



# Status of the Pre-Launch Activities of the Community Collaborative Validation Program for NPP

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# Validation Activities Continuing Through Transition to JPSS/DWSS



- NPOESS Program is reorganizing, but the objectives of the validation program remain unchanged:
  - Provide real-time environmental observations to meet NOAA and DoD operations.
    - Provide the Customers with operationally viable, validated, useful data products for their applications.
    - Provide investigations into product defects, inconsistencies, and improvements of specific impact to Customers.
  - Facilitate the fullest possible exploitation of the unique data provided from NPP by the science, commerce, climate, and academic communities.
    - Provide general Program information to all users about data products, sensors, and algorithms.
    - Provide technical support to broad research and development community in their assessment and exploitation of JPSS data.
    - Support NASA and NOAA climate initiatives by sharing data, software, tools, and information as needed.
- Validation team activities are continuing uninterrupted to prepare for efficient validation of data products post-launch.
- Adjustments in relationships resulting from the new DWSS/JPSS “shared ground system” are being made in coordination with Customers, and under the advisement of our experienced team leads.



# Discipline Leads Provide Heritage Experience and Customer Knowledge



- Sensor Data Record (SDR) Team Leads
  - VIIRS –Frank DeLuccia, Aerospace
  - CrIS - Gail Bingham, USU/SDL
  - OMPS – Scott Janz, NASA/GSFC; (Limb-Glenn Jaross, NASA/GSFC)
  - ATMS –Bill Blackwell, MIT/LL & Ed Kim, NASA/GSFC
- Environmental Data Record (EDR) Team Leads
  - VIIRS Atmosphere: David Starr, NASA/GSFC
  - VIIRS Land: Jeff Privette, NOAA/NESDIS/NCDC
  - VIIRS Ocean: Bob Arnone, NRL Stennis
  - VIIRS Imagery/Cloud Mask: Tom Kopp, Aerospace at AFWA
  - CrIS/ATMS Sounding: Chris Barnet, NOAA/NESDIS/STAR
  - OMPS Ozone: Larry Flynn, NOAA/NESDIS/STAR; (Limb-Didier Rault, NASA/LaRC)

- “SDRs” are Sensor Data Records, or Level 1 data products.
- “Sensor Scientist” leads each SDR Team.
- Subject Matter Experts (SMEs) from across the community, including stakeholder government agencies and academia, comprise the team.
- Goal of each team is to characterize/validate the SDR post launch.
  - Develop requirements for the sensor test program.
  - Analyze sensor test data to fully characterize instrument prior to launch.
  - Fix, update, and modify SDR algorithm post-launch to assure SDR performance meets Customer needs.





# VIIRS SDR Team

## Frank DeLuccia, The Aerospace Corp.



- Final analysis for recommended post-launch RSR complete, and test results on spacecraft using T-SIRCUS shows no significant variation in RSR behavior by detectors within a band for most VisNIR bands.
- Definition of validation tasks to incorporate data from and needed by the VIIRS EDR teams underway.
- Porting VIIRS SDR Processor operational code to a Linux environment for Cal/Val tool development and team training in “practice” modifications of LUTs and code parameters underway.
- Gathering recommendations for upgrades in VIIRS hardware and testing for F2 and beyond



VIIRS ( Raytheon)

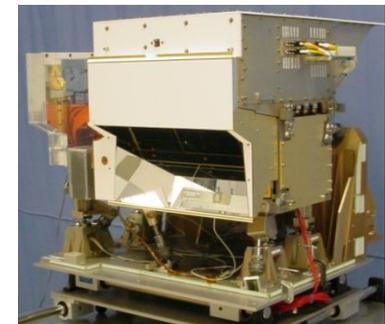


# CrIS SDR Team

## Gail Bingham, USU/SDL



- Integrated onto the NPP spacecraft after successful Pre-Ship Review 17 June 2010.
- Well characterized, excellent on-orbit SDR performance is expected, with key radiometric and spectral performance parameters meeting or exceeding requirements for the NPP mission.
- Currently assessing the benefits and impacts of a CrIS Full Spectrum data upgrade. Team is in discussions with the NPP Project to determine the feasibility of executing this capability during NPP Spacecraft TV Testing , in order to demonstrate safe sensor operations.



CrIS (ITT)



# ATMS SDR Team

## Bill Blackwell, MIT-LL



- Provided final version of justification for on-orbit maneuvers and descriptions of some on-orbit activities.
- Currently working to identify further inputs to the NPP Integrated Mission Timeline, which includes planned sensor activities for the first 90 days after launch.
- Reviewing the S/C-level EMI testing procedure to ensure adequacy for Cal/Val needs.
- Developing recommendations for Flight 2 sensor enhancements.
- Unified Cal/Val Plan: Latest version released 12Mar10
  - Changes since last release:
    - Mapped tunable parameters (in the ATMS SDR algorithm) to ATMS Cal/Val tasks
    - Identified ATMS SDR team members to ATMS Cal/Val tasks



ATMS (NGES)



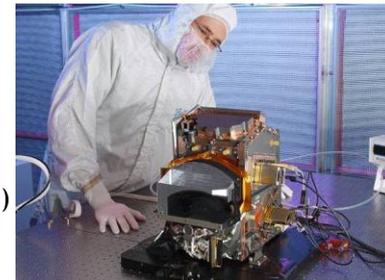
# OMPS SDR Team

## Scott Janz, NASA/GSFC

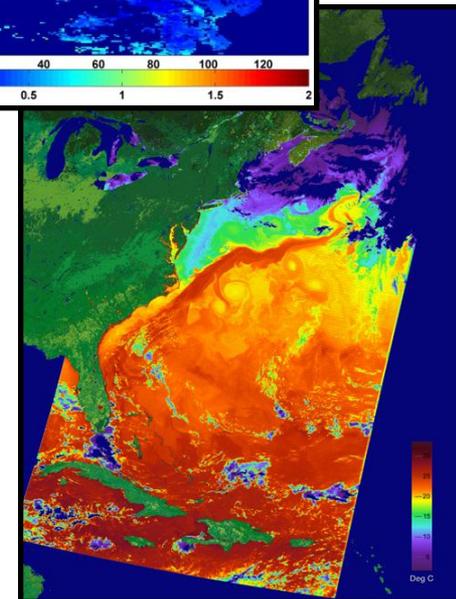
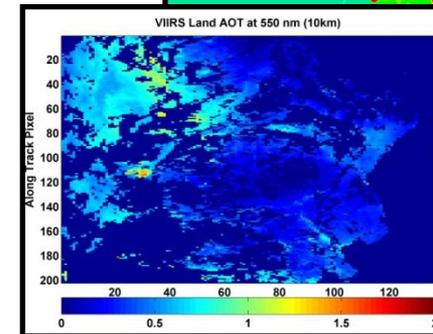
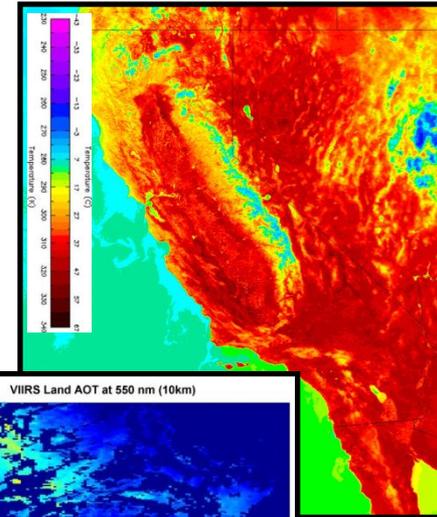


- Integrated Mission Timeline sequence provided to Mission Operations, CRs submitted and reviewed. Final baseline in progress.
- NPP S/C maneuvers in support of calibration & characterization proposed, reviewed, submitted to BATC for evaluation of S/C impacts. Additional observatory-level integration analysis in progress.
- Tool development for pre-launch tasks nearly completed, in progress to execute post-launch tasks.
- The final NGAS science SDR code and results have been provided to IDPS.
  - Changes included bugs and gridding of NASA climatology files (used if VIIRS and CrIS information is not available)
  - OMPS sci2ops CAL and EV results will be returned to NGAS in late July/early August for results review and acceptance
- IDPS has generated RDRs with the OMPS TVAC (day in the life) data . TVAC RDRs will be inputs to the operational SDR to insure interface consistency. SDR results are expected by September 2010.

OMPS (Ball)



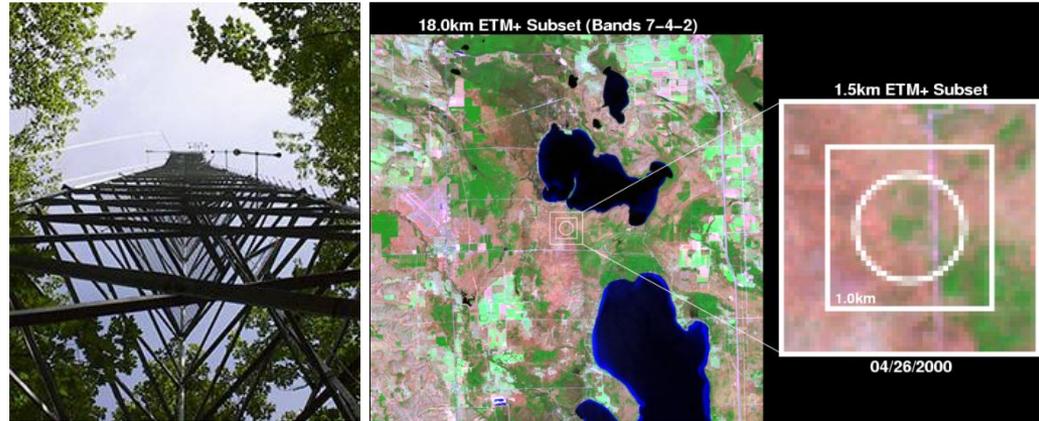
- “EDRs” are Environmental Data Records, or Level 2 data products.
- “Product Scientist” leads each team.
- SMEs from across discipline community, including data product stakeholder government agencies and academia, comprise each team.
- Primary goal is to characterize/validate the EDR post launch for use by the operational Customers.
  - Collaborate with SDR team to ensure sensor data needed is obtained.
  - Characterize data product performance using correlative data from *in situ* and remote sensors.
  - Correct, update, and modify algorithm as needed to provide Customers with operationally viable data products.



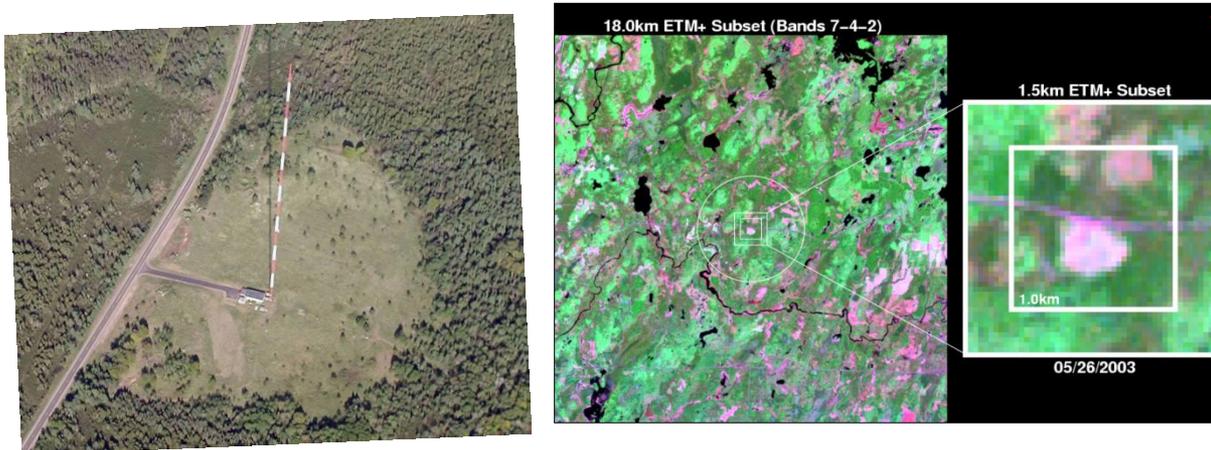
- Analyzing ways to improve correlative data comparisons.
  - Site Spatial Characterization Method successful in reducing Validation Uncertainties.
    - Objective statistical approach (Román et al., 2009) identifies best sites for validation assessments and is being systematically applied to FLUXNET (seen here), US-CRN, SurfRad, DOE-ARM, BSRN

**FLUXNET UMBS:** *The presence of lake water near the 50m flux tower increases the structural variability of this site at distances > 2.0km.*

External variability, Leaf-Off Conditions



Internal variability, Leaf-On Conditions



**WLEF Park Falls:** *Exposed pasture field surrounding the 450m tall tower can influence validation assessments at distances < 1.0km; but has little effect at > 1.0 km.*

Source: M. Román (GSFC)<sup>10</sup>  
C. Schaaf and X. Yang (BU)



# Ocean EDR Team

## Bob Arnone, NRL



- Held first team-specific Program Review, where each of the team's investigators presented current efforts, accomplishments, path forward, and budget. The review was a success in providing the IPO and other team members with insight into the progress of the diverse efforts taking place across this large group.
- Working closely with the IPO GRAVITE team to improve the VIIRS proxy data available on the GRAVITE system.
- Augmented Aeronet with M-AERI sensors at the following sites:
  - East Coast (CUNY)
  - Gulf of Mexico (NRL, LSU)
  - West Coast (OSU, USC).
  - Australia (CSIRO)

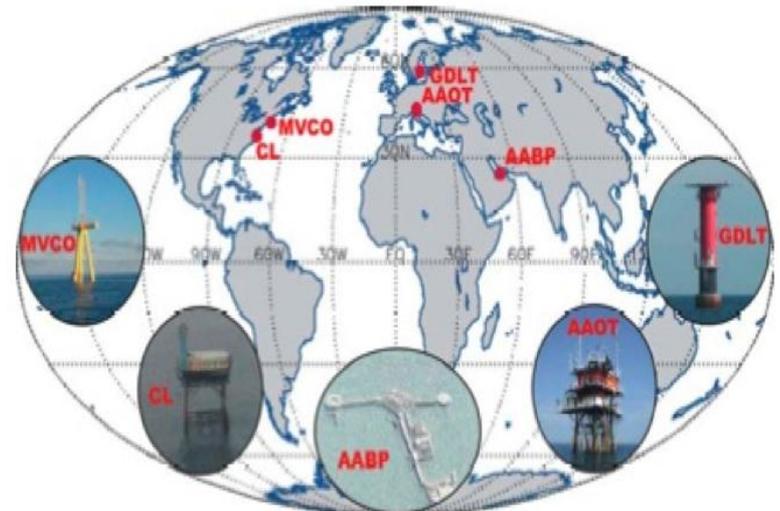


Figure 1. AERONET-OCS sites during the network testing phase (2002-2005)

- Cloud

- Algorithms undergoing additional enhancements by NG to more closely align with heritage algorithms.
- MODIS validation tool, a University of Utah relational database providing access to the DOE's ARM data, has been reactivated for NPP validation.

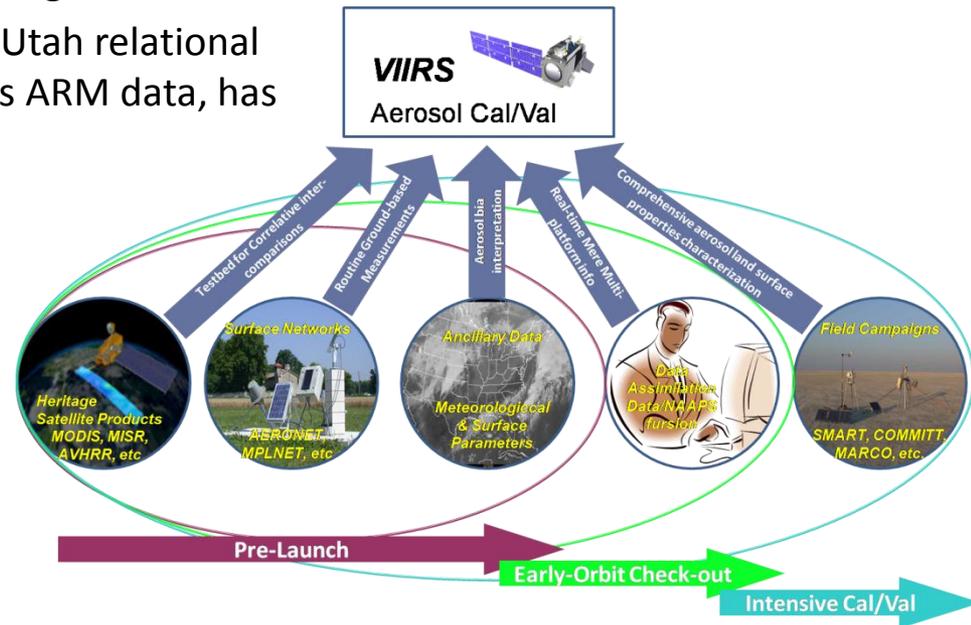
- Aerosol

- Operational aerosol code has been ported into the Low-Earth Orbiting Cloud Algorithm Test-bed (LEOCAT) at the University of WI for pre-launch verification and characterization using proxy data.

- Six months of data has been run and analysis is underway

- Aerosol assimilation is now operational at NRL, which is a critical capability for rapid Day-1 assessment of aerosol algorithm performance.

- Rapid quantitative evaluation tools have been developed, based on experience with MODIS and adaptable for VIIRS, which will provide rapid evaluation of both satellite AOT data and aerosol assimilation results.





# VIIRS Cloud Mask & Imagery

## Tom Kopp, The Aerospace Corp.



- **VCM Cal/Val Current Status**

- Currently generating the proper tools and environment in order to exercise tuning of VCM thresholds on GRAVITE and subsequent distribution to and coordination with other VIIRS Cal/Val teams.
- Continuing to maintain team structure, with members from Wisconsin, AFWA, as well as the contractor (NGAS). This group has worked very well together for over 5 years and has resolved 7-8 significant issues relative to the VCM.
- Analyzing pre-launch performance (both quantitative and qualitative) of the VCM, using MODIS as proxy data. Analysis using 2 months worth of data has already taken place and is available.

- **Imagery Cal/Val Current Status**

- The bulk of Imagery Cal/Val activities take place post-launch, as they are dependent upon the performance of the sensor.
- Prelaunch activity consists of ensuring optimal performance of the sensor, and this is handled by the VIIRS SDR Cal/Val team.



# Sounder EDR Team

## Chris Barnet, NOAA/STAR

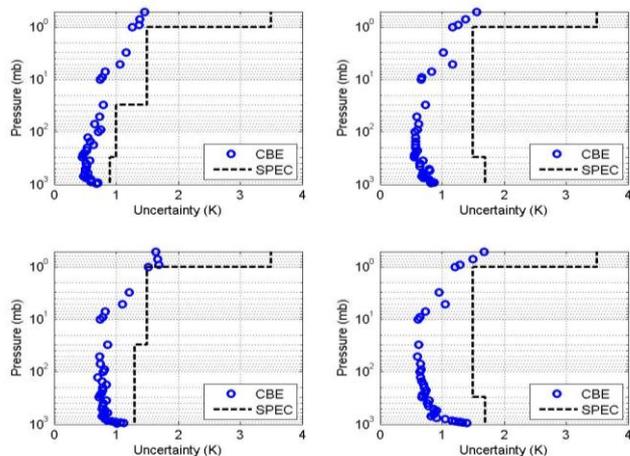


- CrIMSS operational algorithms shown to meet contractual specifications for AVTP, AVMP, and AVPP using Global Synthetic Datasets simulated by NGAS.

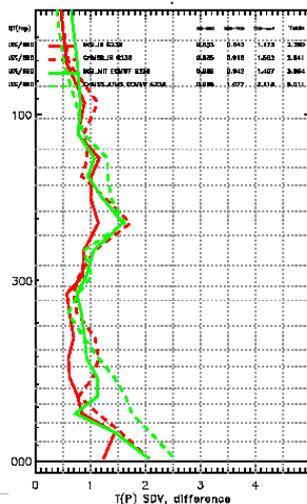
- Simulated data for wide range of environmental scenes (seasonal, diurnal, and spatial variability, self-consistent temperature, moisture, ozone, and cloud water profiles, and actual sensor scanning geometry including FOV rotation)
- Simulated sensor effects based on actual sensor performance characterization results.

- CrIMSS algorithm demonstrates good convergence based on testing with proxy data from AIRS and IASI.

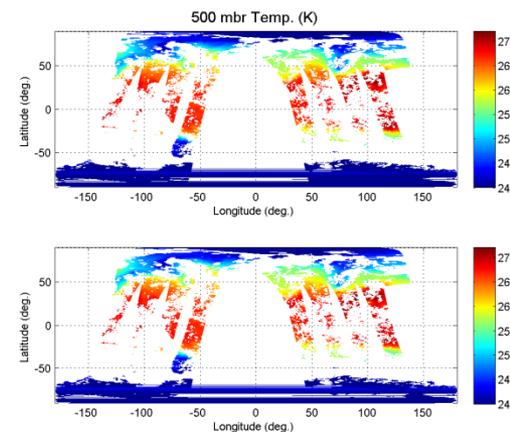
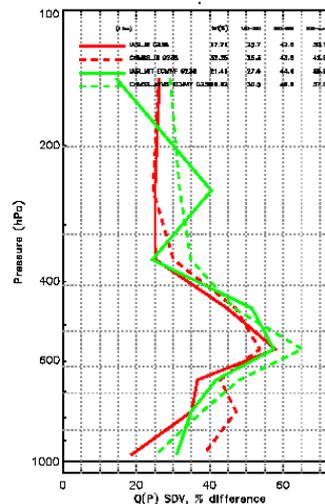
- AIRS L2 product used as input data to CrIMSS forward model
  - AIRS atmospheric temperature, moisture, and ozone profiles, cloud information, and surface emissivities for both MW and IR
- IASI/AMSU/MHS provides highly realistic SDR proxy data
  - Flowing from GRAVITE to team in near-real time.



GSD Results: Top row Clear, bottom row Partly Cloudy; Left Ocean, Right Land/Ice



IASI (IR + MW) (Solid Red); CrIMSS (IR+ MW) (Dotted Red)  
IASI (MW) (Solid Green); CrIMSS (MW) (Dotted Green)



AIRS L2 retrievals (top) show little difference from CrIMSS retrievals from AIRS L2 proxy.

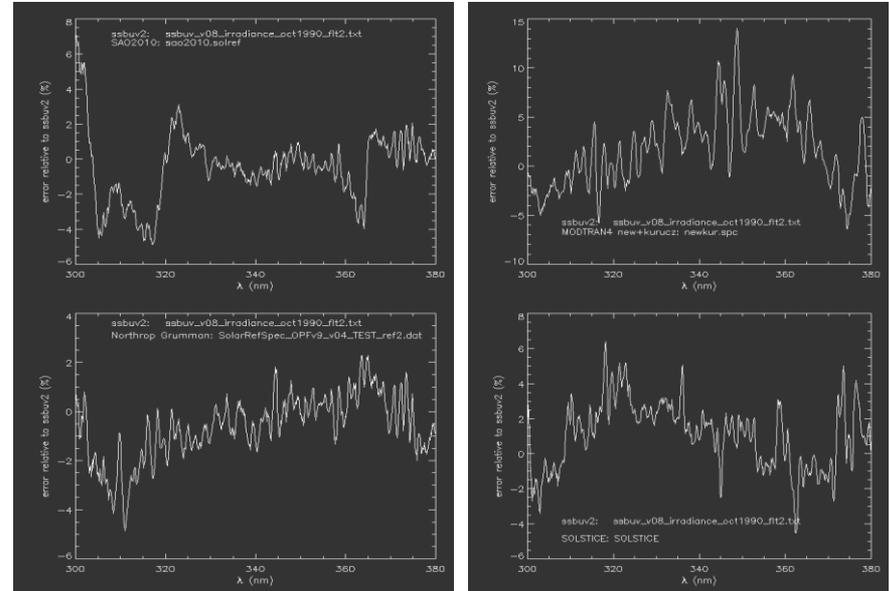


# Ozone EDR Team

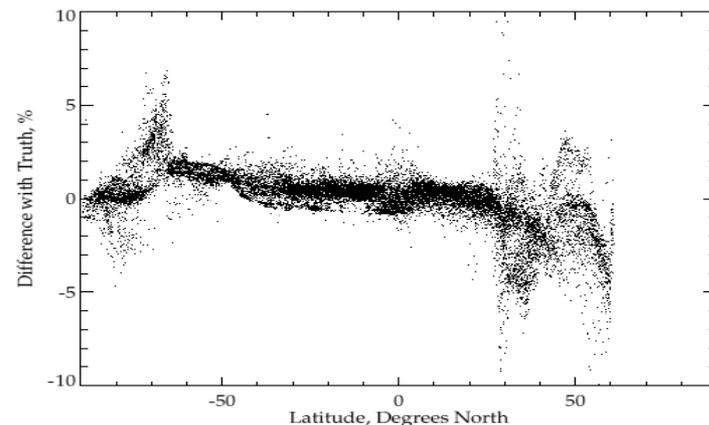
## Larry Flynn, NOAA/STAR



- Completed survey of high-resolution solar reference spectra for UV and developed tools to apply spectral bandpasses and determine relative wavelength shifts.
  - Established relative bias and relative wavelength scales of reference spectrum.
  - Created proxy OMPS TC solar spectra.
  - Created OMPS TC Look Up Tables for alternative algorithms..
- Adapted Version 8 Total Ozone Algorithm (currently used with the GOME-2 and OMI instrument measurements) and demonstrated with synthetic OMPS TC data.
- Demonstrated preparedness for processing OMPS TC data after launch for comparison to the EDR product, OMI, and GOME-2 products.
- Demonstrated assimilation and assessment capability for OMPS using GOME-2, SBUV/3, and MLS ozone products.



Comparison of four high resolution reference spectra to an SSBUV reference. A 1.1-nm Full-width Half-Maximum (FWHM) triangular bandpass was used to degrade them to the SSBUV resolution. This comparison will help to explain possible differences between the Cal/Val groups in establishing the absolute calibration of the OMPS TC solar irradiances and in creating Look-up Tables for the EDR algorithms.



Demonstration of V8 Total Ozone Algorithm with OMPS NM GSD Test Data Set #4



# Next Steps....



- Complete plans for the pre-launch check-out and post-launch SDR/EDR validation flights.
- Execute end-to-end validation rehearsal to test validation tools, data distribution, and communication tools.
- Complete the transition into the JPSS organization.
- Develop the Validation Program website to communicate data product status.