

# A AIRS Plus CrIS/IASI Multi-Decadal Trends and Anomalies with Full Spatial Sampling and Rigorous Error Characterization

AIRS Science Team Meeting

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# Overview: Two Products Proposed

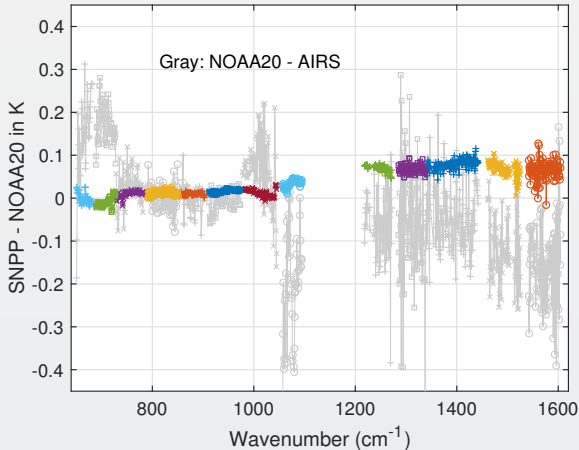
## **(1) Multi-Instrument Hyperspectral Climate Time Series**

- 1:30 Orbit: AIRS + CrIS, 9:30 Orbit: IASI
- Convert to common ILS, CrIS 0.8/0.6/0.4 cm OPD (LW/MW/SW)  
"Hybrid Time Series"
- Allows inter-instrument radiance calibration, needed for climate
- Allows use of a common forward model
- Emphasize routine/fast processing of data for validation and Level 3

## **(2) Level 3 Products: Radiance and Geophysical**

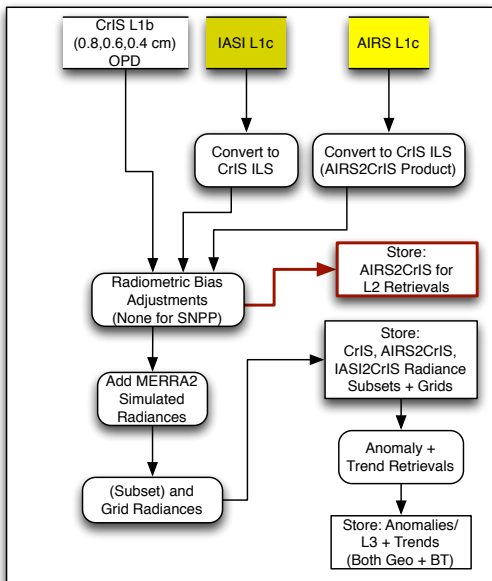
- Produce time/space grids of radiance time series and anomalies for climate analysis
- Generate geophysical (T/Q, etc.) "Level 3" anomaly time series and trends
- Generating radiance trends/anomalies first reduces errors and influence of a-priori
- Optimal estimation for Level 2 anomalies, proposal emphasis on applicable covariance estimates and total system uncertainties

# SNPP vs NOAA20 CrIS (via AIRS Snos)



- AIRS and CrIS radiometric calibration differences after putting AIRS on the CrIS ILS grid. (AIRS - NOAA20 CrIS) and (SNPP CrIS - NOAA20 CrIS) shown.

# Data Processing Flow

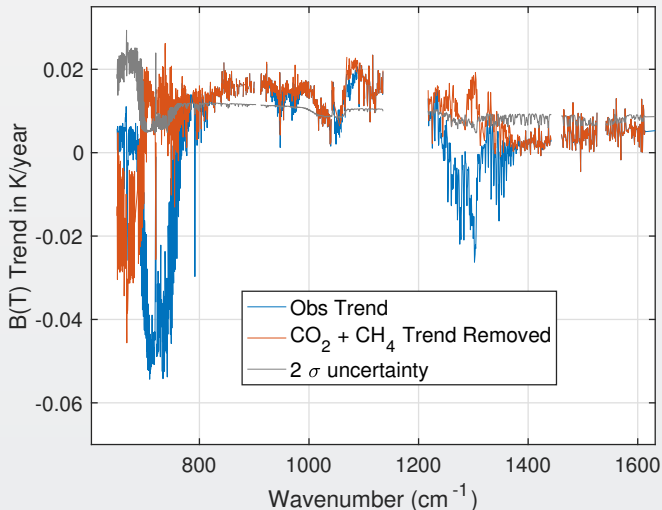


## AIRS2CrIS for Level 2 Retrievals? (Summary)

- Continuity requires adjusting for satellite differences
- Only way I can see is to use a common ILS
- Which allows you to use a common RTA
- Instrument noises can be adjusted to be identical if needed (AIRS noise will be lowered when converted to CrIS ILS)
- DOFs of CrIS (NSR or FSR) very similar to AIRS
- "AIRS2CrIS" product samples will hopefully be ready soon for testing

## Example Product Slides Below

## Global B(T) Trend (hardest case)

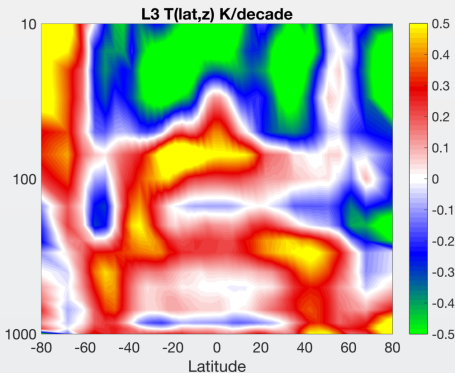


Uncertain on fit vs specify CO<sub>2</sub>, CH<sub>4</sub> etc. trends. We have done both.  
Specifying OK for long-term trends.

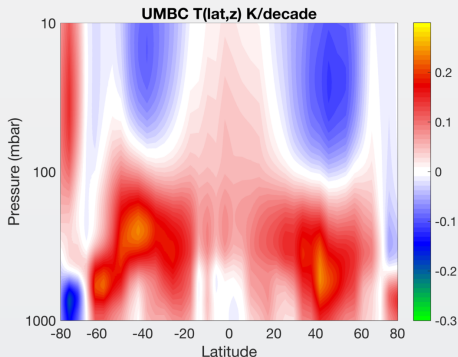
# Example: 14-Year Zonal Temperature Trends

*NOTE larger color scale on left.*

From Level 3



From Radiance Derivatives



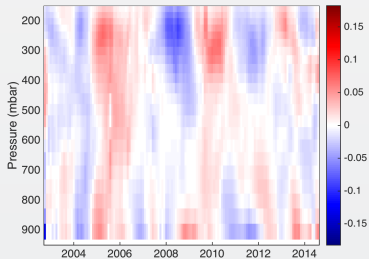
Interannual variability (observation covariance) regularizes OE solution.

Need to work on off-diagonal obs covariances to get uncertainties right.

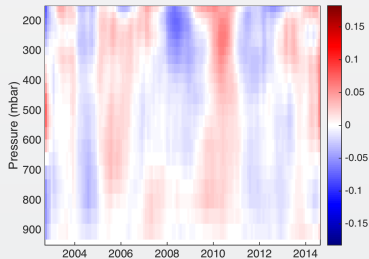


# Anomaly Example: Water Vapor (27N to 30N Latitude Zonal)

From radiance anomaly



ERA  $\times$  Avg Kernel



AIRS Level 3

