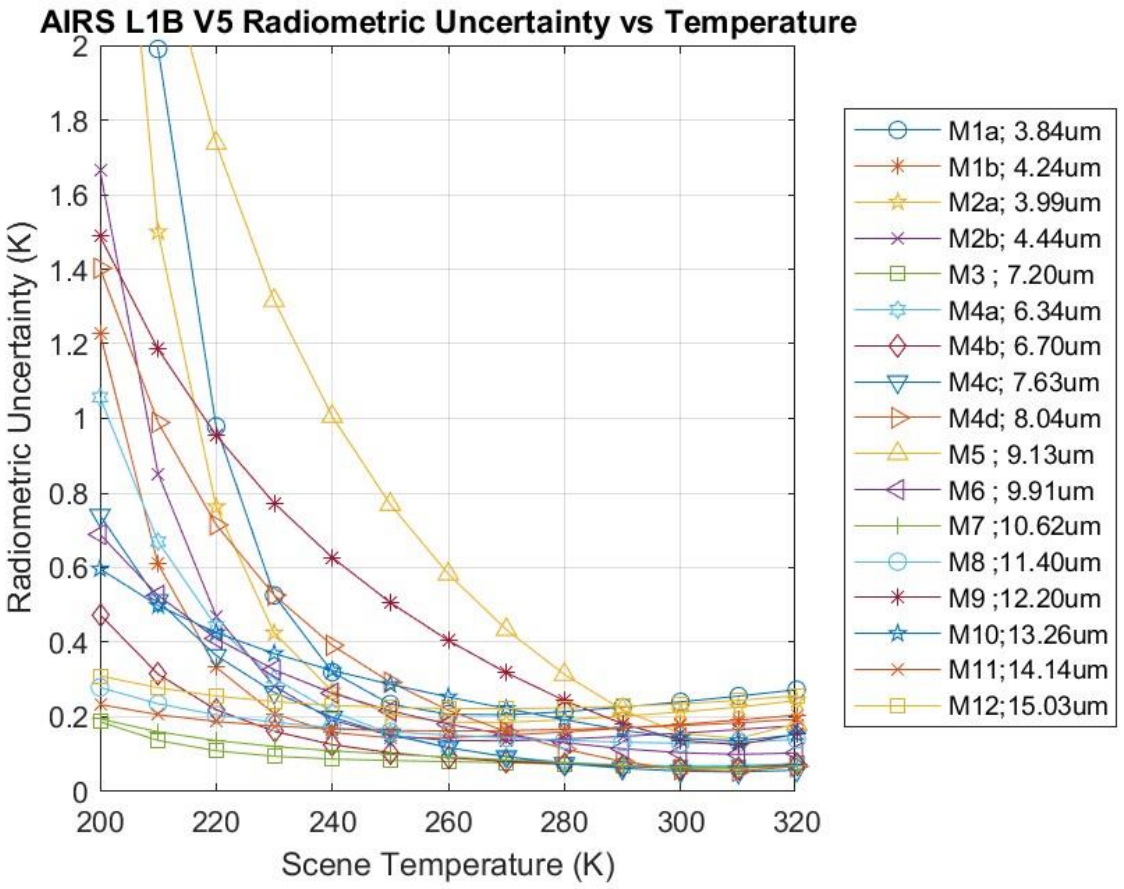


V7 Updates Polarization, Nonlinearity, Emissivity. First update to AIRS radiometry since launch

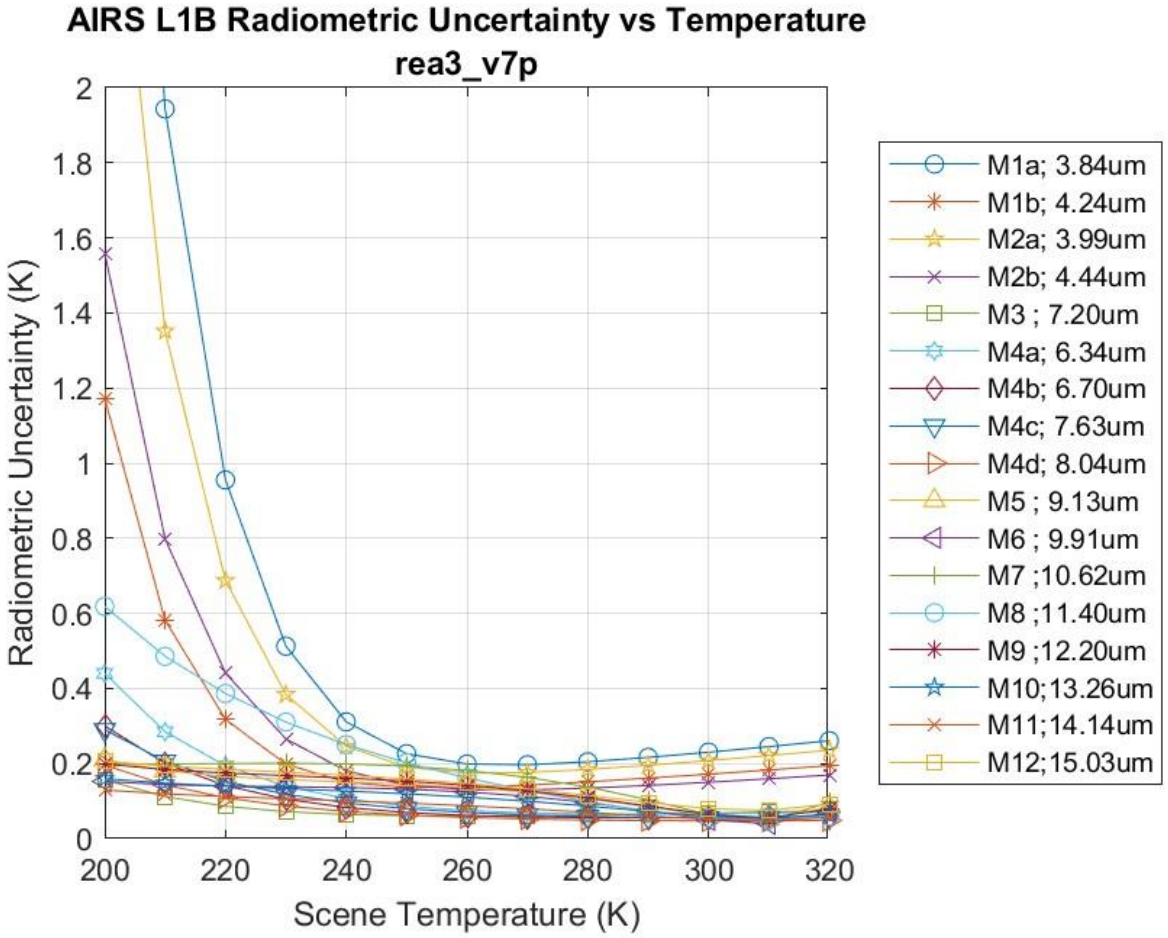
Version 7 Reduces Radiometric Uncertainty

(All Uncertainties Shown are 1-sigma)

Version 5 Level 1B*



Version 7 Level 1B

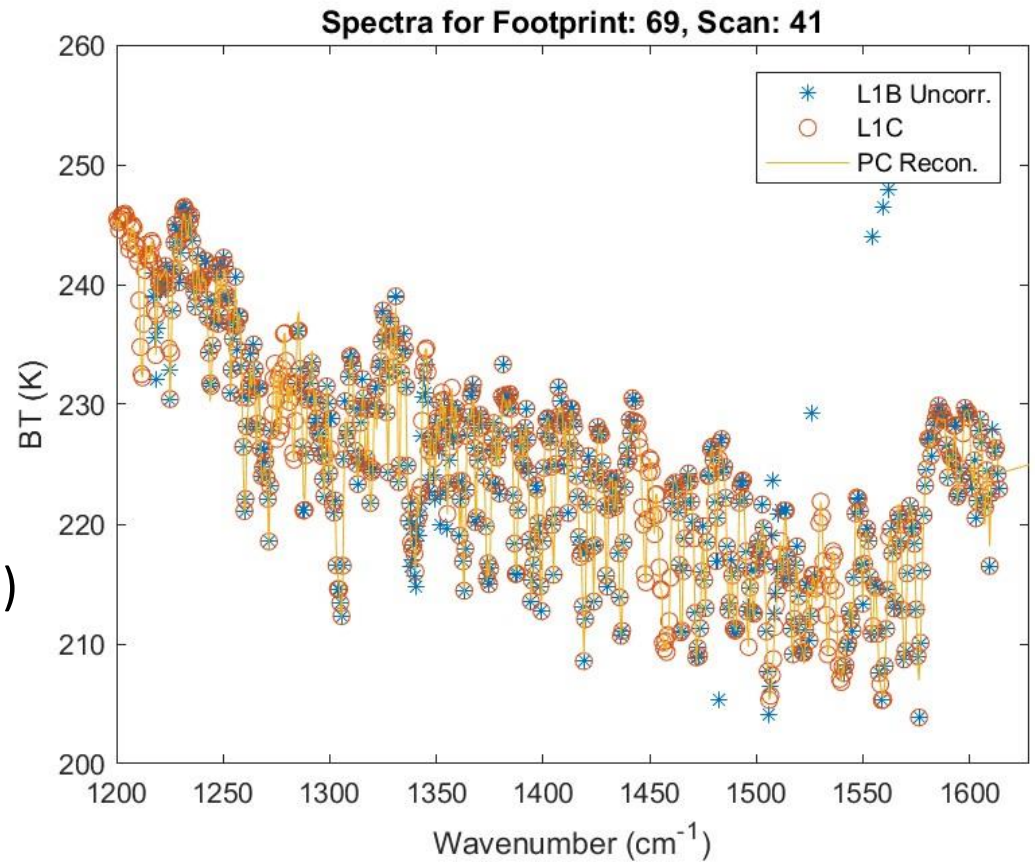


*Pagano, T.S., H. Aumann, S. Broberg, C. Canas, E. Manning, K. Overoye, R. Wilson, "SI-Traceability and Measurement Uncertainty of the Atmospheric Infrared Sounder Version 5 Level 1B Radiances", Remote Sens. 2020, 12, 1338; doi:10.3390/rs12081338

L1C Designed to Make Life Easier

Version 6.7

- Designed to facilitate use of AIRS Level 1 radiances
  - For Comparison to other Hyperspectral IR
  - For Comparison to Broadband Imagers
  - For Ingest by L2 Retrievals
- Version 5 L1B for all "good" channels
- Fills Dead Channels with PC Reconstruction (PCR)
- Fills bad Cij (Co-registration) Pixels with PCR
- Fills Gap with PCR
- Fills Very High Noise Pixels with PCR
- Constant Frequency Grid (does not change with time)
- V6.7 L1C will be used to support LLS's CHIRP product



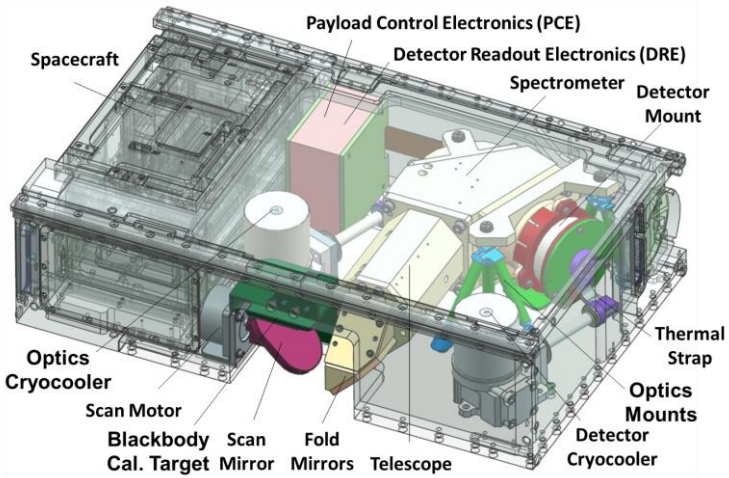
AIRS.2014.03.01.124.L1C.AIRS_Rad.v6.1.0.2.X14295151145.hdf

Version 7.0. Pending

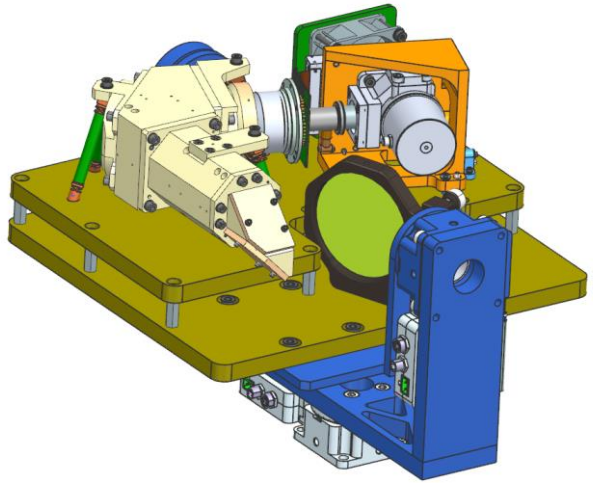
- Same as Version 6.6 but with
- Updated filling algorithms.
- Version 7 L1B Radiometric and Polarization Coefficients
- netCDF Output

The CubeSat Infrared Atmospheric Sounder (CIRAS)

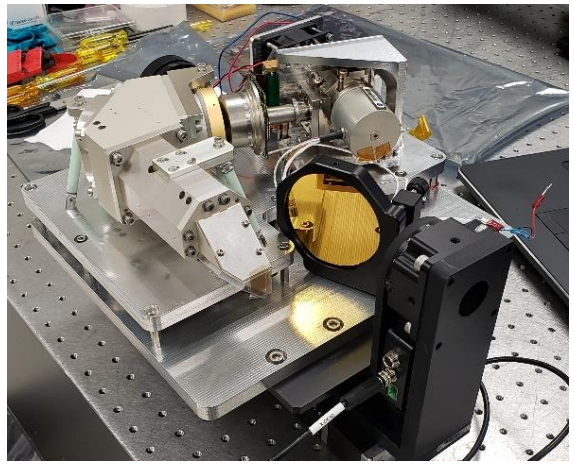
CIRAS in a 6U CubeSat



CIRAS Breadboard Configuration



CIRAS Hardware Under Test



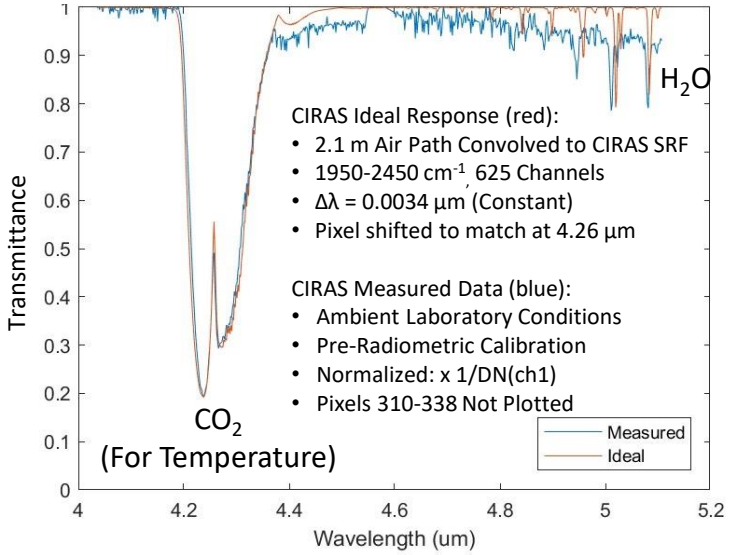
- CIRAS provides accurate profiles of atmospheric temperature and water vapor in a 4U form factor

Parameter	CrIS	CIRAS
Orbit	833 km	600 km
Spectral Range	650-2550 cm^{-1}	1950-2450 cm^{-1}
Spectral Resolution	0.9 cm^{-1}	1.2-2.0 cm^{-1}
Spatial Coverage	2200 km	1520/600 km
Spatial Resolution	13.5 km	13.5/3.5 km
NEdT	<0.2 K	<0.2 K
Size	0.9 x 0.8 x 0.55 m	4U
Mass	117 kg	4 kg
Power	90 W	23 W

Status:

- All CIRAS components and subsystems have been demonstrated to TRL 5
- CIRAS as a system has reached TRL 4
- Ambient Test results show excellent spatial, spectral and radiometric performance
- JPL Preparing for TVAC Testing of the CIRAS breadboard
- Most components are in hand for a proto-flight model (PFM) demonstration

CIRAS First Spectrum (Room Air)



AIRS Status Summary

- NASA AIRS on Aqua
  - AIRS in excellent shape! Expect mission to continue to at least 2025.
  - Mean local time expected to start to drift in Jan/Feb 2022 when Aqua exits the A-train
  - AIRS designed and tested to produce SI traceable radiances
  - Legacy data set connects to operational weather sounders: CrIS, IASI
  - Interest in AIRS radiance data record growing due to long duration in space and overlap with current sounders. Participation in GSICS more important than ever!
- Radiometric Calibration Coefficients Updated
  - Current operational version uses pre-launch coefficients (V5)
  - Updates provided to polarization, emissivity, and nonlinearity (for V7)
- AIRS Level 1C Released in March 2020!
  - Level 1C V6.7 (based on Level 1B V5) is available for the entire mission at the GES/DISC
  - Level 1C V6.7 Used in the generation of CHIRP (L. Strow climate radiance product)
- Version 7
  - V7 Level 1B and Level 1C public release currently planned for June 2021
  - V7 Level 2 Products (Run off V5 Level 1B) Released in July 2020
  - CLIMCAPS-Aqua Level 2 Products to be released in April or May 2021