NPP Science Team Meeting

NPP Sounder PEATE Status

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... and the Sounder Science Team

- William Blackwell
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- Larrabee Strow

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Sounder PEATE Objectives

- **Support evaluation and analysis of CrIMSS* SNPP products to determine suitability for NASA's climate research program, extending the climate data record started with Aqua AIRS/AMSU:**
  - Support the Sounder Science Team in assessing climate quality
  - Utilize local technical/science staff to support Science Team
- **Primary products being evaluated are:**

Sensor Data Records (SDRs)	Environmental Data Records (EDRs)
CrIS SDR ATMS SDR ATMS TDR ATMS Remapped SDR	CrIMSS Vertical Temperature Profile CrIMSS Vertical Moisture Profile CrIMSS Vertical Pressure Profile – (including surface) ATMS & CrIMSS Intermediate Products

*CrIMSS = Cross Track Infrared Microwave Sounding Suite, includes EDR products derived from retrievals of data from the following instruments:

Cross-Track infrared Sounder (CrIS)
Advanced Technology Microwave Sounder (ATMS)

Support Provided to Science Team

- **Provide assistance to the Science Team in…**
  - Cal/Val activities
  - Assessing and validating Calibration xDRs
  - Assessing and validating climate quality of SDRs and EDRs
  - Evaluating the Retrieval Code
    - Evaluate IDPS production and science code
      – develop, demonstrate, test and verify algorithm enhancements
- **Provide data and analysis products to the Science Team**
  - All data in PEATE and AIRS archives are available to the Science Team
- **Develop inter-instrument data comparison tools:**
  - CrIMSS data compared to other instruments and correlative data
- **Provide compute resources, analysis tools for Science Team use**
  - Science Team members have access to PEATE compute resources

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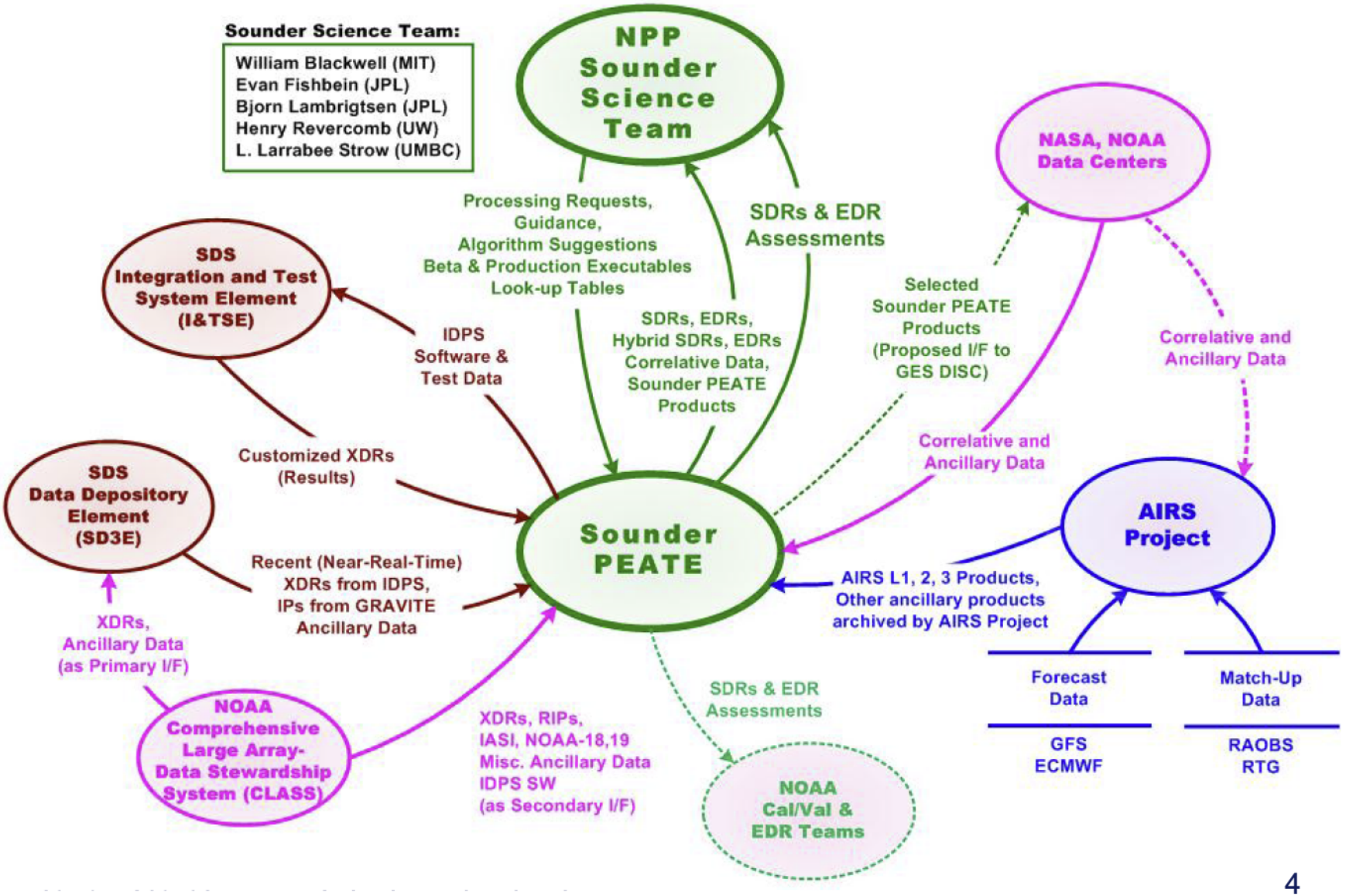
Interfaces (Functional Relationships)



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Sounder PEATE Products (1 of 2)

- **Calibration Subsets (CrIS and IASI)*** FOVs in four categories:
  - Clear
  - Random
  - Deep-convective Cloud
  - Fixed-site

  *Sounder PEATE also has access to AIRS Calibration Subsets

- **Simultaneous Nadir Observations (SNO), SNPP-CrIS/ATMS with:**
  - Aqua (AIRS/AMSU) (radiances matched to radiances)
  - MetOp A/B (IASI/AMSU/MHS)
  - NOAA-18, NOAA-19 (AMSU)

- **Match-up Products** (radiances matched to correlative data)
  - Analysis Matchup (Calculated radiances from forecast models)
  - Radiosonde Matchup (dedicated radiosondes)
  - GPS-RO Matchup – *planned for this year*

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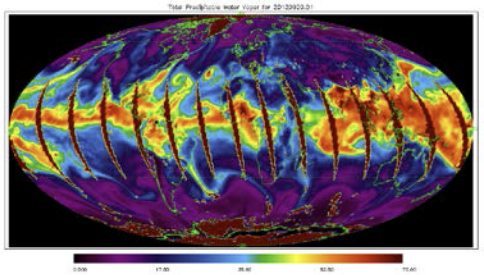
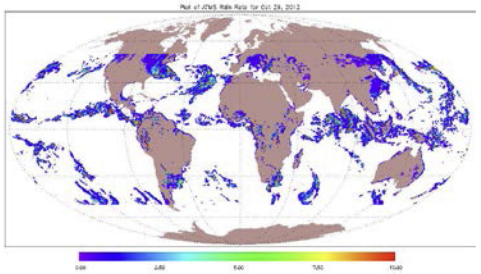
Sounder PEATE Products (2 of 2)

- **Calculated Radiances (SARTA, OSS)** (from forecasts)
  - Inputs: Numerical Weather Forecasts
  - Matched to RAOBS, GPS-RO, dedicated radiosondes, field campaigns
  - ATMS and CrIMSS retrieved EDRs and IPs

- **Level 3 Products – for all EDR and IPs**
  - Daily
  - Multi-day
  - Monthly



- **Rain Rate (ATMS)**
  – (beta version – Blackwell / MIT Team)



- **GPolygon Maps (granule coverage maps)**

Access to Sounder PEATE Data Products

- **Sounder Science Team has access to:**
  - All data products generated by the Sounder PEATE
  - SNPP products and ancillary products archived at Sounder PEATE
- **Public access to Sounder PEATE products is currently not available**
- **Archive and data ordering capability for selected Sounder PEATE Products may be available at GES DISC soon:**
  - Agreement established
  - ICD and product descriptions under development
  - Product availability to include:
    - SNO
    - Calibration Subset
    - Level 3 (daily, multi-day, monthly)
    - Other TBD PEATE products (depending on future requests)

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Sounder PEATE Support to Sounder Science Team

- **Data quality**
  - Conformance to ICDs
  - Continuity of operations – data stream interruptions
- **Calibration**
- **Retrieval Algorithms**
  - Retrieved quantities (EDRs) – accuracy and yield
  - Analysis of production algorithm, alternative algorithms
- **Will SNPP products support climate studies?**
  - SNPP products by themselves
    - ATMS and CrIS SDR
    - CrIMSS EDR (Standard and Intermediate Products)
  - Evaluation whether inter-platform products can be used to provide long-term continuous climate baseline:

    Aqua ➔ MetOp ➔ SNPP

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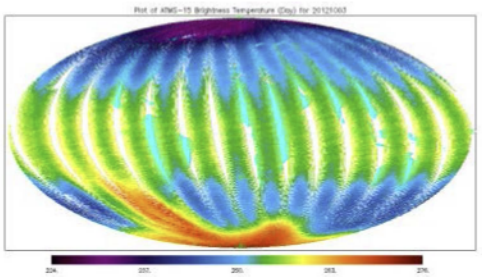
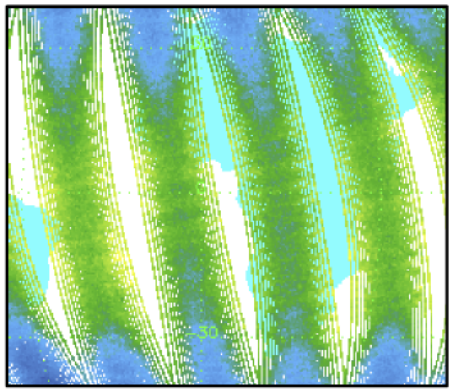
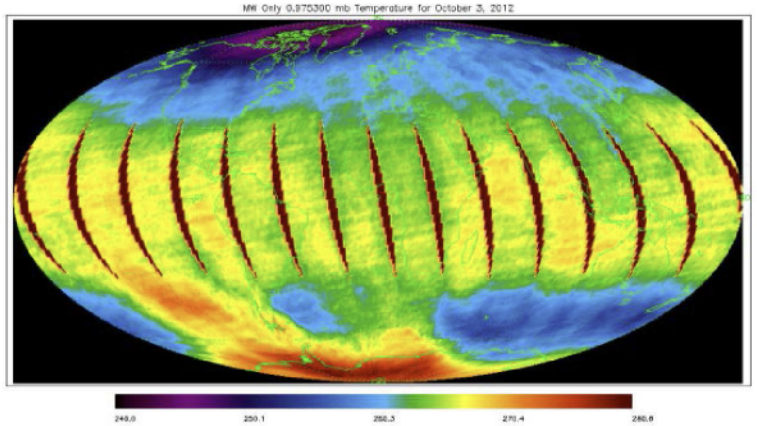
Data Product Evaluation: IDPS ATMS MW-Only 1mb Temperature (MW IP)

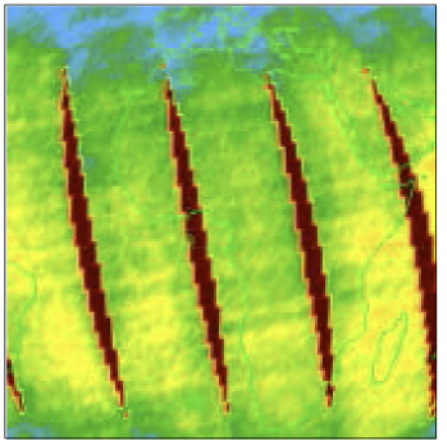
- ATMS-15 has 1/f noise (low frequency sensitivity fluctuation)
- The striping is transferred to EDR temperature



ATMS SDR







ATMS EDR IP

Source: S.Y. Lee, Sounder PEATE staff

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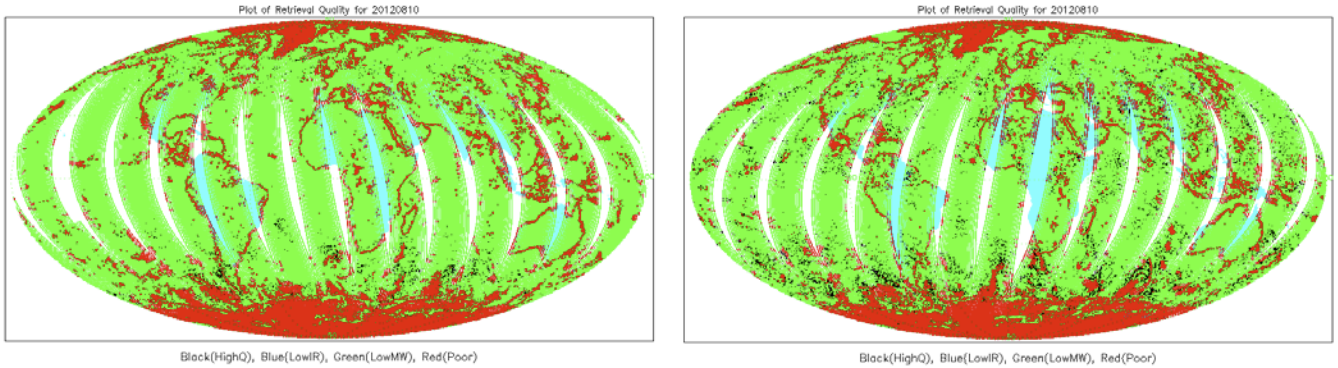
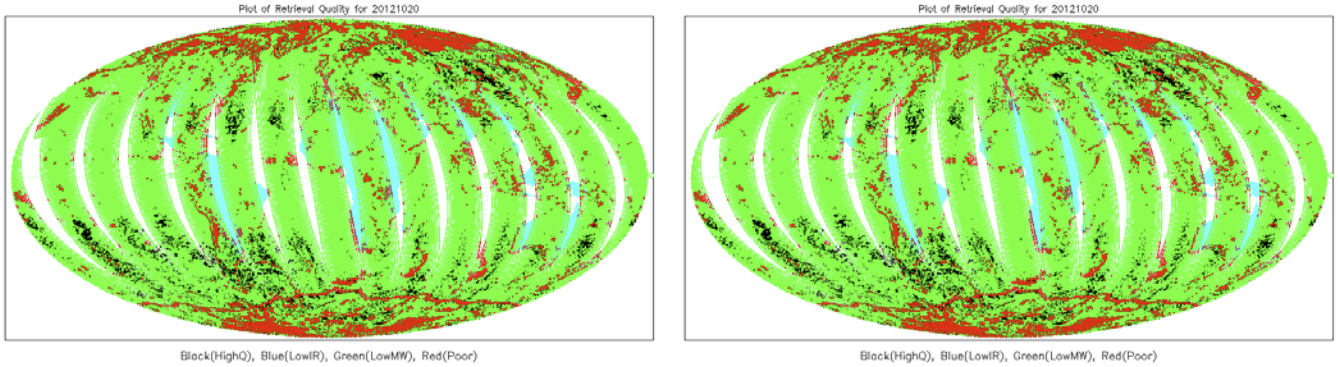
Data Product Evaluation: IDPS EDR Bad Data Quality Indicators

- Most EDR Data are currently not marked as “High Quality” (black)
  - Mostly marked “LowMW” (green) and “Poor” (red) in both Mx6.2 and Mx6.3
  - Nighttime maps are better than day
  - Slight improvement with Mx6.3
  - Real improvement not expected until release of Mx7 (July 2013?)



Mx6.2 Day Night Mx6.3



Source: S.Y. Lee, Sounder PEATE staff

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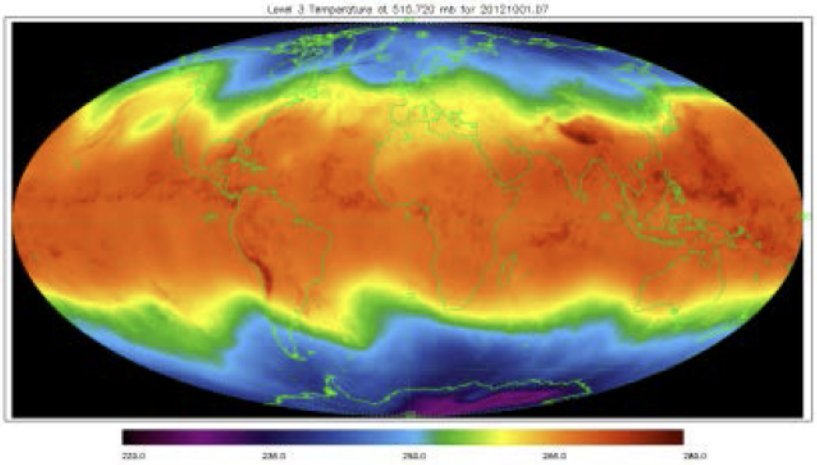
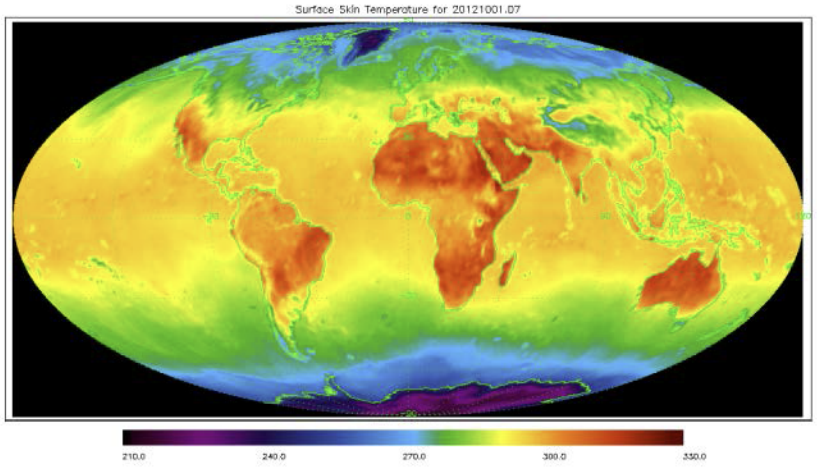
Sounder PEATE Products

- **Level 3 Products (SNPP, MetOP, AIRS*)**
  - Daily, Multi-day, Monthly
  - Currently beta version – production version will be ready for Mx7
  - Will be useful for characterization global patterns of temperature, water vapor and key atmospheric constituents.
  - Will support cross-comparisons between SNPP, MetOP and AQUA sounder products



MW-only Temperature (515 mb) - 7-day mean (CrIMSS EDR)



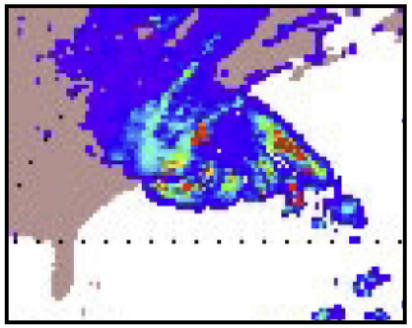
Surface Skin Temperature - 7-day mean (CrIMSS EDR)

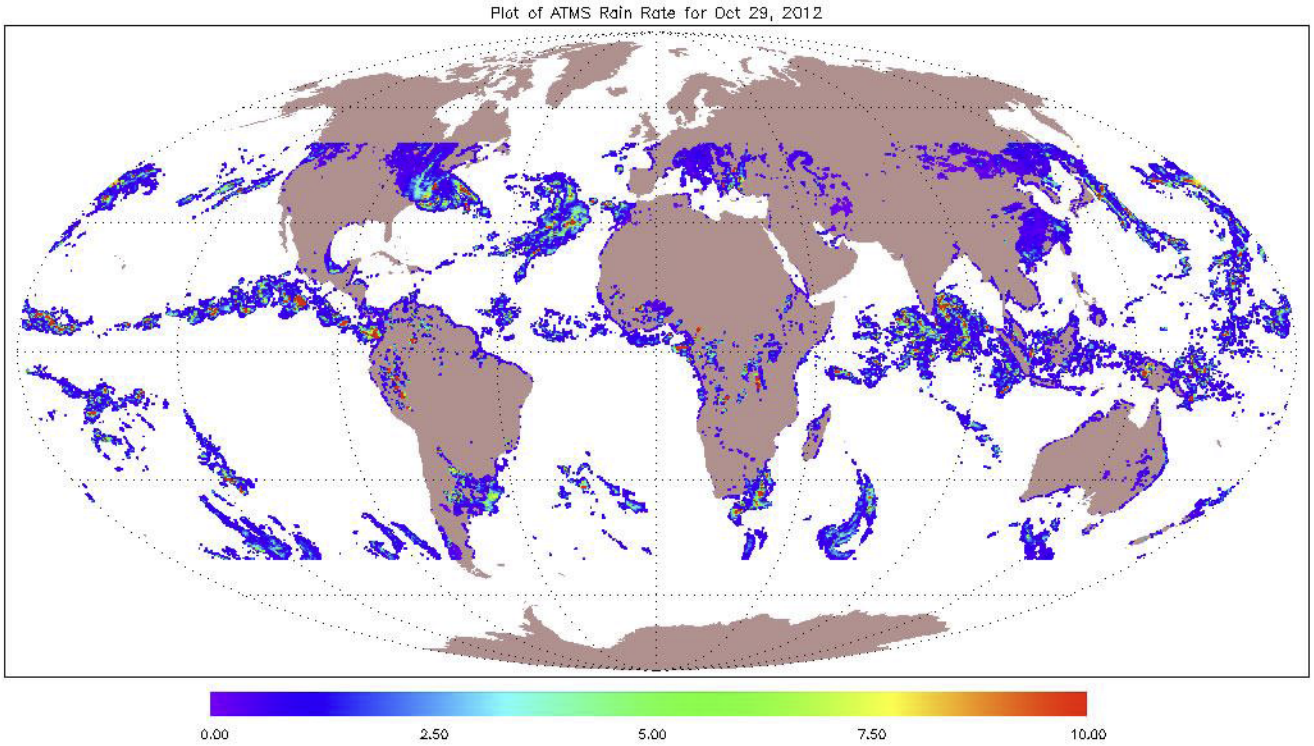
Source: Sung-Yung Lee, Sounder PEATE

Data Product Evaluation: Supporting the Sounder Science Team

- **Microwave Rain Rate (SNPP ATMS) – Daily Product**
  - Current version is pre-beta (early development)
  - Product development supporting research by William Blackwell and his team at MIT

Rain Rate (mm/hr)
October 29, 2012
(Superstorm Sandy)





Source: William Blackwell, Sounder Science Team and Sounder PEATE Staff

Plans for FY13 and beyond

- **Data Production**
  - Continued production of existing Sounder PEATE products
  - Generation of new research products for Science Team
- **Continued analysis of SDR and EDR code and data products**
  - Identify issues/concerns with existing algorithms
  - Suggest corrections and updates to production algorithm
  - Exercising alternative retrieval approaches, compare results
- **Analysis of trends between various instrument products – SNPP in comparison to predecessor platforms**
  - Radiance continuity
  - EDR continuity
  - Consistency in following seasonal trends (Level 3)
- **Production of higher-level products per Science Team requests**

What Must Also be Considered

- **The Sounder PEATE recommends that the Sounder PEATE, in conjunction with the Sounder Science Team, provide the following products:**

- **Full-spectrum SDRs**

Currently, there are no plans to generate full-spectrum SDRs with the IDPS.

  - Needed for continuation of CO and other trace gas studies.
    - *An extended spectrum is necessary for trace gas studies.*

- **Reprocessed EDRs**

Currently, there are no formal plans for reprocessing EDRs with the IDPS.

  - To ensure continuity between inter-instrument collections
    - Current EDRs produced with evolving baseline code
    - Data quality flags result in very low yield
    - Method for handling repaired granules results in inter-granule discontinuities
    - *A consistent product baseline is necessary for climate studies.*

Back Up

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Issue: Incomplete Climate Record

- **The standard IDPS CrIMSS product only includes temperature and water vapor data, and a few retained Intermediate Products. Other calculated values are not retained after derivation of the primary products.**

- **Microwave non-retained IPs must be retained to assess climate data record:**
  - Microwave Cloud Liquid Water, Cloud Height and Cloud Thickness
  - Microwave-only Surface Skin Temperature and Surface Emissivity

- **Products to add to continue the AIRS climate data record**
  - Infrared Cloud Height, Cloud Fraction, Cloud Optical Thickness, and Cloud Particle Size
  - CO, CO2 and CH4 atmospheric concentrations and amounts

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Product Formats: NOT User Friendly

- **Complicated product SNPP data formats and poor user support make products difficult to use**
  - IDPS products use standard hdf5 format, but the use of links, hierarchical groups and spreading of products across multiple files. The format adds complexity.
  - Although extensive documentation is provided, the technical content is poor and climate scientists are prone to mis-interpret data
  - Data distribution system does not provide expert advise nor have a mechanism to connect users with instrument/algorithm teams
  - The lessons learned through NASA Earth science program (EOS) have largely been ignored in the implementation of the NPP data distribution system
- **The Sounder Science Team is now considering asking PEATE to produce more user-friendly product files.**

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IDPS Data Product Evaluation

- **We routinely evaluate products from each IDPS build and share results with:**
  - Sounder Science Team
  - Suomi NPP SDS (and CCB by extension)
  - NOAA's Cal/Val and EDR teams
- **Current Assessment Summary**
  - ATMS is very well calibrated, to be declared provisional soon
    - No side-lobe correction yet
    - Issues with striping on a few channels (e.g., 15, 21, 22)
  - CrIS is well calibrated, to be declared provisional soon
    - Minor issues: sweep direction bias, FOV bias, ringing, and spectral calibration
    - Still some issues with handling missing packets
  - EDRs – currently beta maturity
    - We can assess MW intermediate products, but not EDRs
    - The quality of IR+MW products are improving in each build
    - NOAA Cal/Val team goal: provisional quality by Mx7.0 in early 2013

Data Product Evaluation: Utilization of mini-IDPS (1 of 2)

- **Use of mini-IDPS has been frustrating…**
  - Mini does not have up-to-date software with respect to current IDPS processing version (continuing problem)
  - Configuration of the mini-IDPS is complex, making it hard for SDS and Sounder PEATE to become familiar with system
- **Use of mini-IDPS to date:**
  - Demonstrate capability to modify IDPS code
    - Proved capability
    - Exercised process of providing changes, receipt of products
  - Characterize products created on mini-IDPS to operational IDPS products (Mx 6.2):
    - CrIS were similar – differences within one millikelvin
    - ATMS products exhibited striping and within 0.2K (calibration ?)
    - The Mx6.2 RPM seems to have copies of old LUTs and AUXs
    - EDR products have not been compared

Data Product Evaluation: Utilization of mini-IDPS (2 of 2)

- **Continued use of mini-IDPS?**
  - Use of the mini-IDPS continues to be problematic
  - There are many compatibility and timeliness issues
  - These issues must be resolved if we are going to use the mini
- **Embedding ADL into Sounder PEATE**
  - Conceptually, this shows promise, but we have little experience with ADL code to date
  - Historically, it's been hard to obtain product
  - Goal is to embed ADL (and operational code) into PEATE OPS
  - ADL should eventually replace our need for use of mini-IDPS

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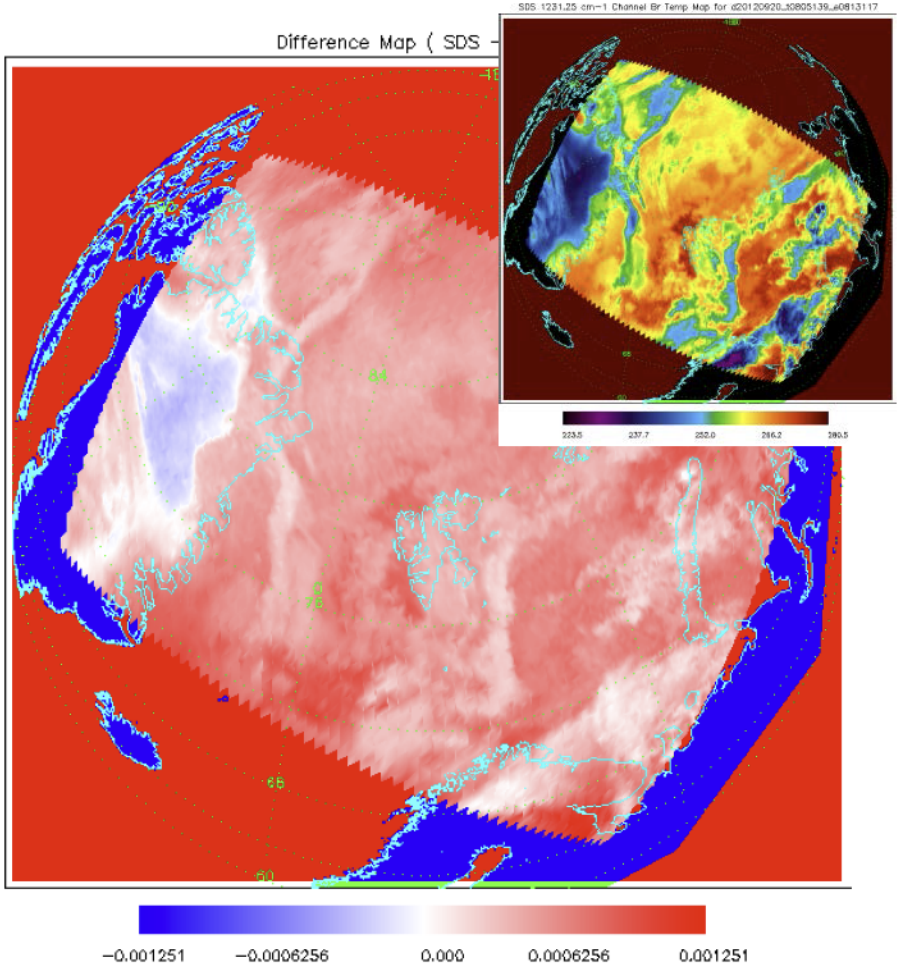
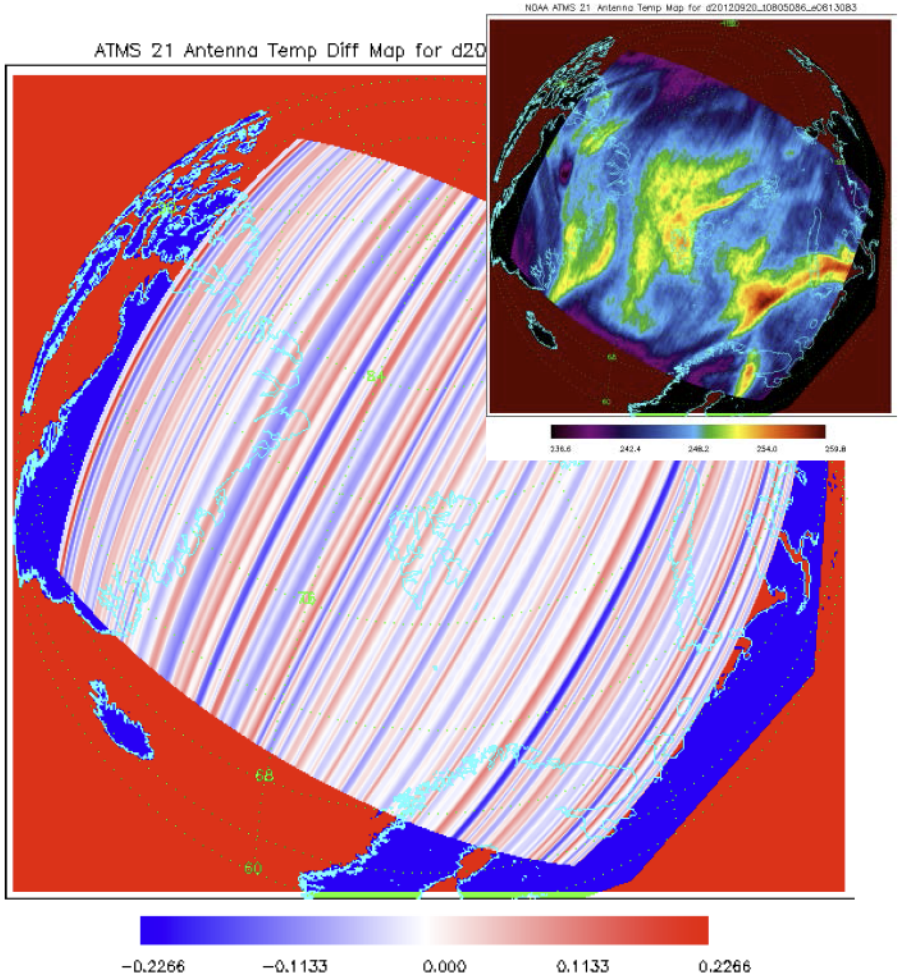
Data Product Evaluation: Utilization of mini-IDPS Brightness Temperature Differences: CrIS and ATMS

Differences exhibited between IDPS and mini-IDPS products:



CrIS 1231.25 cm^{-1} Channel



ATMS channel 21

Source: S.Y. Lee, Sounder PEATE staff