JPSS Program Science Program Science Partnership with Cal/Val Program

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What is Program Science?

1) Program Science provides science integrity for the JPSS Program

2) NOAA JPSS Program Scientist provides the link between the JPSS operational user community and the JPSS Program through
   - Chairing the Low Earth Orbiting Requirements Working Group for gathering and defining requirements,
   - Managing the JPSS Proving Ground and Risk Reduction program to foster improved user applications and science feedback.
   - Provides overarching science oversight for the Program

3) NASA JPSS Project Scientist ensures instruments meet specification through oversight of prelaunch and post launch commissioning of instrument performance.

4) NOAA/NESDIS Center for SaTellite Applications and Research (STAR) provide cal/val algorithm support to Ground Segment Product Generation and algorithm maintenance/sustainment
   - IDPS Products – coordinated by Data Product and Algorithms (DPA)
   - ESPC Products – coordinated by Office Systems Development (OSD)

5) STAR also supports 2) and 3)

What is the Proving Ground & Risk Reduction Program for JPSS?

The JPSS Proving Ground and Risk Reduction program's primary objective is to maximize the benefits and performance of NPP/JPSS data, algorithms, and products for downstream operational and research users (gateways to the public) through:

- Engaging users to enhance/improve their applications through the optimal utilization of JPSS data.
- Education, Training and Outreach
- Facilitating transition of improved algorithms to operations.
- Detailed characterization of data attributes such as uncertainty (accuracy and precision) and long-term stability
- Provides user feedback to the cal/val program

Proving Ground versus Risk Reduction

- Proving Ground
  - Demonstration and utilization of data products by the end-user operational unit, such as a NWS Weather Forecast Office or Modeling Center.
  - Promote outreach and coordination of new products with the end users, incorporating their feedback for product improvements

- Risk Reduction
  - Development of new research and applications to maximize the benefits of JPSS satellite data
    - Example - use of Day Night Band for improved fog and low visibility products at night, benefiting transportation industry.
  - Encourages fusion of data/information from multiple satellite, models and in-situ data
  - Primary work is done at the algorithm and application developer's institution.
  - Address potential risk in algorithms and data products by testing alternative algorithms.

JPSS Proving Ground and Risk Reduction Application Areas

- Weather Forecasting (Improving Global, Regional forecasts)
  - Tropical Cyclones
  - Severe Weather (Nowcasting)
- Ocean/Coastal (Coral Bleaching, Harmful Algal Bloom alerts)
- Land (Droughts, Agriculture)
- Hazards (Smoke, Fire, Volcanic Ash, Air Quality)
- Hydrological (Precipitation, Floods, Soil Moisture, Snow/Ice, River Ice)
- Climate (integrated products, real-time anomaly products)
- Education and Training
- Infrastructure (Direct Readout and Software (CSPP), Airborne campaigns)

JPSS Proving Ground Partners :

NWS, NOS, NMFS, OAR, NESDIS, NOAA Cooperative Institutes, NASA, and NRL

JPSS Significant Proving Ground Accomplishments

S-NPP Direct Broadcast for Alaska, Hawaii, Continental US, and World Wide Users

Routine use of VIIRS Imagery by forecast offices (significant use by Alaska)

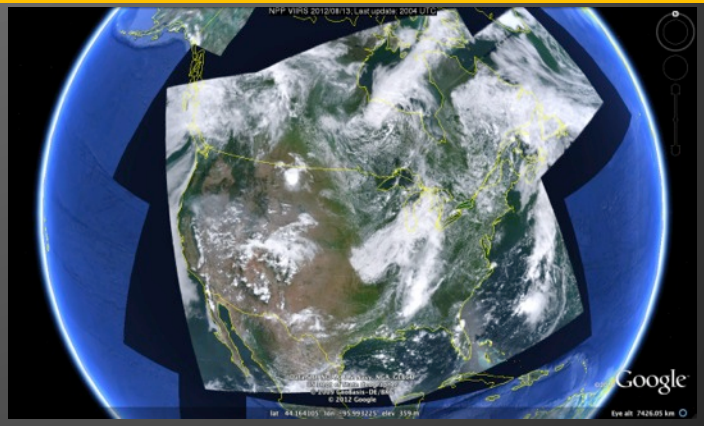
VIIRS Active Fire, Air Quality, and Ocean Color imagery and data portals

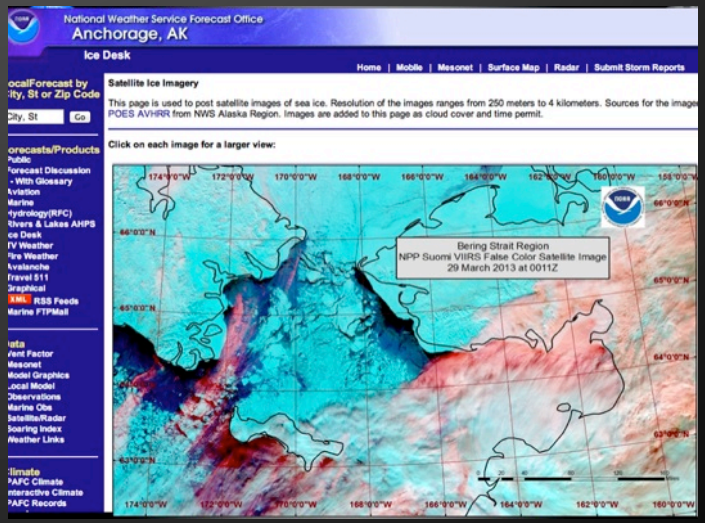
Tropical Cyclone Forecasting Improvements using ATMS and CrIS

Global Data Assimilation Experiments of ATMS and CriS (ATMS and CrIS are used operationally)

Education and Training (New COMET VIIRS Day Night Module)

First Airborne Validation Campaign via NASA ER2





Connecting the dots - from photons to users

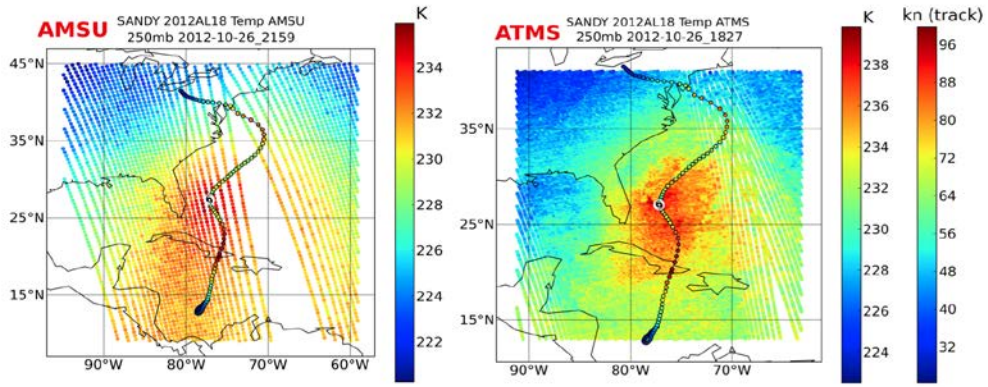
Flight - Instruments, spacecraft

Ground - data reception and real-time operational product generation and access points to the user community

Algorithm Program - provides algorithms for operational product generation and includes calibration and validation, long term maintenance and enhancements.

Proving Ground – focuses on improving user applications by fusion of JPSS data in key NOAA /partner products and services such as weather forecasting, fire monitoring, coastal ecosystems, air quality, ice/snow monitoring, drought monitoring, etc. Provides direct readout applications and training.

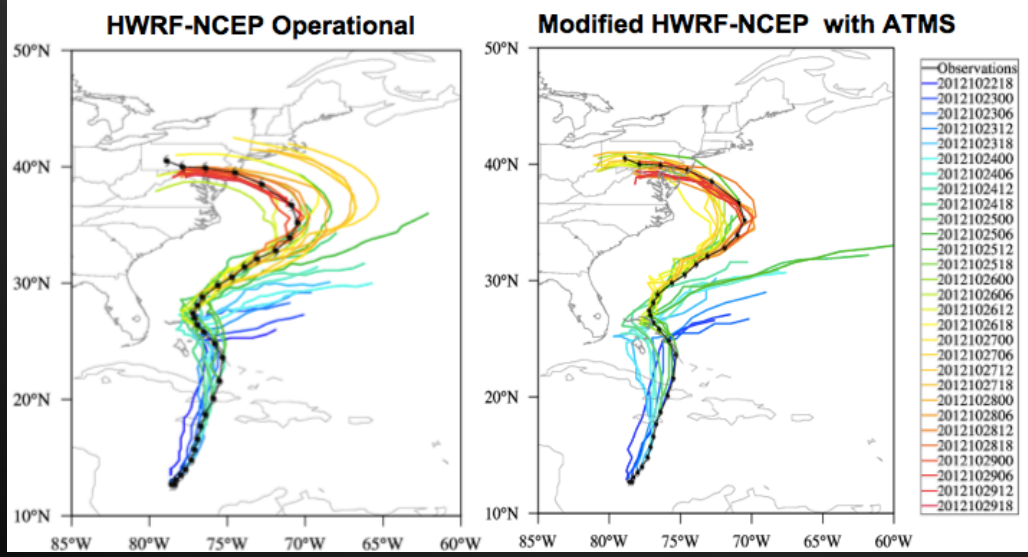
Resolution: ATMS vs AMSU



ATMS:

- higher resolution
- wider swath
- much smaller gaps between passes

Experimental results showing improvements in Sandy track forecasts from Hurricane Weather Research Forecast model with ATMS



Algorithm Program provides the science and stewardship to enable high quality ATMS SDRs from the ground segment which enables Proving Ground to invest in the necessary changes to the HWRF model to demonstrate improved hurricane track forecasting using ATMS

JPSS PGRR Supports Education/Training Modules

ADVANCES IN SPACE-BASED NIGHTTIME VISIBLE OBSERVATION

Produced by The COMET® Program

UAF-GINA

Introduction

Nightime Visible Imaging With the DNB

Lunar Phases and Modeling

Applications of Nightime Visible Imaging

- Introduction
- City Lights
- Tropical Cyclones
- Fog/Stratus
- Airglow
- Polar Nights and Auroras
- Wildland Fires
- Volcanoes
- Dust Storms
- Air Pollution
- Moonglint
- Lightning
- Gas Flares
- Ships and Boats
- Population/Economic Geography

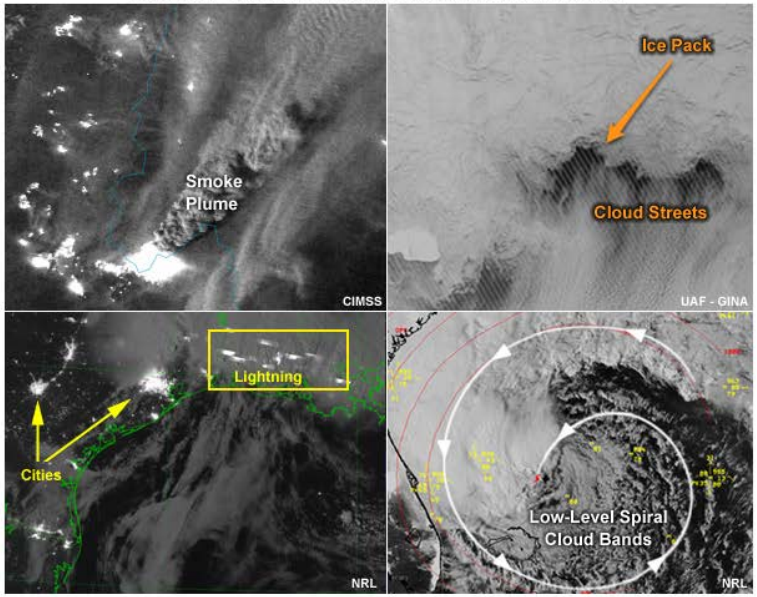
Future of Nighttime Visible Observation

Interpretation Guidelines

References

This section explores the use of nighttime visible images and derived products to detect and monitor a variety of meteorological and other features at night. The derived products are made from VIIRS DNB visible images and infrared channels. As of 2013, some are currently available while others are still experimental.

Suomi NPP VIIRS DNB Nighttime Visible Images & Products



If you are not familiar with RGB products, we recommend that you take COMET's Multispectral Satellite Applications: RGB Products Explained module at https://www.meted.ucar.edu/training_module.php?id=568.

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SUOMI NPP ORBITS, DATA, AND PRODUCTS
SUOMI NPP INSTRUMENTS
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VIIRS Imager, Part 1
VIIRS Imager, Part 2
Hyperspectral Sounding with CrIS
Microwave Sounding with ATMS
OMPS (Ozone Mapping)
CERES (Radiation Budget)
ENVIRONMENTAL MONITORING
CONCLUSION

1:40 | 1:40

SUOMI NPP / JPSS-1 SENSORS

Cloud and Earth Radiant Energy System (CERES)

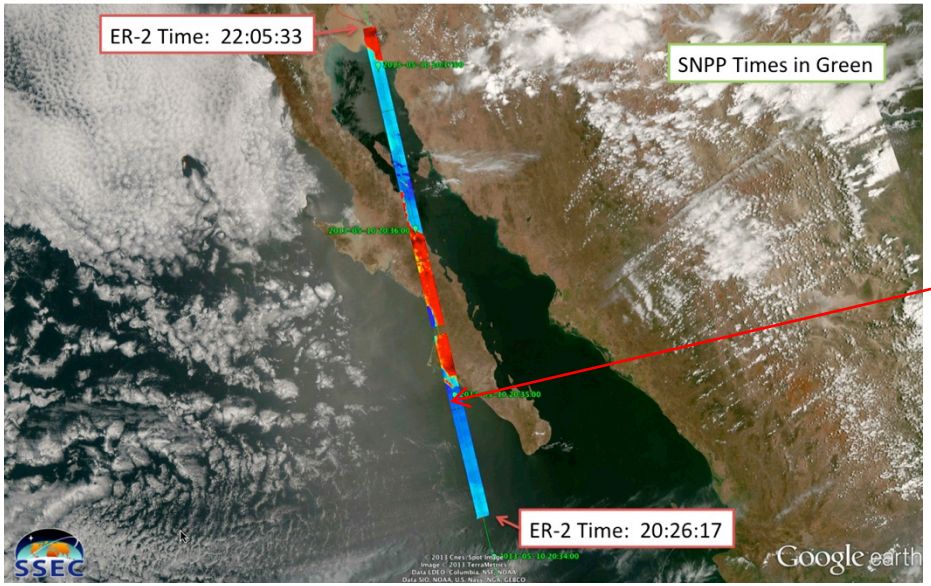
NASA/ GSFC

- CERES measures reflected solar radiation, emitted terrestrial radiation, and total radiation

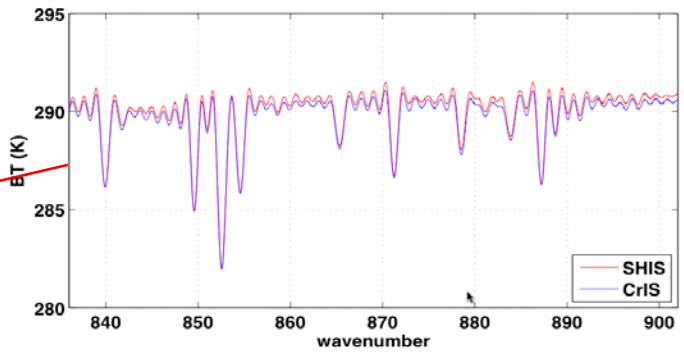
JPSS PGRR Deep-Dive Validation
First S-NPP ER-2 Aircraft Campaign to provide validation for CrIS, ATMS and VIIRS

NIST traceable absolute calibration for CrIS

S-HIS 895-900 cm^{-1} (280 – 320K) over VIIRS Imagery



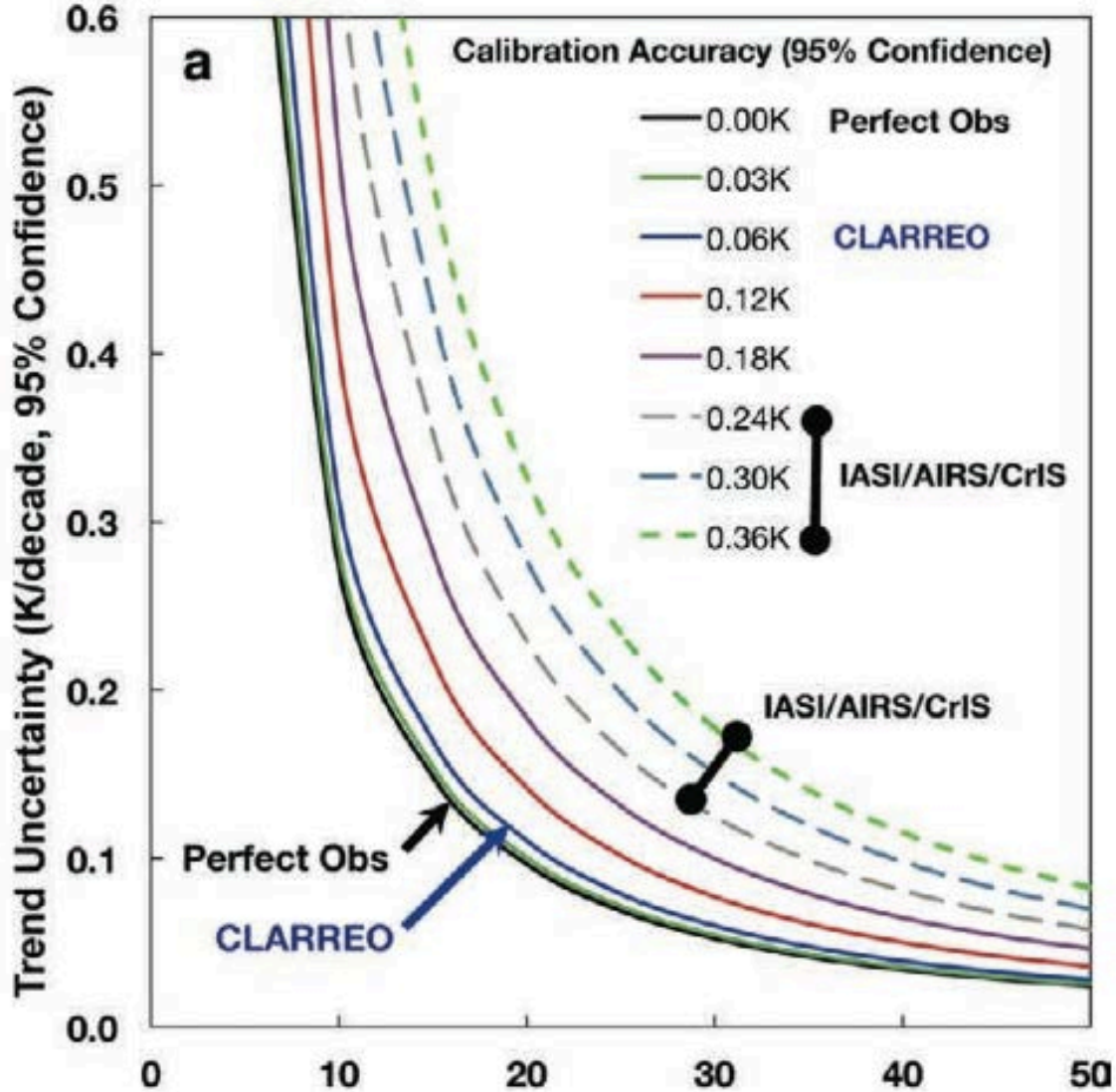
Zero-th Order S-HIS / CrIS comparison: Window region comparison. Same spectral resolution.



May 10, 2013 – first look

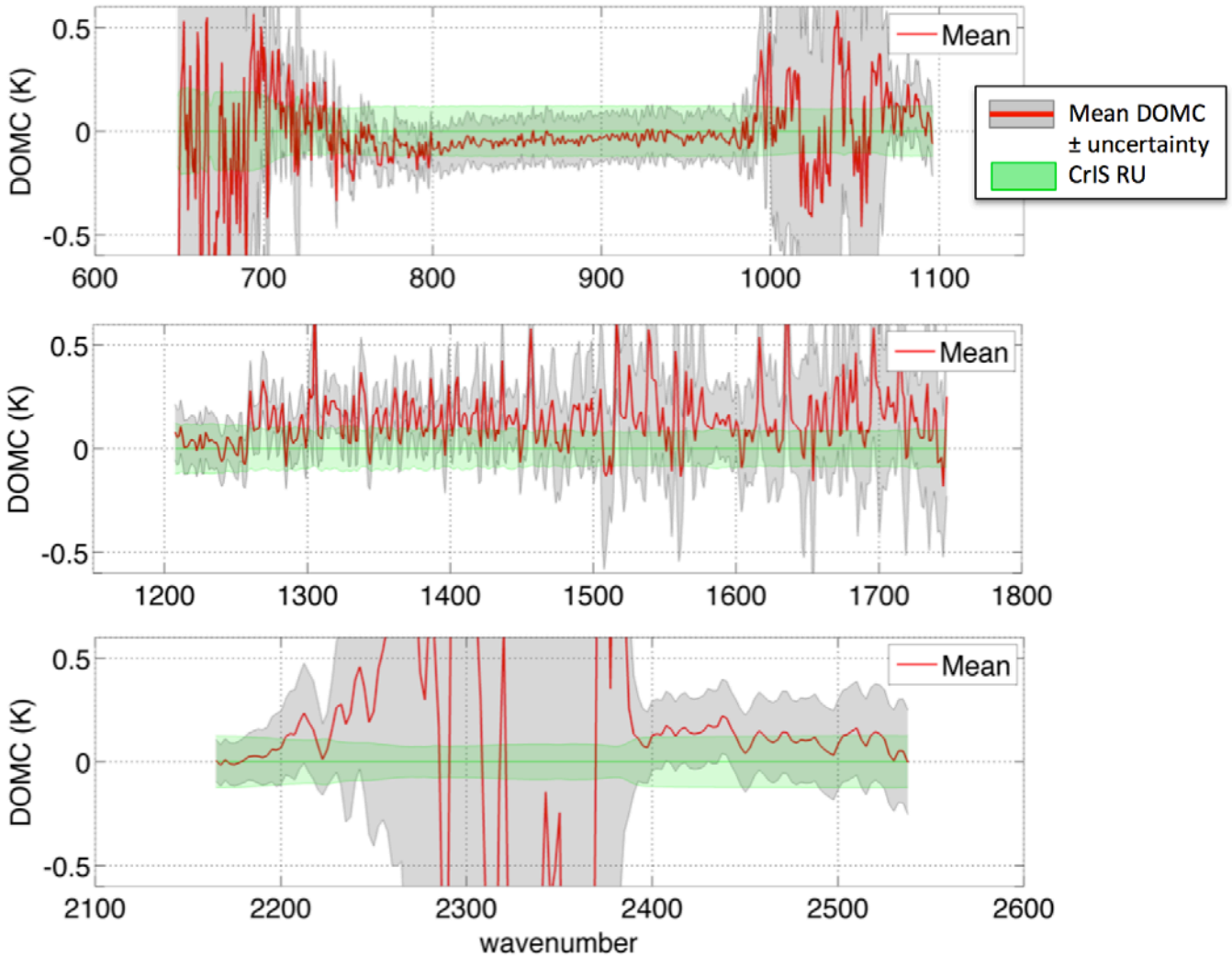
ER-2 with aircraft validation sensors under flies Suomi NPP sensors. In the case of CrIS, the validation sensor in this example is from the Scanning High-resolution Interferometer Sounder (S-HIS) which has been tied to a NIST traceable calibration source. Quick look comparisons show excellent agreement. Significance – NIST traceable validation is critical for uncertainty analysis needed to fully assess data quality of S-NPP and JPSS sensors.

Why do we care about 0.1 C absolute accuracy?



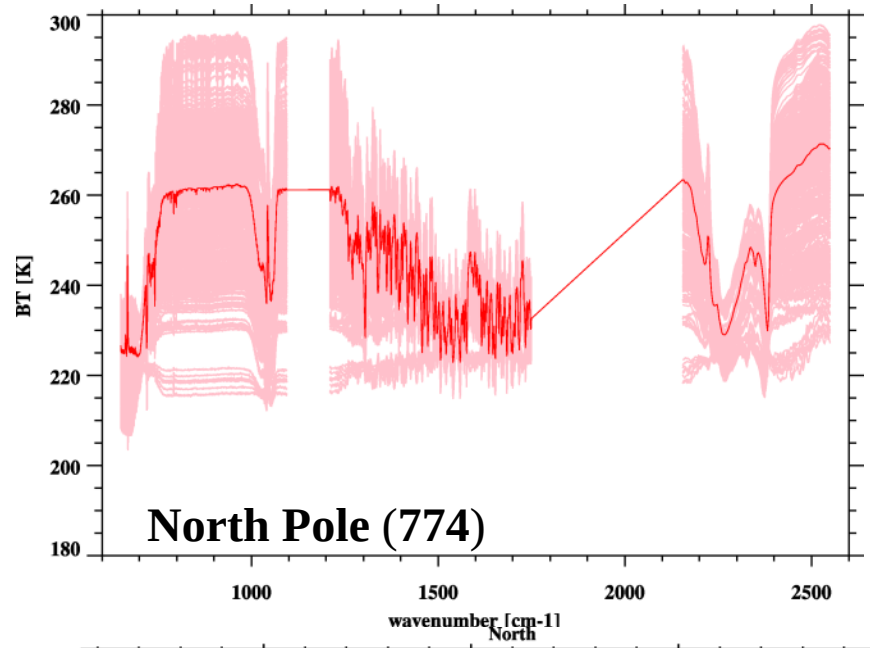
CrIS/S-HIS Underflight Results

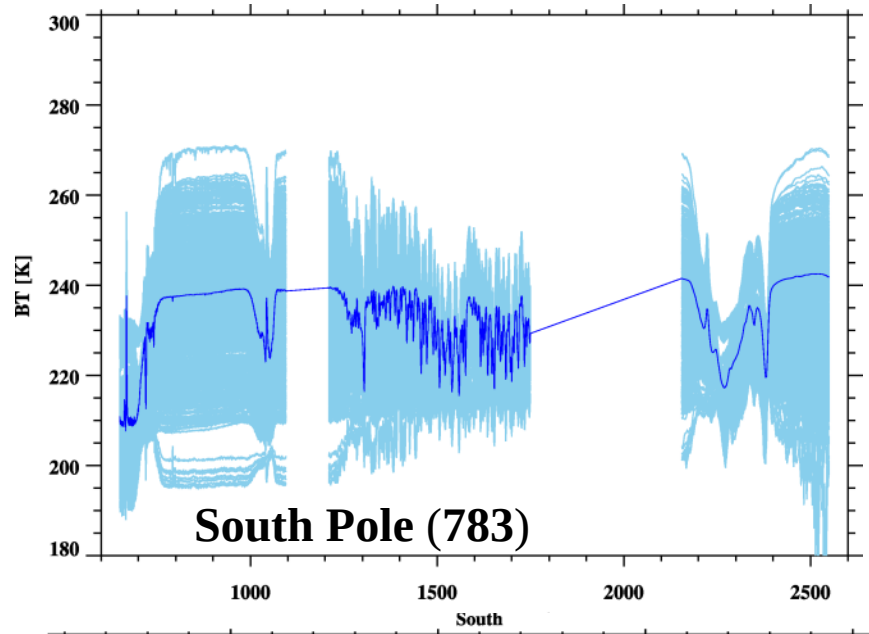
Hamming apodization

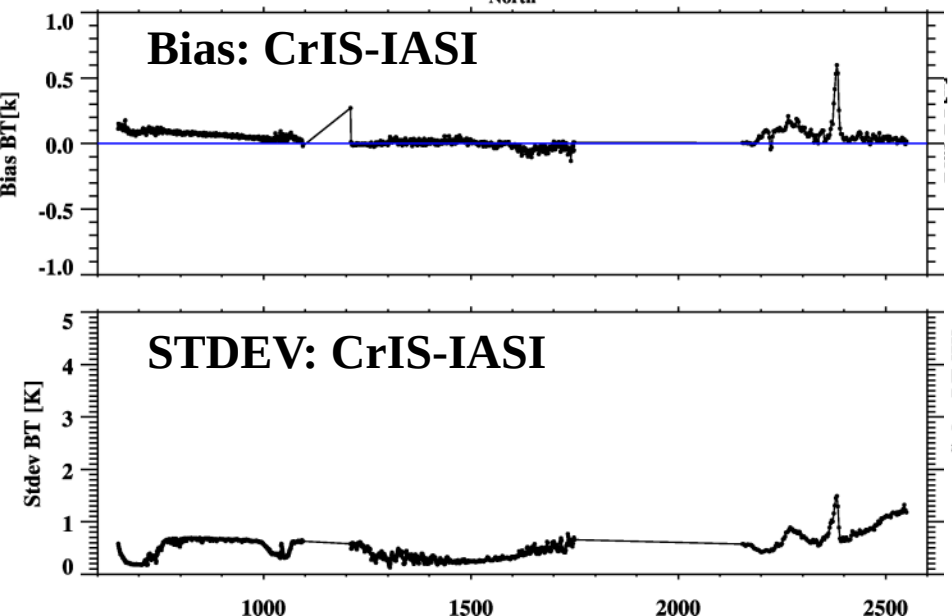


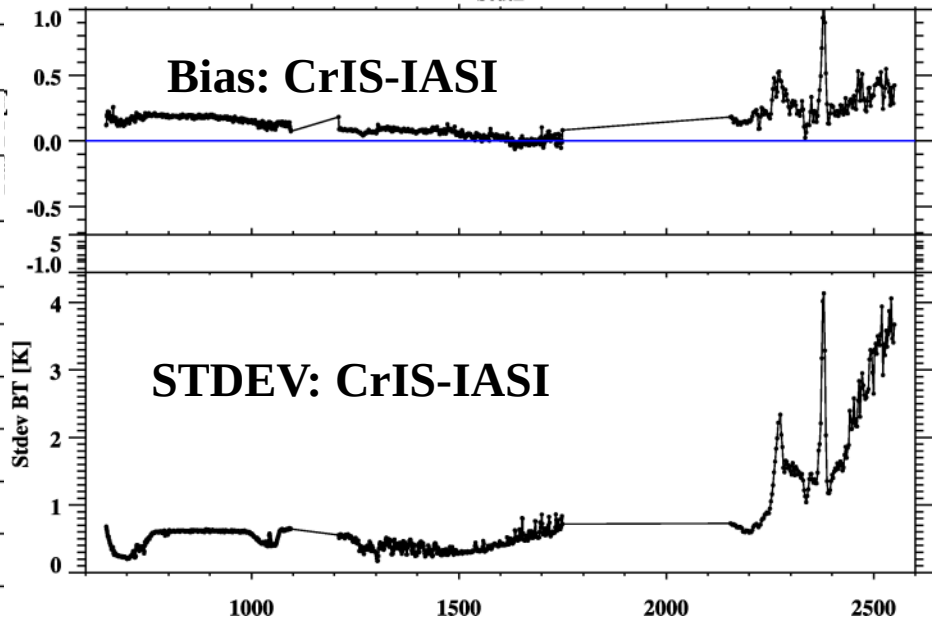
- Aircraft underflights provide periodic end-to-end verification of CrIS RU estimates with 0.1-0.2K uncertainty over most of the spectrum.

SNO Results between CrIS and IASI/Metop-B from 10 months' reprocessed CrIS SDR (2013/02-12)









Summary

- Program Science connects the science with the users

- Science must drive the applications and the applications `must drive the science
  - Careful balance of the two.

- Algorithm science >> Applications demonstrations >> Operational Utilization