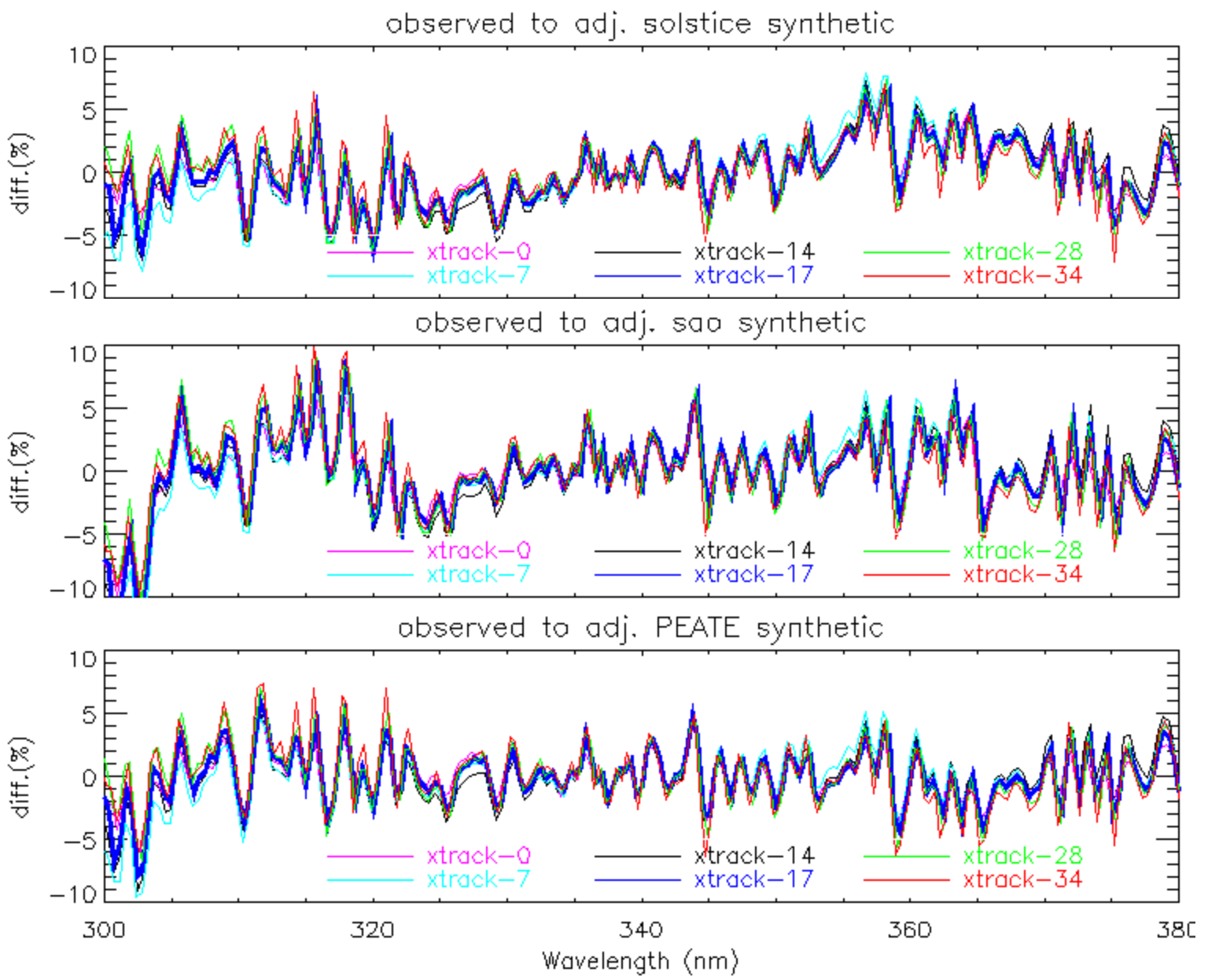
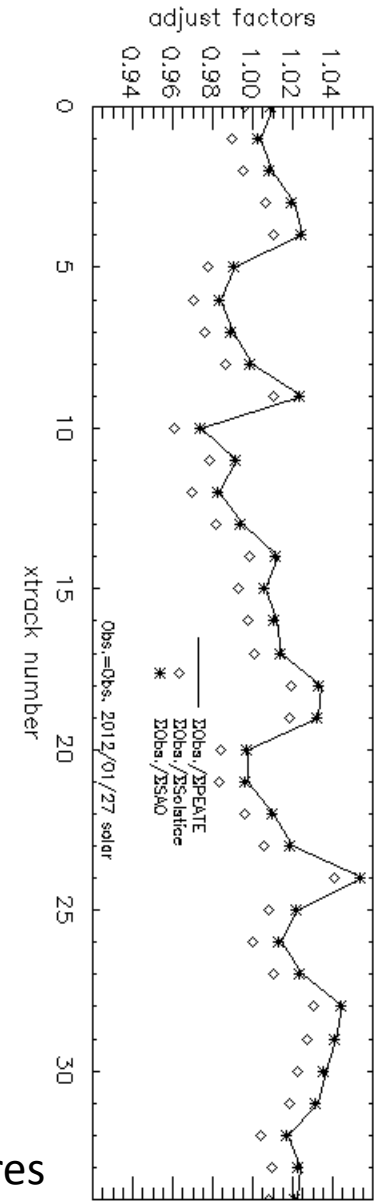
20120308 Update
to
OMPS
Initial Performance Evaluation

Summary New Bullets

- Collection of Golden Day (20120225) data sets is proceeding.
- STAR data repository (scdr-files system) has begun receiving IDPS products from CLASS; ozone profile products are present in the March files received by scdr.
- ICVS monitoring plots for OMPS are starting to be populated.
- Surface reflectivity values for the Nadir Mapper are sometimes greater than 1. This has been traced to the climatology.
- Comparisons of the observed solar to synthetic spectra show consistent biases and features.





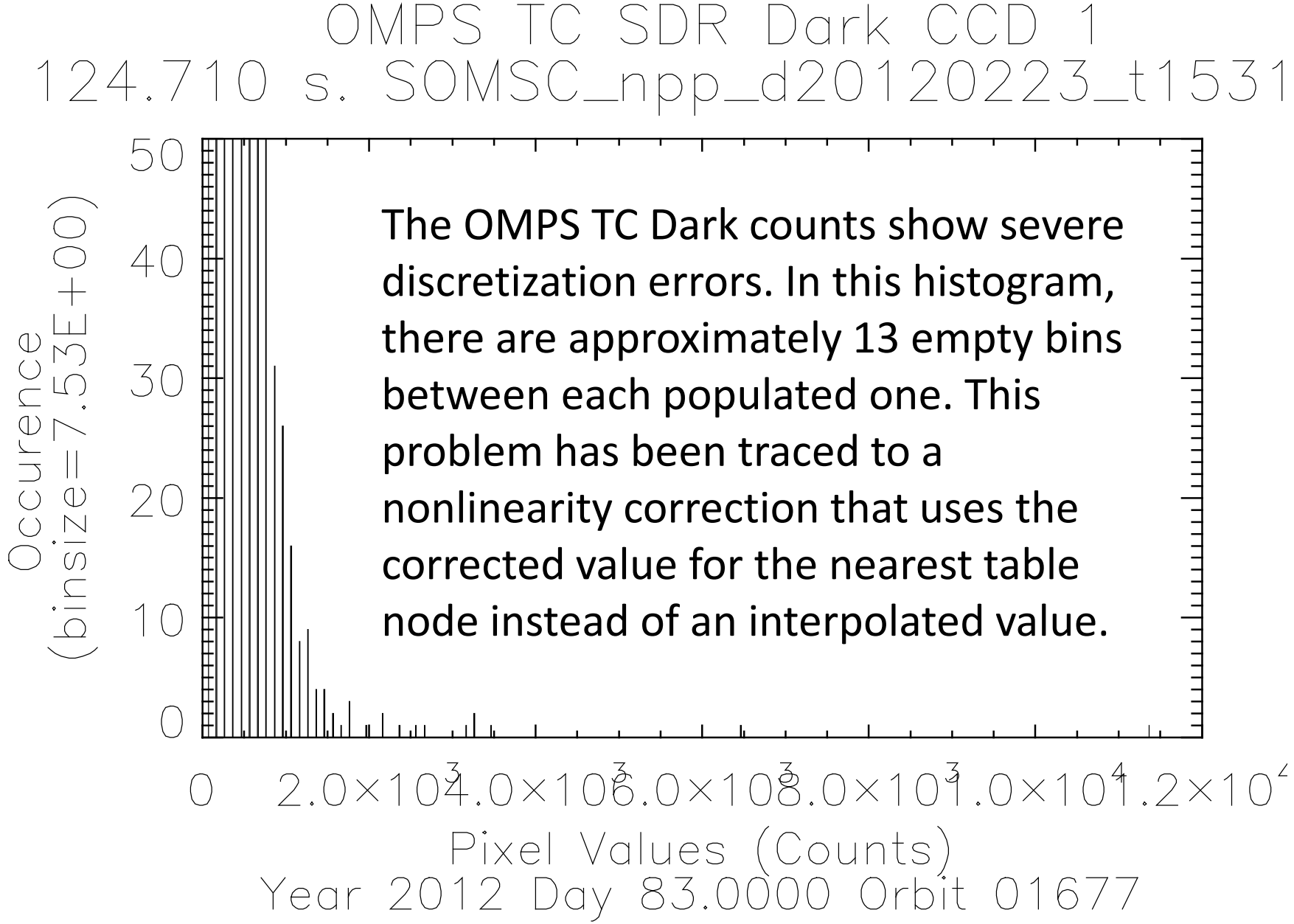
Comparisons between 201201027 Solar & synthetic data. Notice the features are shared between the three. The figure on the right shows that all three have the same pattern of average bias as a function of cross-track position.

20120301 Update
to
OMPS
Initial Performance Evaluation

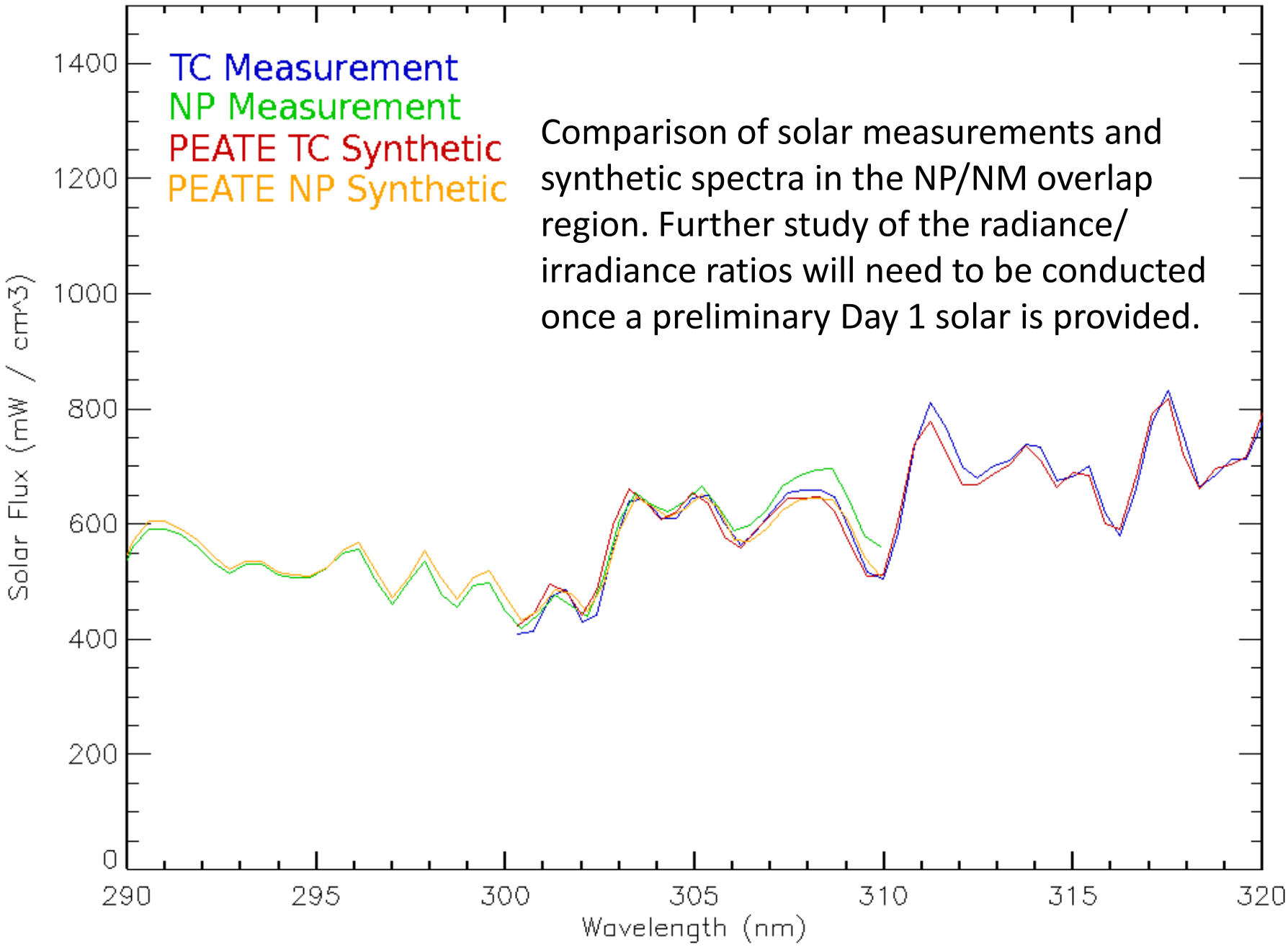
Summary new Bullets

- Work is proceeding to produce a provisional Day 1 Solar spectra
- Offline V8 processing (TOZ and PRO) is active
- NP stray light investigation will compare estimates to those from modulation transfer functions
- G-ADA processing of February data has been delayed due to other priorities. The Day-of-Year error plaguing February processing does not appear to be present for March for total ozone.
- There is a dark current discretization error that will be present until the next build caused by the non-linearity correction
- We need to develop a screen to filter transients for the smear correction

Histogram of Dark Counts for TC Cal SDR



The OMPS TC Dark counts show severe discretization errors. In this histogram, there are approximately 13 empty bins between each populated one. This problem has been traced to a nonlinearity correction that uses the corrected value for the nearest table node instead of an interpolated value.


TC Measurement
NP Measurement
PEATE TC Synthetic
PEATE NP Synthetic
Comparison of solar measurements and synthetic spectra in the NP/NM overlap region. Further study of the radiance/ irradiance ratios will need to be conducted once a preliminary Day 1 solar is provided.
Solar Flux (mW / cm^3)
1400
1200
1000
800
600
400
200
0
290
295
300
305
310
315
320
Wavelength (nm)

OMPS Earth View SDR Status (1)

- Dark Current levels and the increase in Hot Pixels are consistent with prelaunch characterization and expectations.
- On-orbit Non-Linearity measurements match laboratory data very well.
- Solar Spectra is consistent with synthetic spectra from instrument bandpass convolved reference spectra.
- Preliminary analysis of Signal-to-Noise levels show performance above requirements.
- Stray Light is present in the Nadir Profiler spectra and will need a correction. Measurements were taken in the laboratory to provide these corrections.
- The Wavelength Scale shows small intra-orbit variations tracking the optical bench temperatures
- Charge particle effects in the South Atlantic Anomaly are apparent in the Nadir Profiler spectra in the expected region.
- Preliminary evaluation of the Geolocation Registration shows it well within specifications
- The CCD array Detector Temperatures are within allowable tolerance of the design values.

OMPS Earth View SDR Status (2)

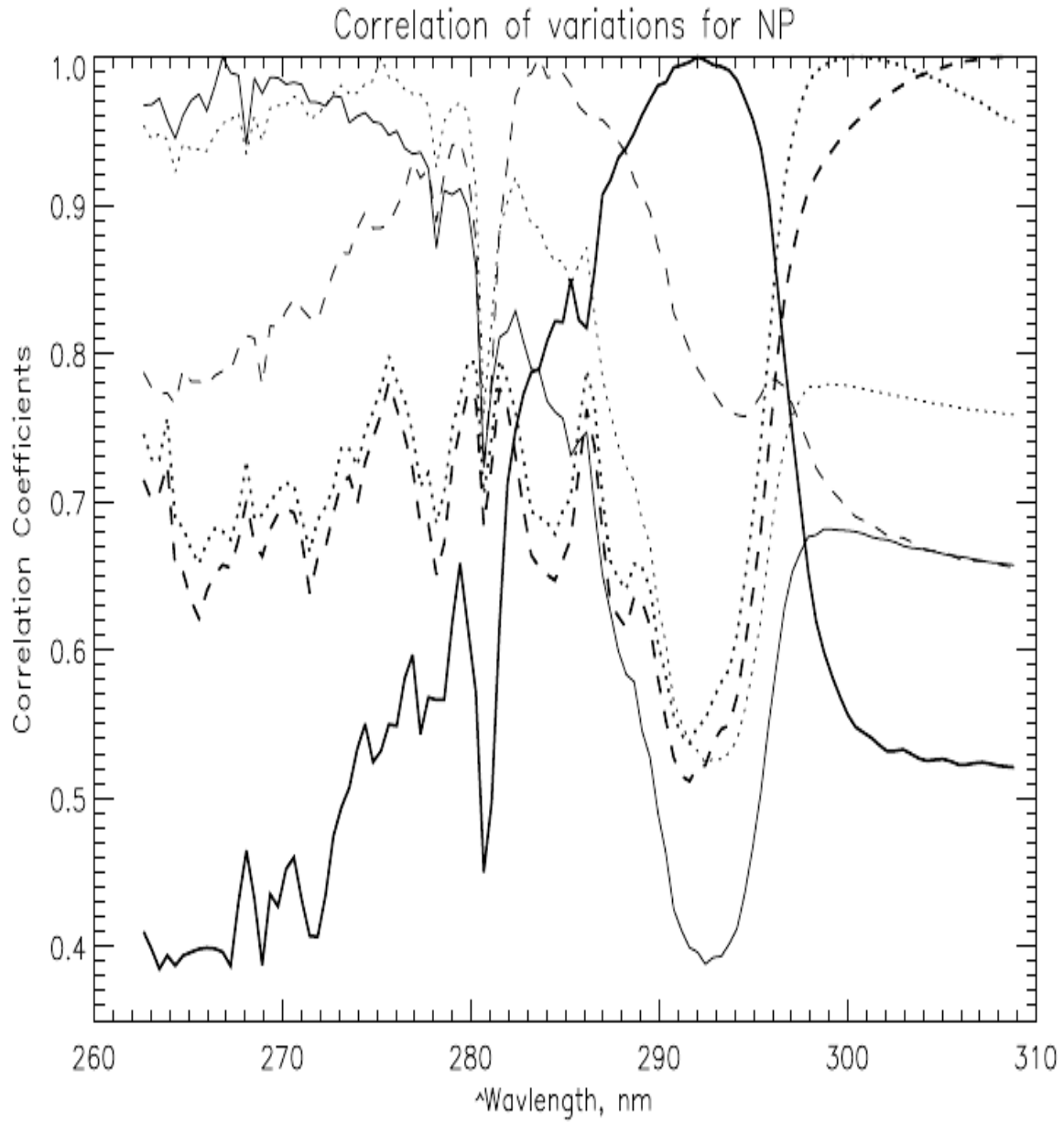
- A good amount of Earth-View SDR data has been obtained over the last month for both Nadir instruments.
- A minor code bug and a minor table bug have led to missing fields for scales and solar flux in the EV SDRs. The radiances are complete. This has prevented the creation of IPs and EDRs at IDPS since February 1. The issues will be resolved on March 1.
- In the meantime, the GRAVITE-ADA has begun reprocessing February data to provide the missing information (both SDRs and IPs).
- OMPS EV SDRs have been used successfully to generate total ozone and ozone profiles in offline processing (at the PEATE and STAR) with various flavors of the Version 8 Algorithms.
- The process to provide new and updated SDR Calibration tables to IDPS is now working well. Fast Track Tables have been identified and can be replaced with less bureaucratic overhead.
- Several DRs have been identified (both SDR and EDR related) and solutions are proceeding through the system.
- The teams are awaiting the introduction of measured day one solar into the products.
- Delivery and archiving of JPSS-Funded, PEATE-processed Calibration SDRs is an open concern.

20120223 Update
to
OMPS
Initial Performance Evaluation
and
First Images

Summary new Bullets

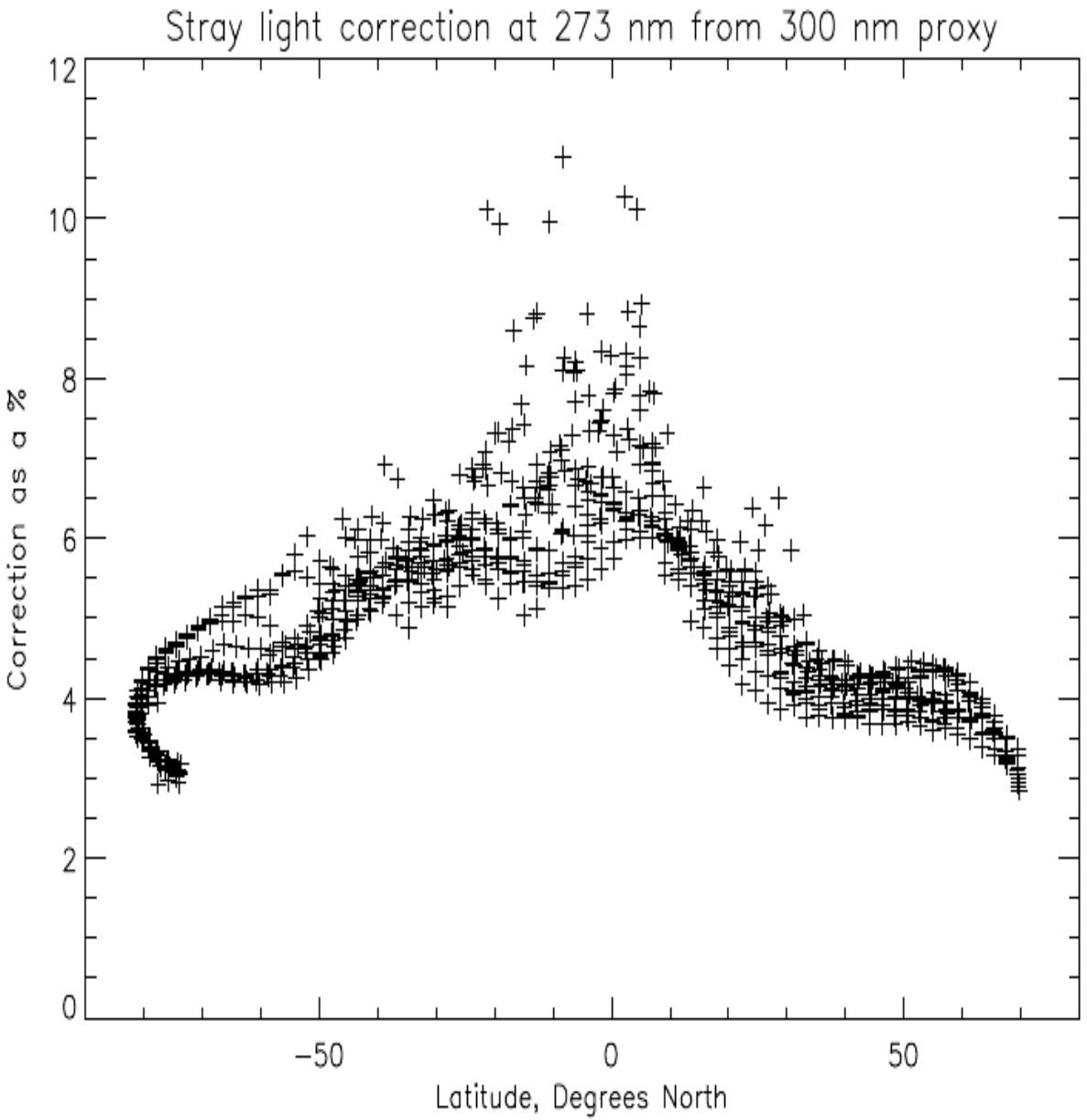
- NP has stray light; a two term correction using radiances at 305 nm and at 298 nm is envisioned. The mean magnitude of these corrections will affect any radiance/irradiance validation.
- Pre-launch solar reference results for NM: NASA PEATE vs IDPS show ±4% wavelength dependent offsets
- Increase in hot pixels as expected

NP Stray Light Study via Correlation Matrix

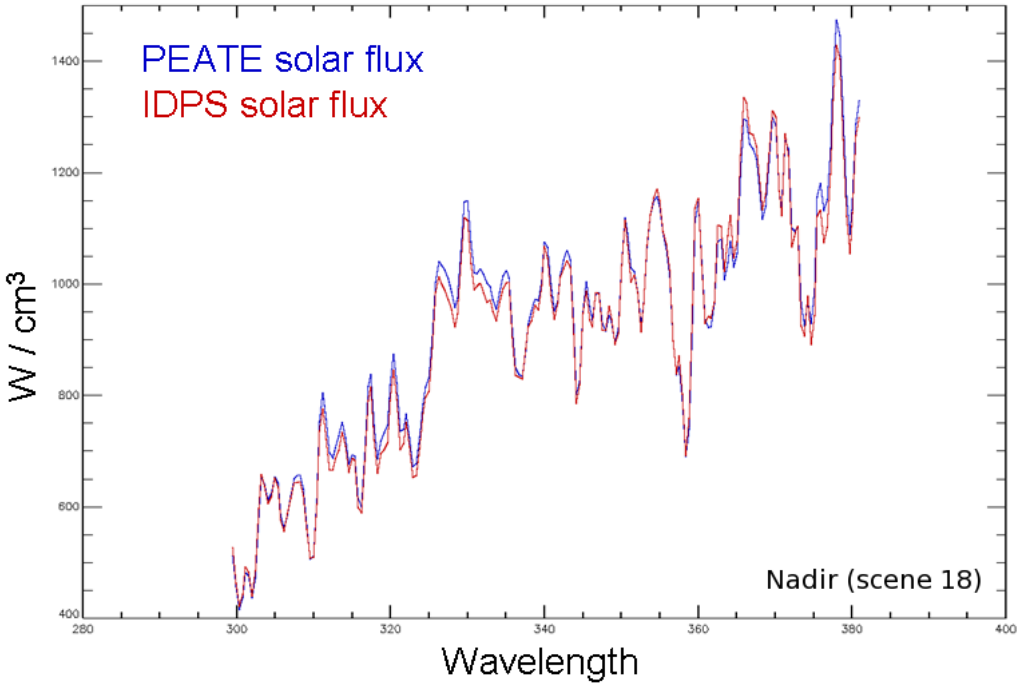


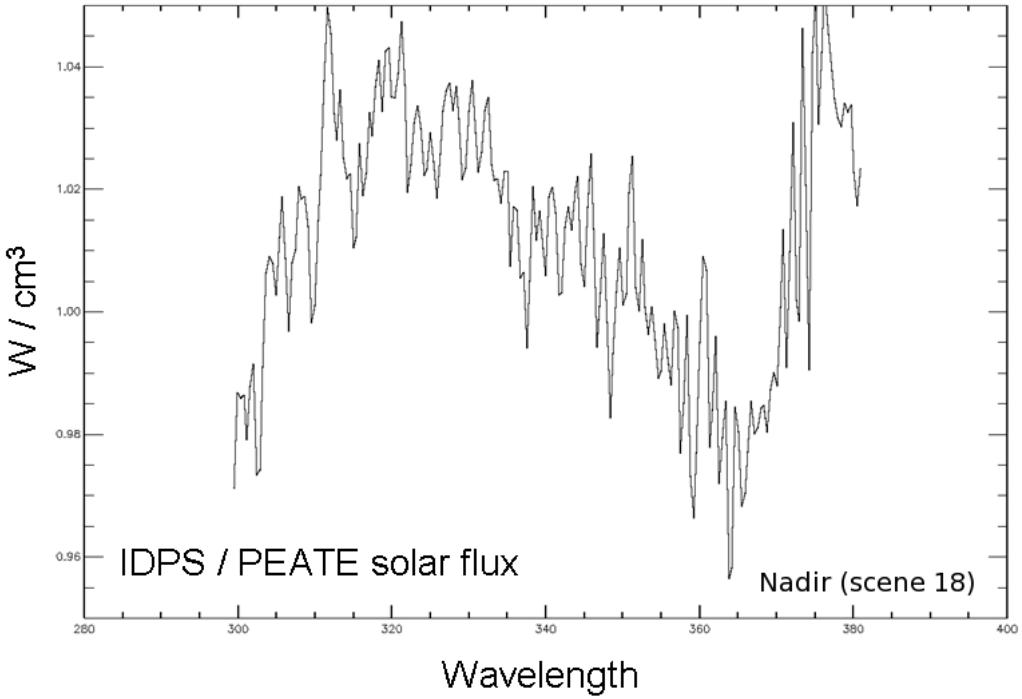
A smooth polynomial fit as a function of latitude was computed for each wavelength using three orbits of NP spectra. The correlation matrix was computed for the differences between the measurements and these fits. The results for six wavelengths are presented to the left. The peaks at 1.0 identify the selected wavelengths. The high correlations between wavelengths below 290 nm with those above 300 nm is direct evidence of stray light. E.g., the thin dotted line for 275 nm drops off as expected until 292 nm where it rises back up due to stray light contamination. Over half of the variations at this wavelength could be explained by variations at a channel between 300 and 310 nm. Similar results hold for all channels below 287 nm.

NP Stray Light Study with 300 nm Proxy



The single wavelength proxy model gives stray light ranging from 3% at high SZAs to 7% at low SZAs for the four shortest profiling wavelengths (253-288 nm) with additional variations when scene reflectivity variations are present in 300 nm. This signal contamination will complicate any attempts to find a Radiance/Irradiance adjustment. That is, we need to come up with a first-order stray light correction, before we try to adjust the NP calibration. Further investigation of the NP stray light in Earth View with a single wavelength proxy suggests that a weighted proxy may be needed. The relative weights can be provided by the BATC data.



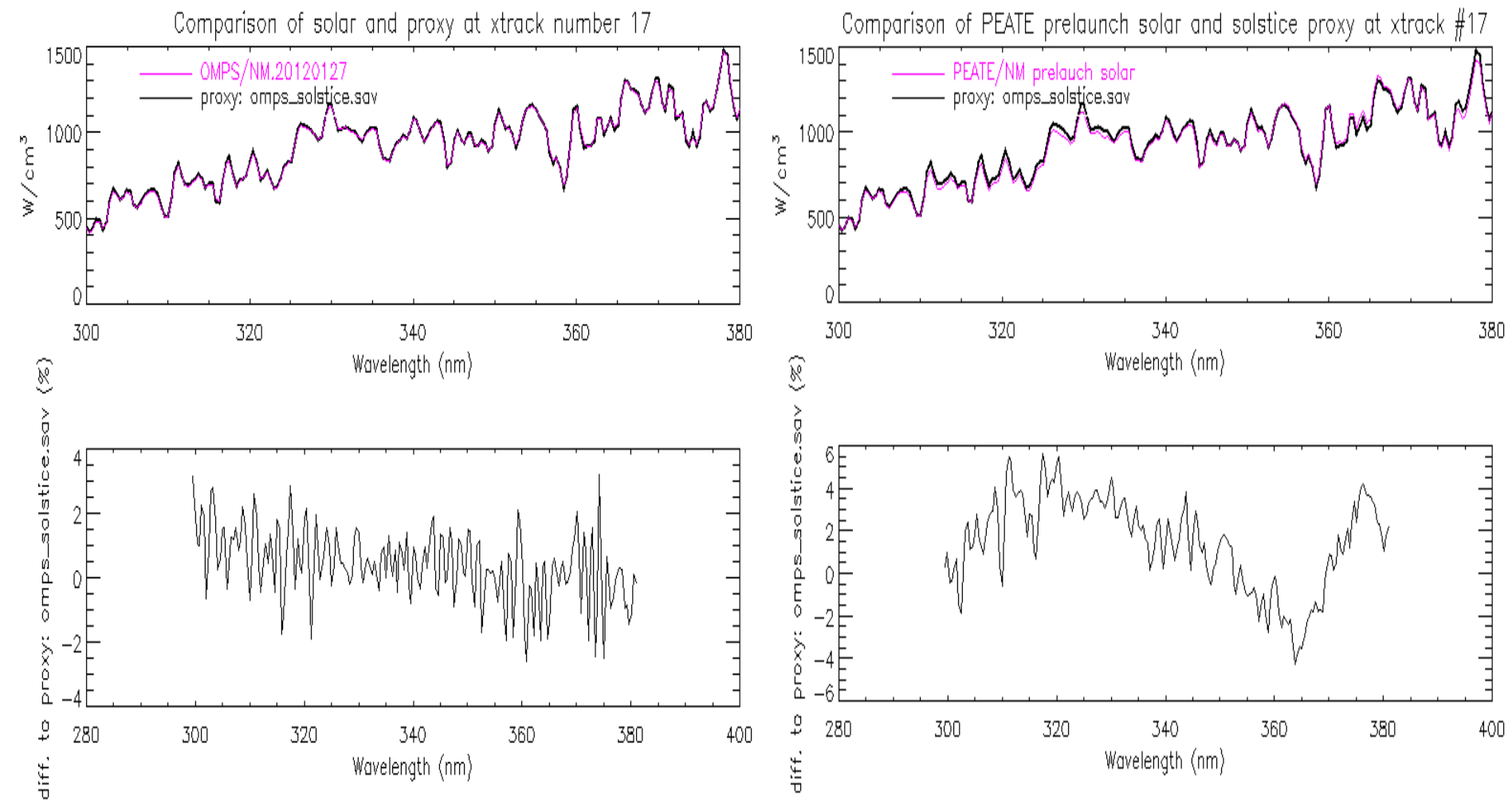


Comparisons of pre-launch solar flux.

The plot on the top shows the solar flux from the IDPS IP versus the solar flux from the PEATE product for the nadir scene (IDPS position 18; for the PEATE a simple average of scenes 18 and 19). There is a definite, wavelength-dependent difference between the IDPS and PEATE solar flux values (that is surprisingly large).

The PEATE product is made from a reference solar flux that has been convolved with the appropriate OMPS BPS and CBC data.

C. Seftor, NASA/GSFC (SSAI) 1/26-27/2012



IDPS and Star Solstice proxy comparison are shown on the left. Differences are less than 3% and show high frequency features. The spectral scale have less than 0.01 nm differences in all 35 cross track position. The PEATE proxy comparisons to the STAR Solstice one are shown on the right. The differences range from ±5%.

Figure: J. Niu, NOAA/STAR (ERT)

Support Material for OMPS SDR to Beta Maturity Decision Performance compared to Pre-launch

Compilation of results from

JPSS and NPP OMPS Teams

Data Product Beta Maturity Definition

NPP SDR Product Maturity Levels
1. Beta • Early release product. • Initial calibration applied. • Minimally validated and may still contain significant errors (rapid changes can be expected. Version changes will not be identified as errors are corrected as on-orbit baseline is not established) • Available to allow users to gain familiarity with data formats and parameters • Product is not appropriate as the basis for quantitative scientific publications studies and applications

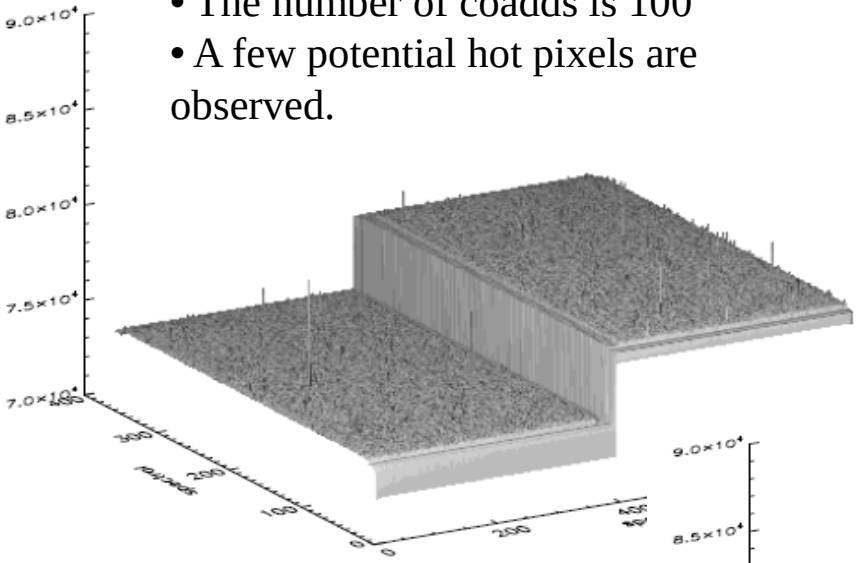
Outline

- Dark Current
- Hot Pixels
- Non-linearity
- Solar Spectra
- Signal-to-Noise
- Stray Light
- Wavelength Scale
- South Atlantic Anomaly – charged particle effects
- Geolocation Registration
- Detector Temperature

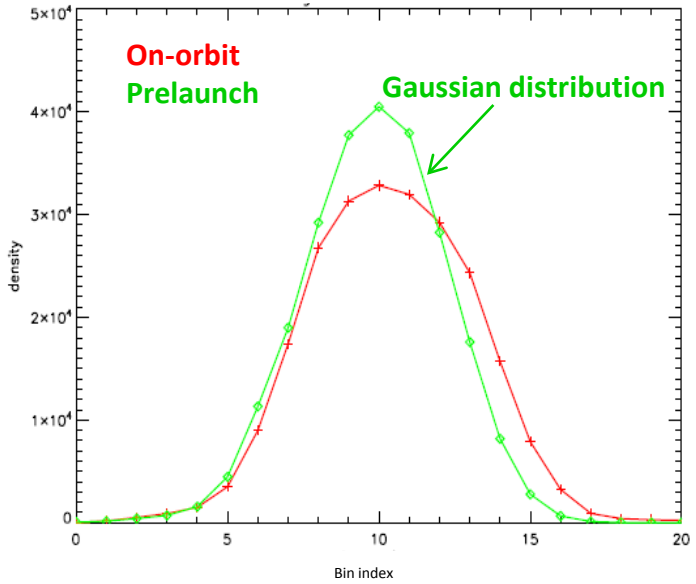
Dark Transition from Ground to Orbit

On-orbit

- Raw dark image for orbit
- Exposure time of 1247.1 second
- The number of coadds is 100
- A few potential hot pixels are observed.

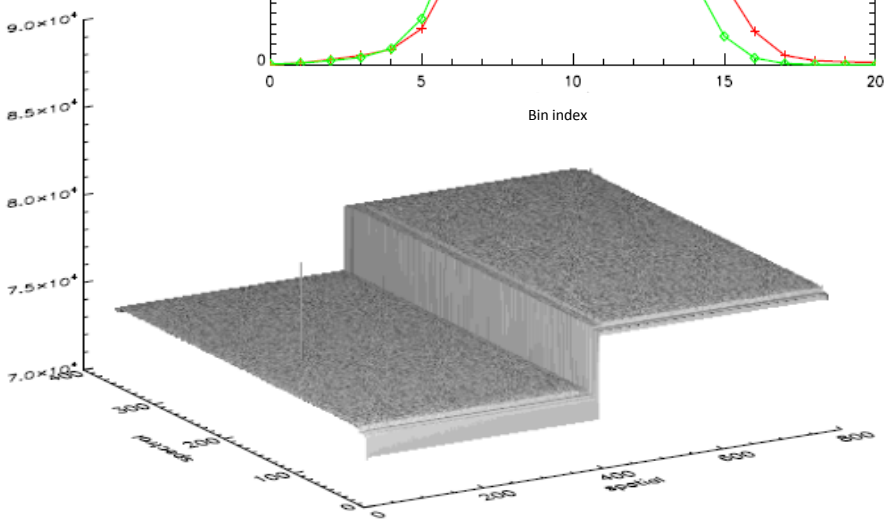


Histogram function



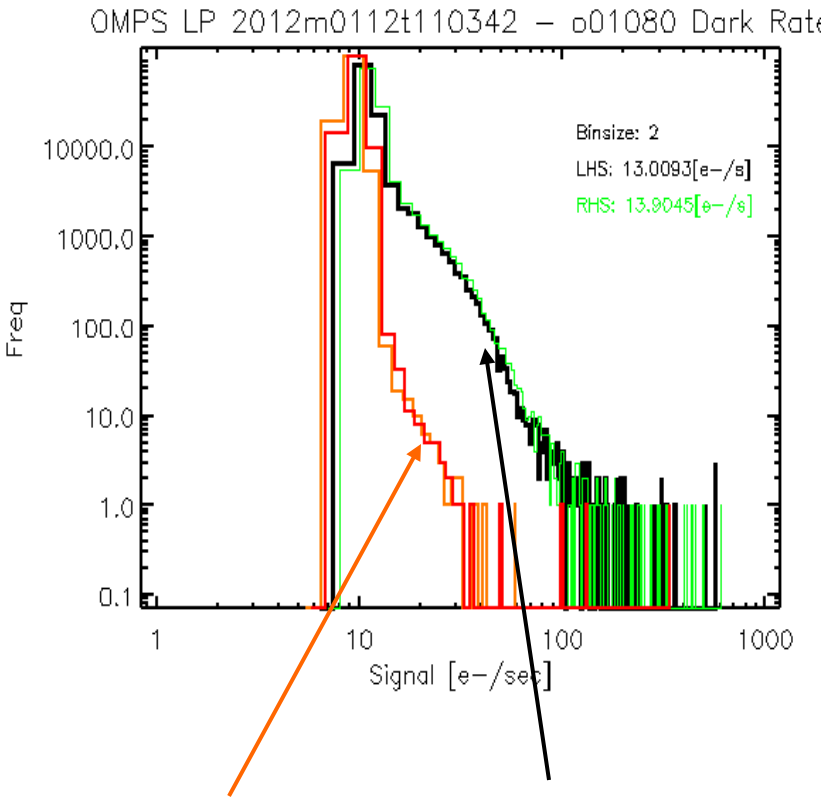
Prelaunch

- Raw dark image for prelaunch
- Exposure time of 1247.1 second
- The number of coadds is 100
- Only one hot pixel is identified

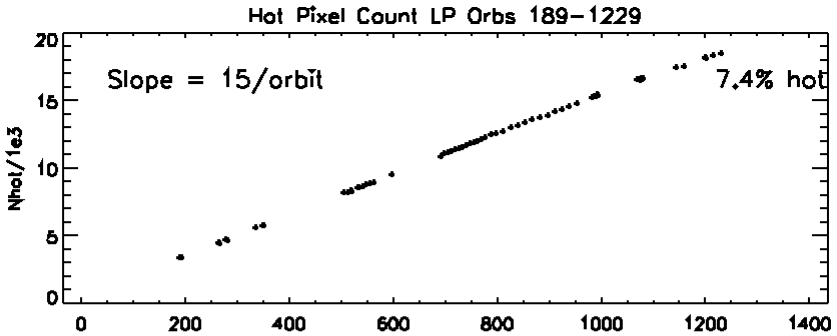


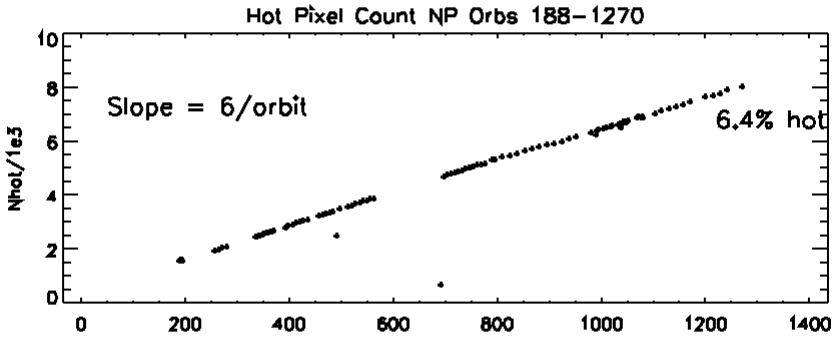
Hot pixels increasing as expected

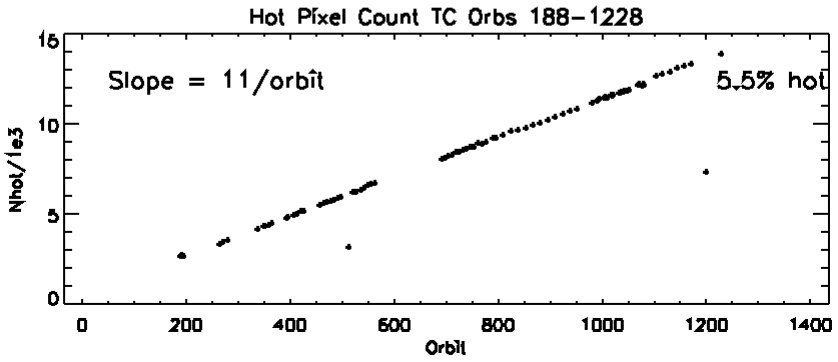
Hot pixel defined as 8σ above pre-launch distribution



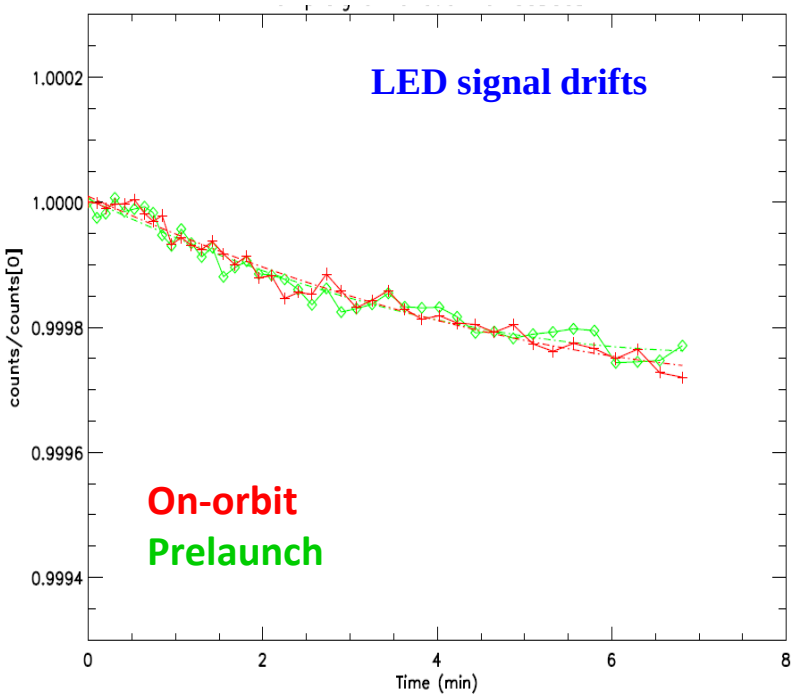
Pre-launch Orbit 1080

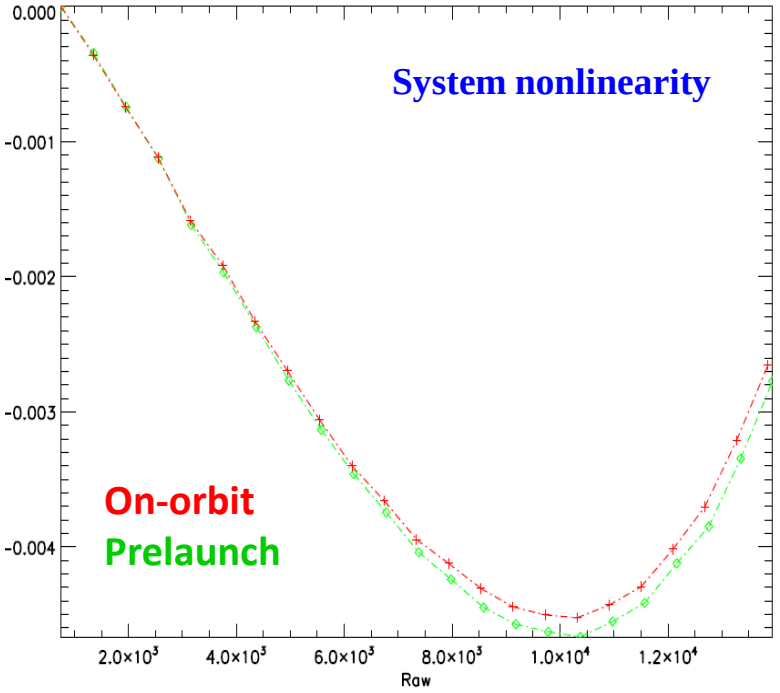






Linearity Performance
Transition from Ground to Orbit

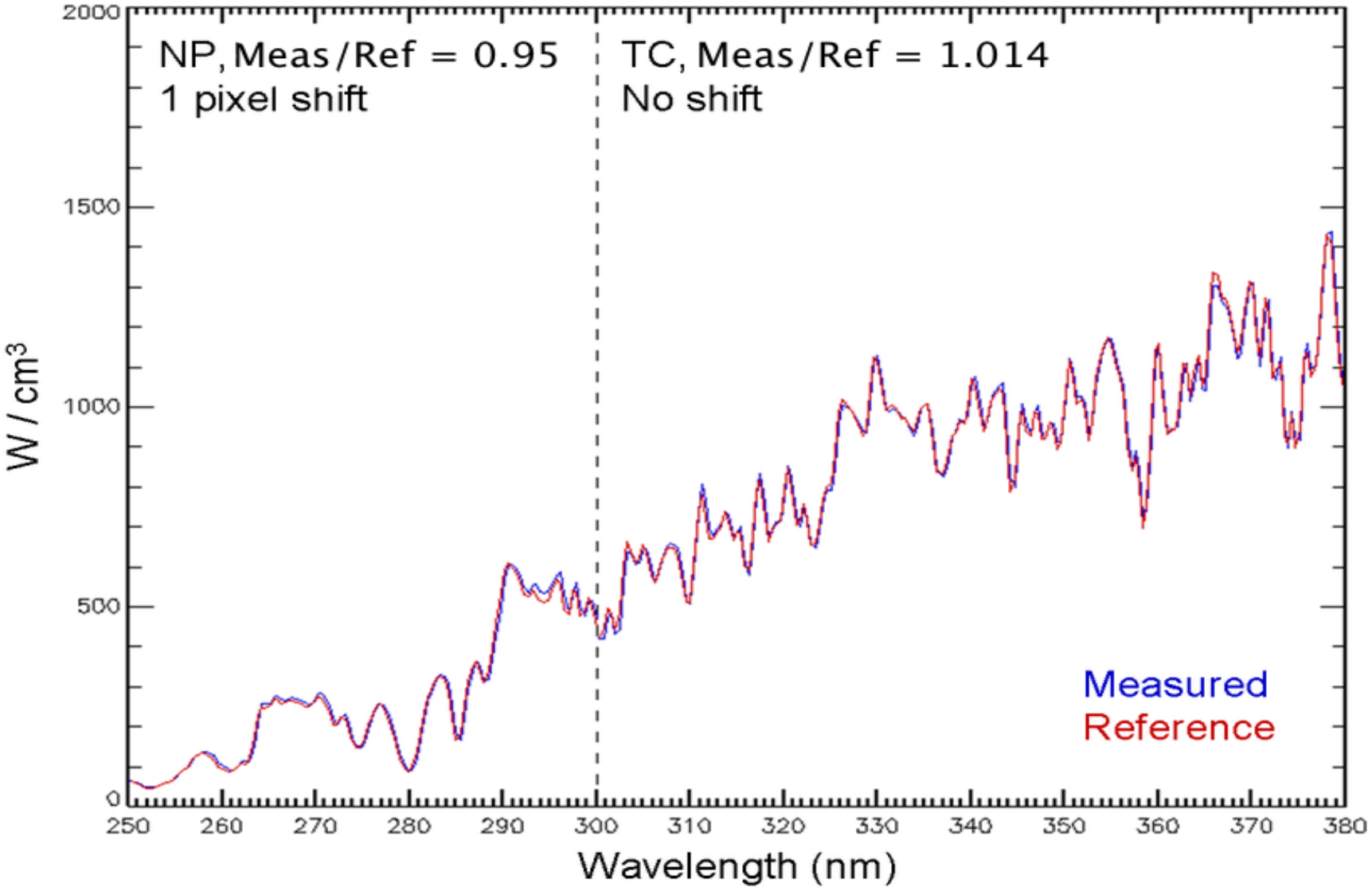




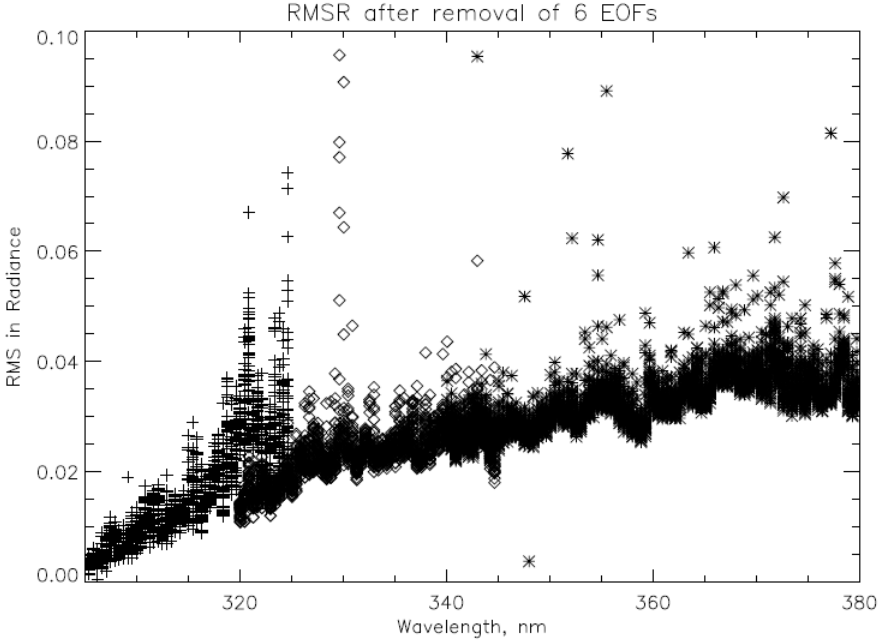
Observed OMPS TC LED drifts over time meets the system requirement of < 1% per minute

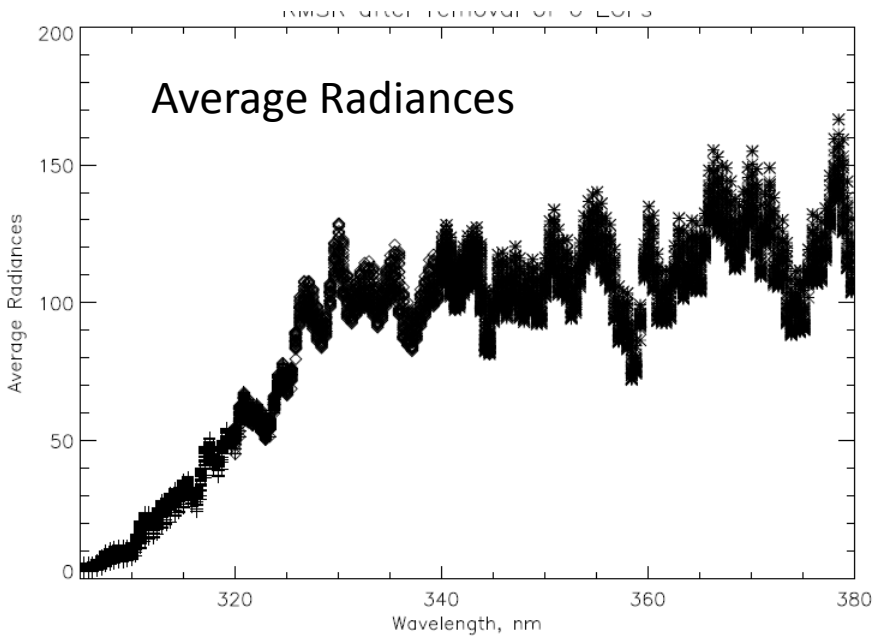
Sensor nonlinearity is compliant with the specification of < 2%

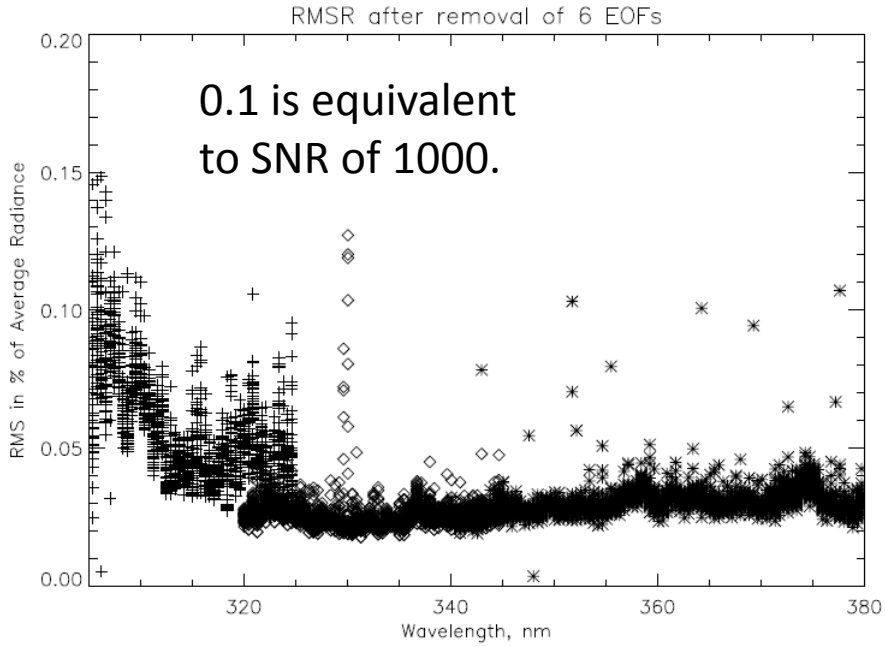
Spectral Calibration
Transition from Ground to Orbit

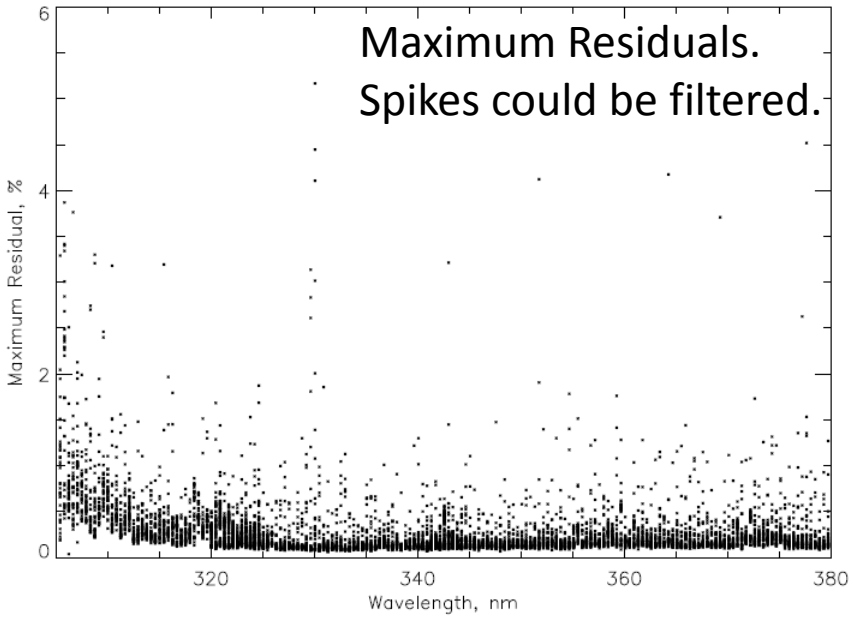


EOF/SNR analysis for six orbits (~1800 scans) OMPS NM on 1/28/2012 using three wavelength ranges (305-325, 320-345, 340-380) for 35 CT

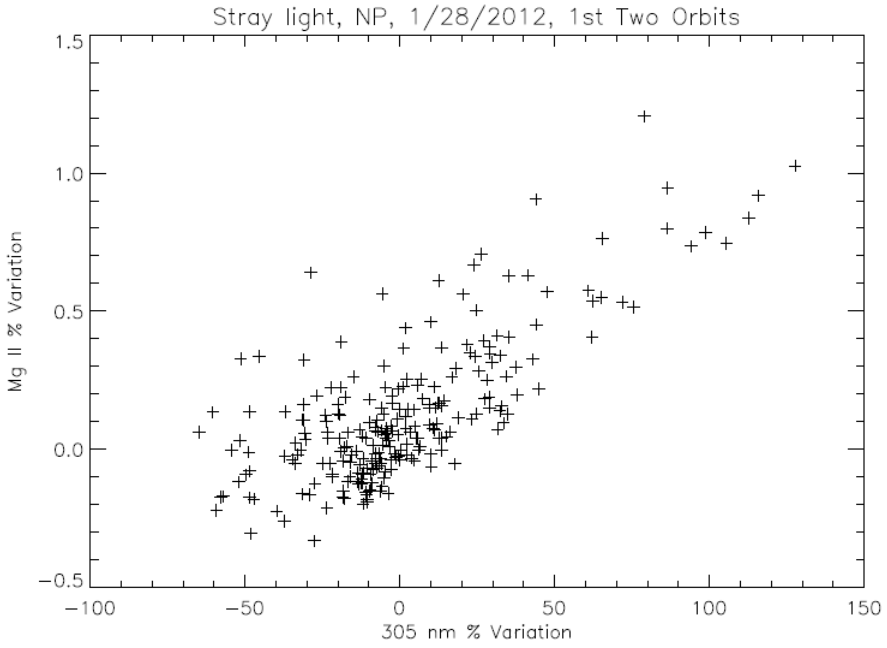






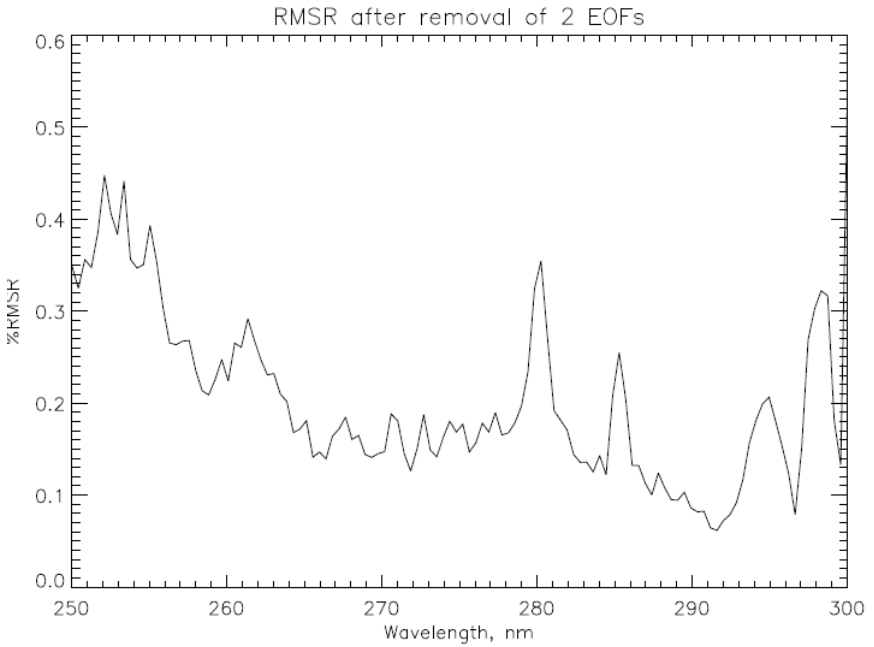


Stray Light and SNR for OMPS NP

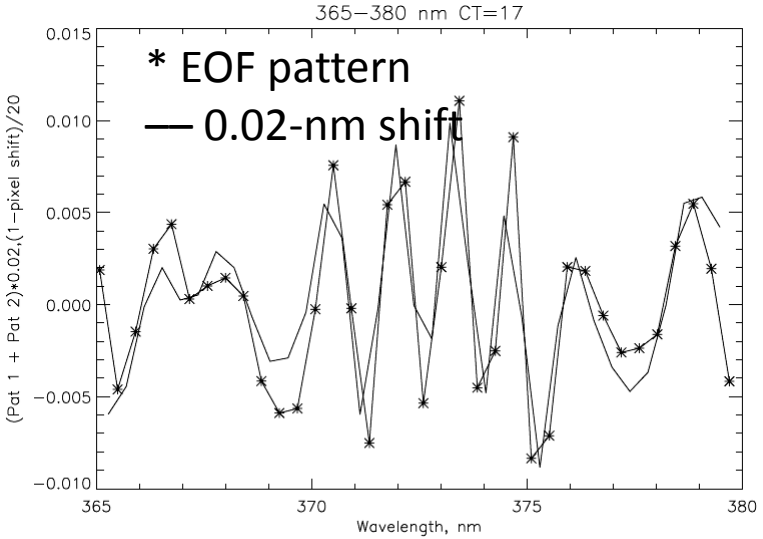


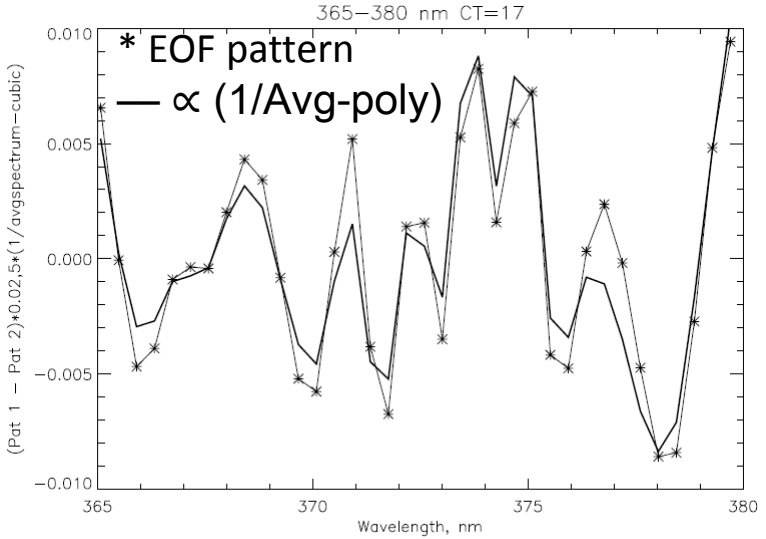
The scatter plot on the left compares simple three-wavelength Mg II core-to-wing ratio variations (280 nm to the average of 277 nm and 282 nm) with longer wavelength variations at 305 nm. The core average is ~0.4 of wings, so this -0.5% to 1.5% variation represents (1.0/0.4 – 1 =) 1.5 times the wing variations.

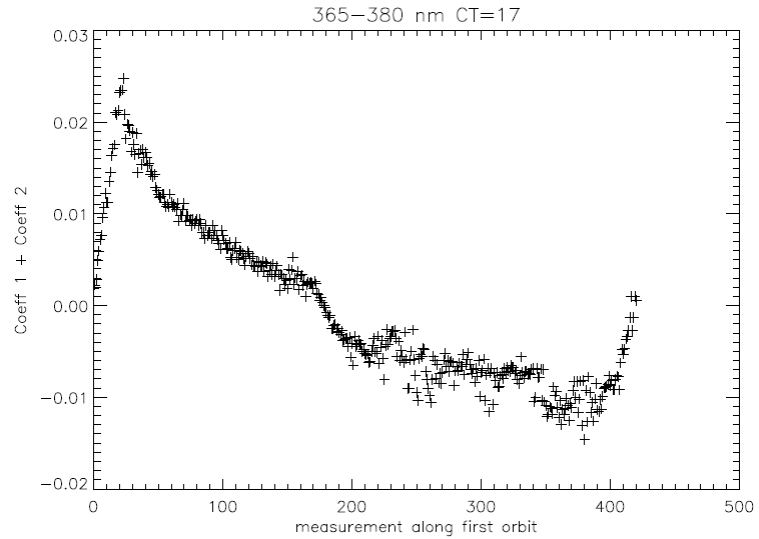
The RMSR estimates on the right were done on clean data for 230 spectra. A spectral screen detected and removed one deviant value on average from each of the 120-wavelength spectra. The removal of the second EOF pattern was somewhat arbitrary as it and the third EOF may be stray light patterns. The EOF used a 6th order polynomial for normalization.

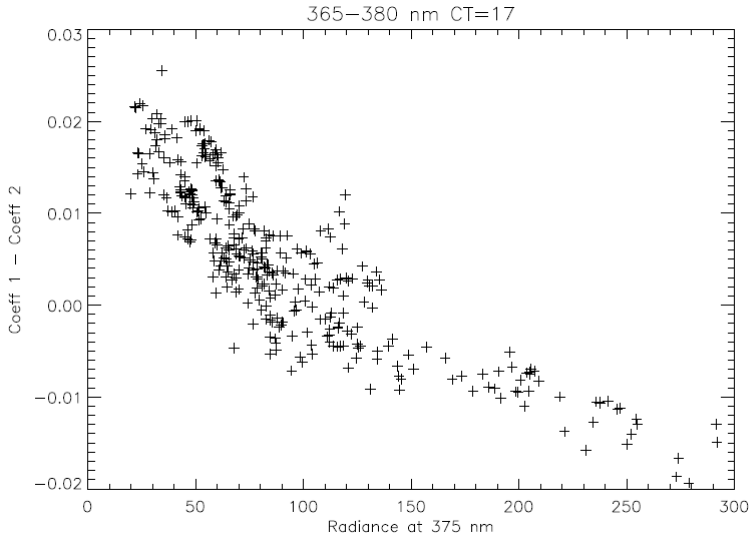


Wavelength Shift and Ring Effect/Stray Light



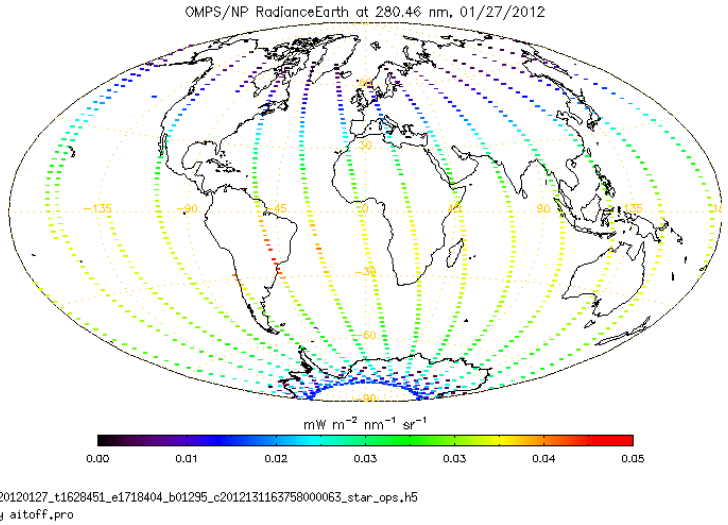


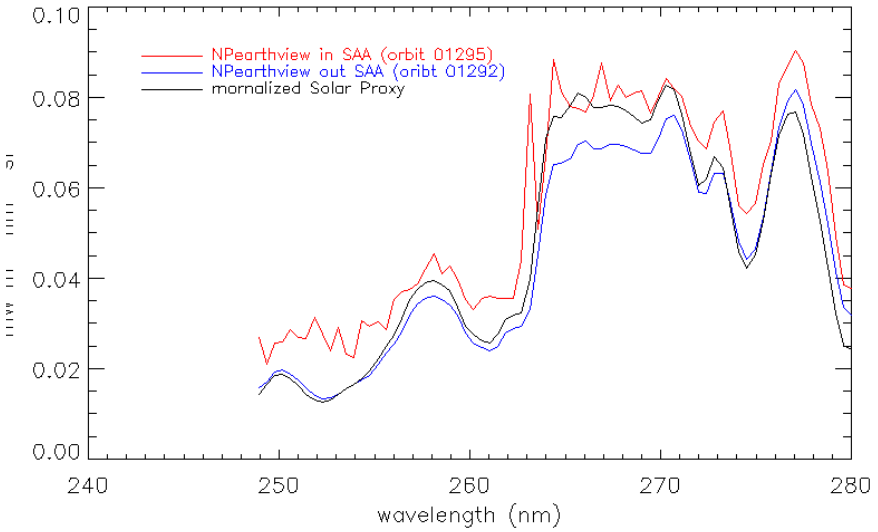


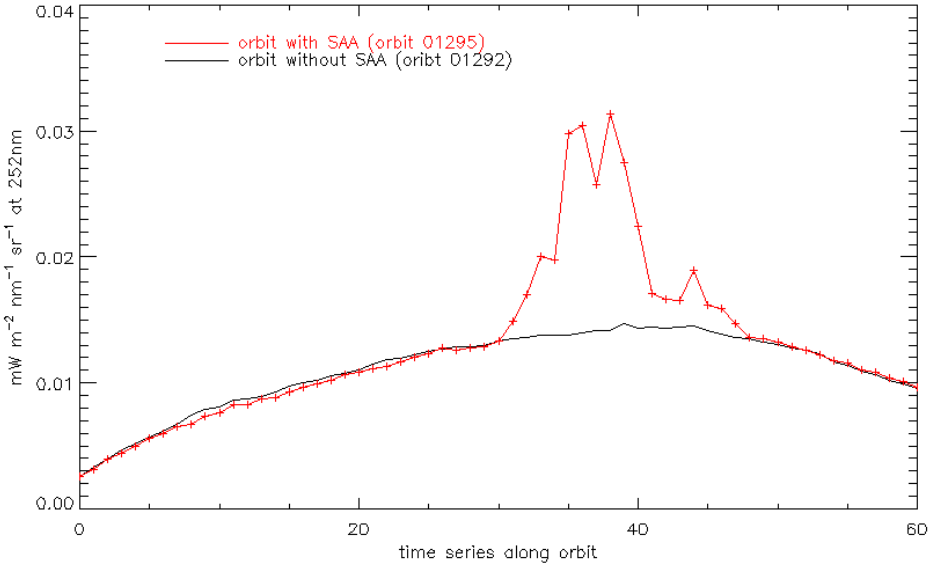


EOF analysis 365 to 380 nm for parts of six orbits on 1/28/2012. The first two patterns contain 90% of the variability after removing a 3rd order polynomial from Rad/AvgRad. They are combinations of a Wavelength Scale Shift and Ring Effect/Stray Light. Given the radiance levels, a 0.01 in the figures at the top equates to approximately 1% variation.

SAA Effects on NP



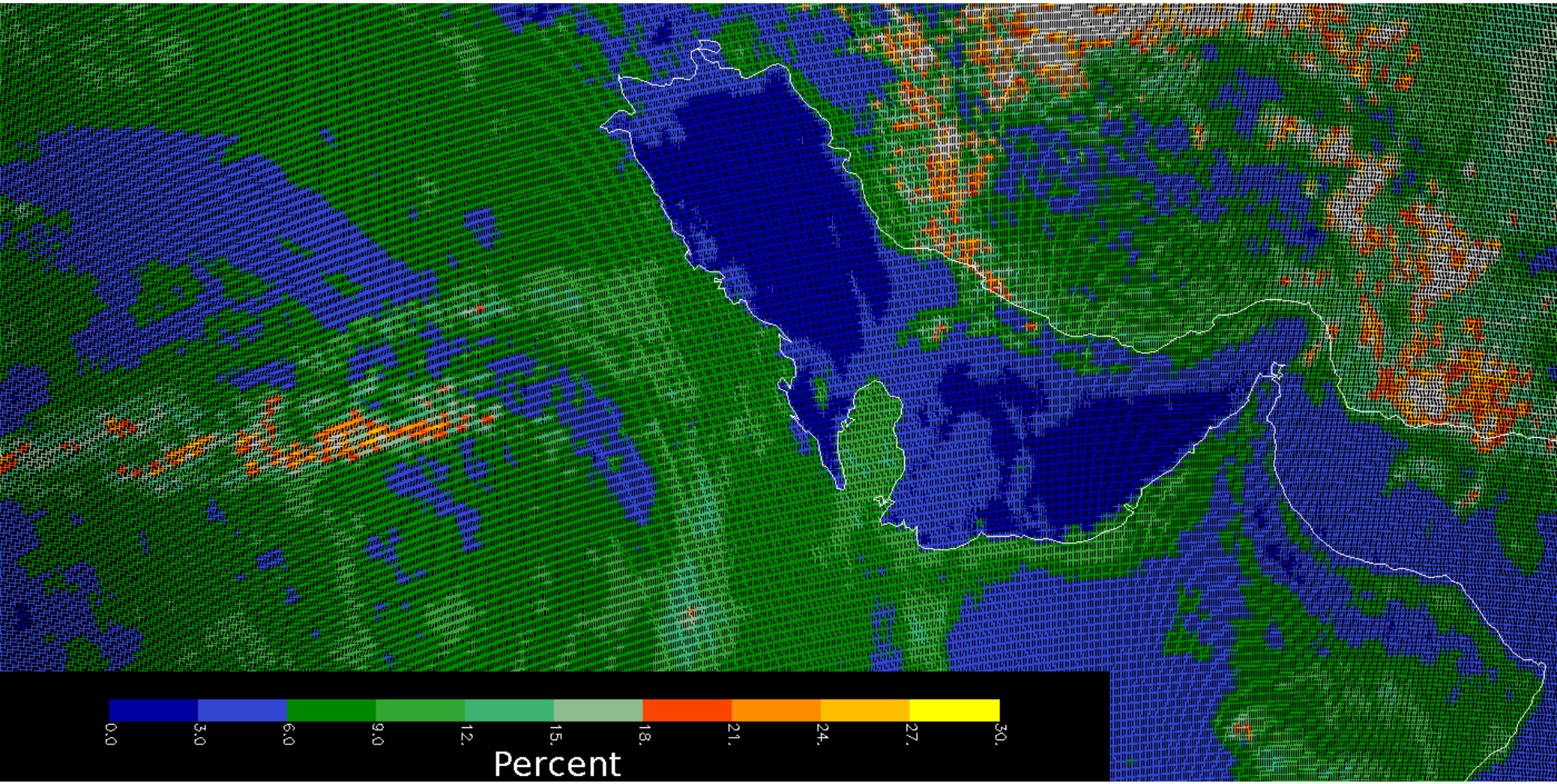




The noise/spikes show the expected increases when an orbital path falls with within the SAA but return to normal levels after passing through it.

Figure: J. Niu, NOAA/STAR (ERT)

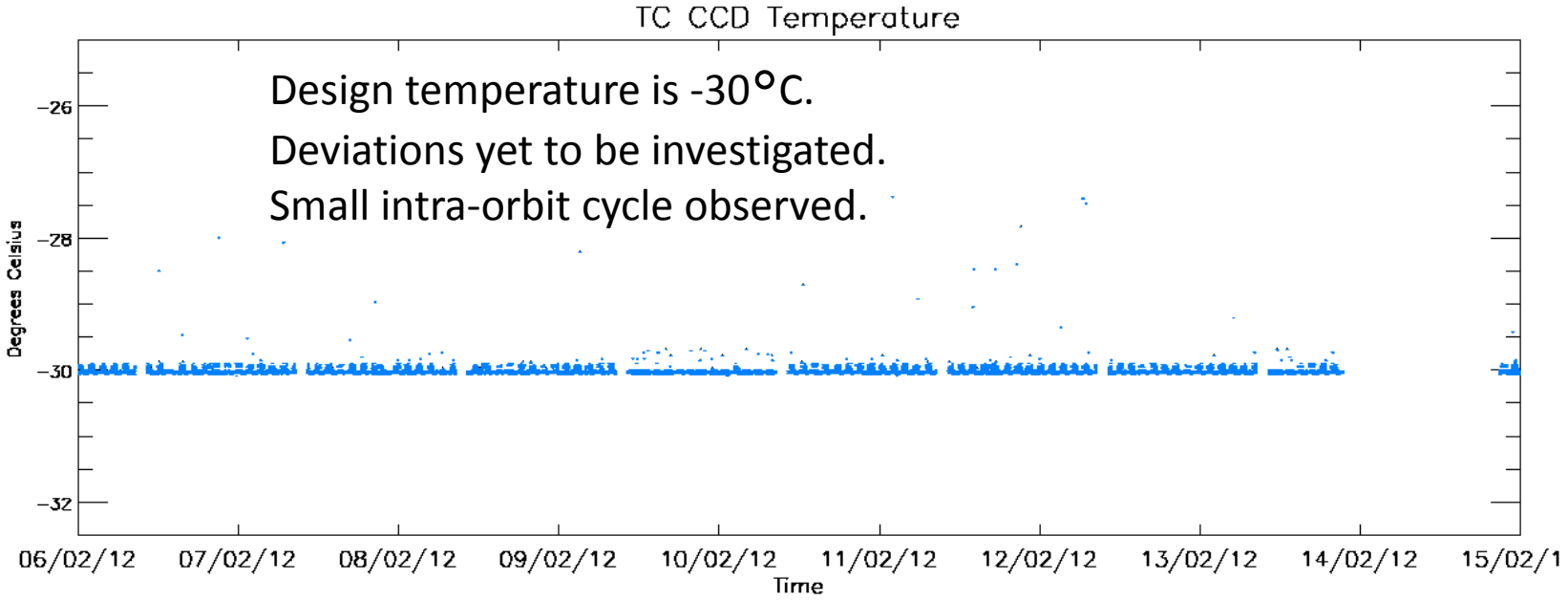
OMPS Geolocation

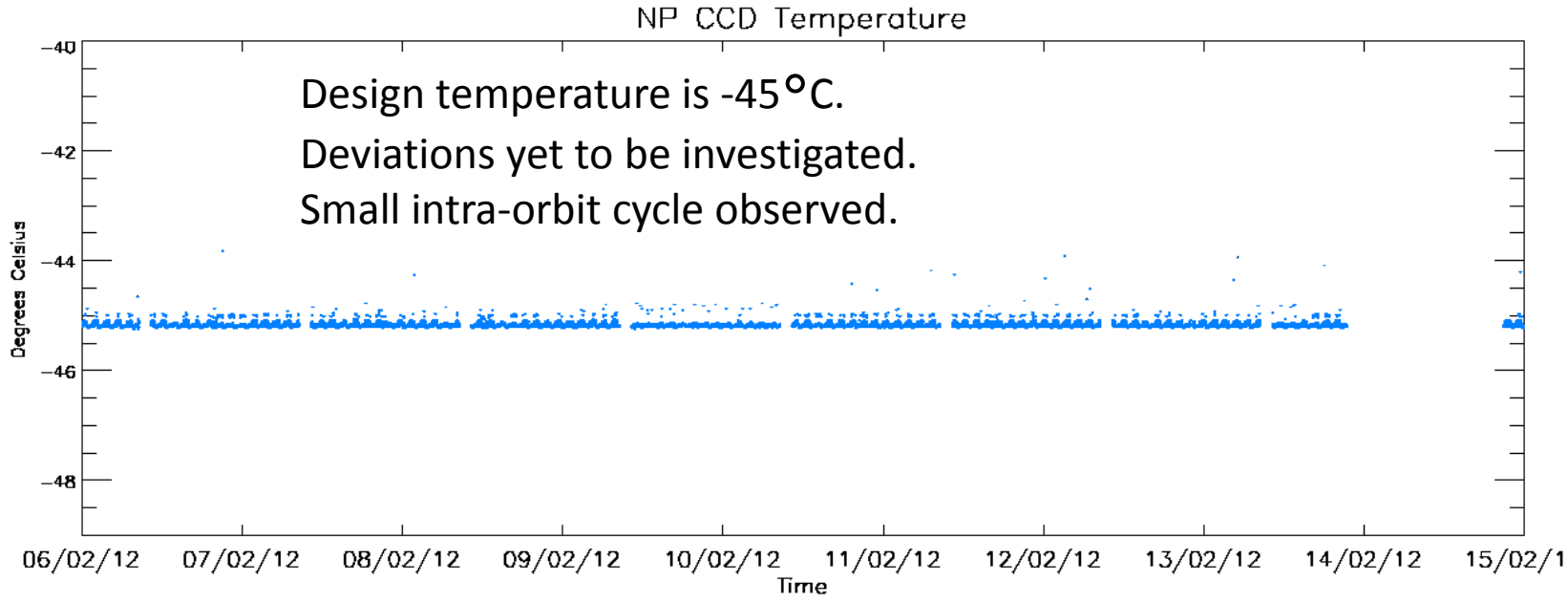


This image shows the effective reflectivity for the 380-nm Channel for part of an orbit of small Field-of-View (5 KM X 10 KM at Nadir) made by the OMPS Nadir Mapper in a special diagnostic mode. The Qatar peninsula sticking into the Persian Gulf in the middle of the picture lies along the nadir view of the orbital track and gives a preliminary assurance of the geolocation at better the 5 KM.

C. Seftor, NASA/GSFC (SSAI) 1/26-27/2012

CCD Temperatures for the last ten days

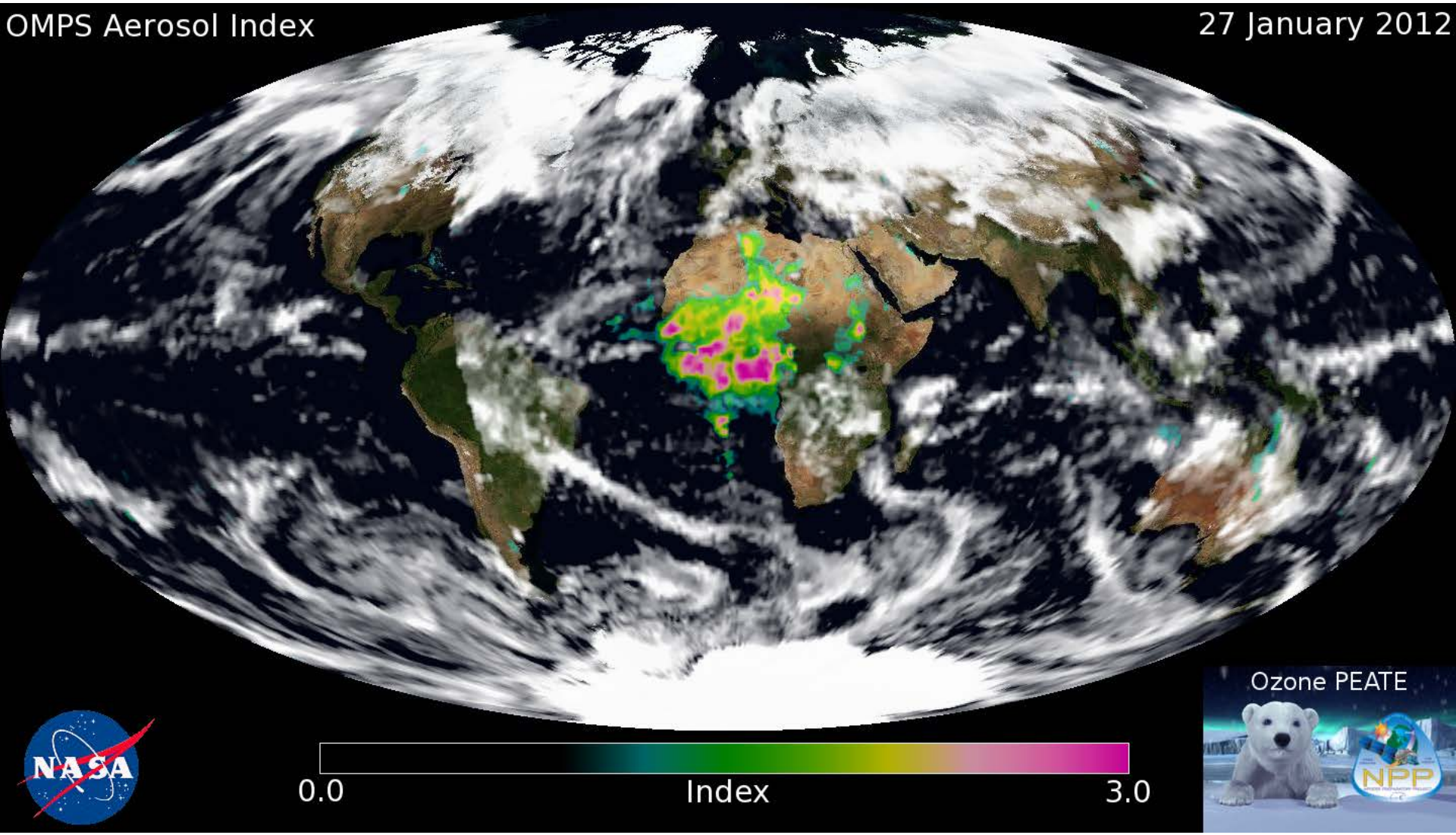




20120208 Update
to
OMPS
Initial Performance Evaluation
and
First Images

Summary Bullets (Compiled by L. Flynn 2/8/2012)

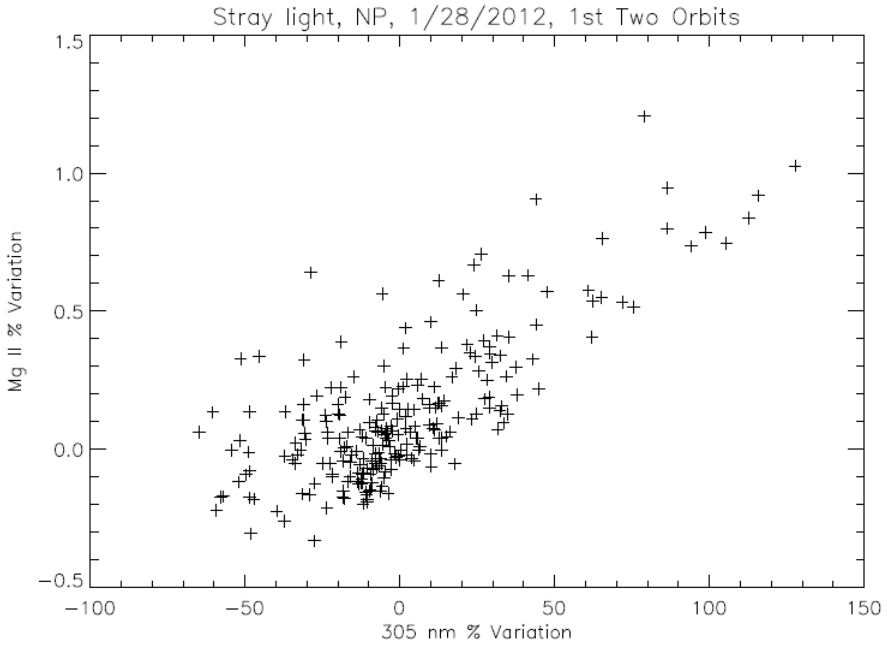
- OMPS NM SDRs
  - SNRs as expected (EOF and NN analysis)
  - Provide reasonable ozone and reflectivity (IDPS IP)
  - Geolocation is good at 5-KM level (Small FOV)
  - Intra-orbit Wavelength scale stability of 0.02-nm (EOF)
  - First Solar at 1% relative to laboratory
  - Solar is not in SDRs starting in February (Fill in ozone products)
  - Good Aerosol Index after NPP Science Team tweaking
- OMPS NP SDRs
  - SNRs as expected (EOF and NN analysis)
  - No wavelength scale in product; all zeros – Fill in Profiles
  - Will need corrections/filtering in SAA as expected
  - Stray light is present (correlation of 280-nm variations with 305-nm variations gives 3%::50% response ratio)
  - First Solar at 5% relative to laboratory (possible 1-pixel offset in wavelength scale from expected)



We've been working on a (very) preliminary set of soft calibration factors using the extremely limited amount of data we have so far. Using this calibration, we've generated the first daily aerosol index map from OMPS, which I'm attaching here. Sun glint has been screened out (for the most part), and clouds are represented by the OMPS reflectivity measurements. The MODIS Blue Marble image is being used for the background. Note the missing orbit over North / South America.

C. Seftor, NASA/GSFC (SSAI) 1/26-27/2012

Stray Light and SNR for OMPS NP



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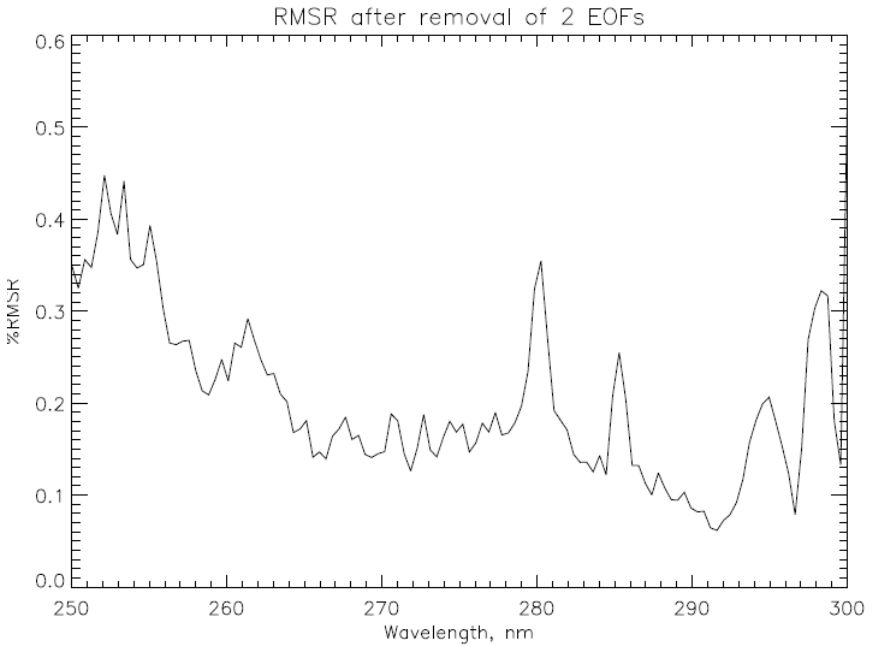
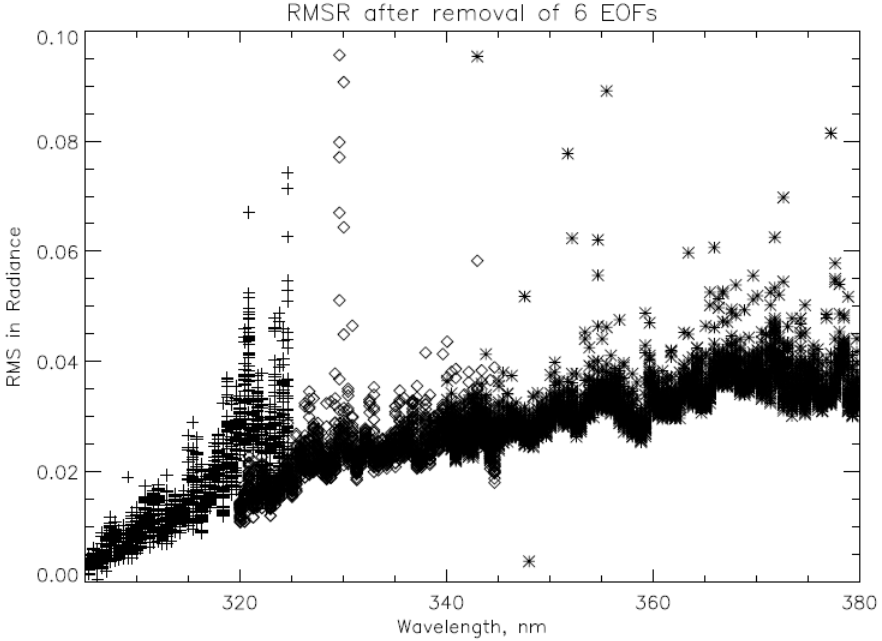
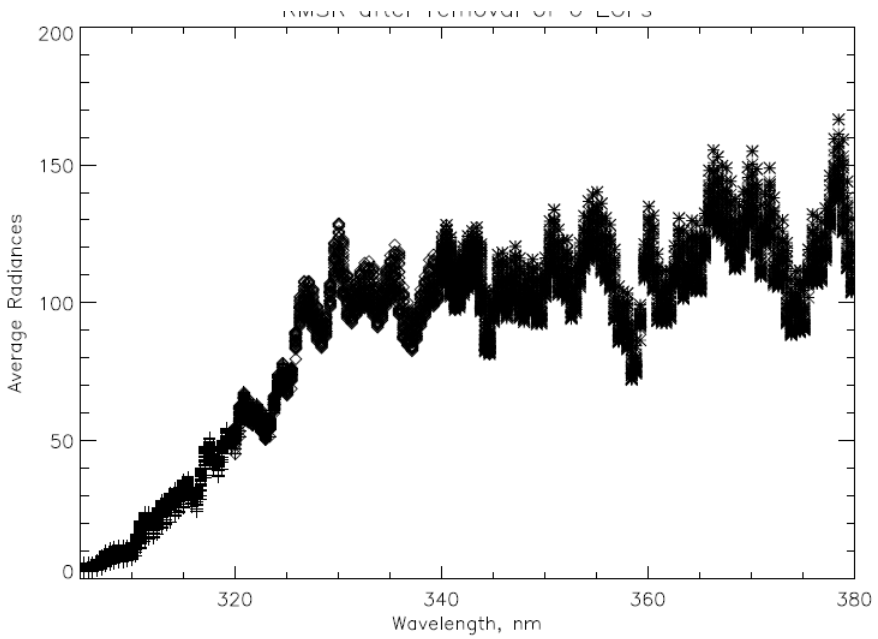
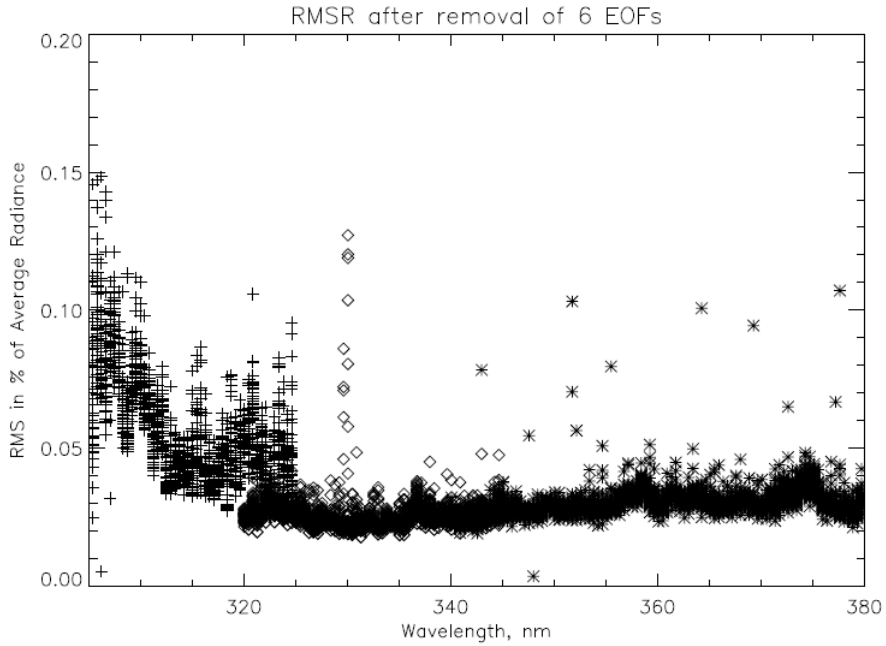
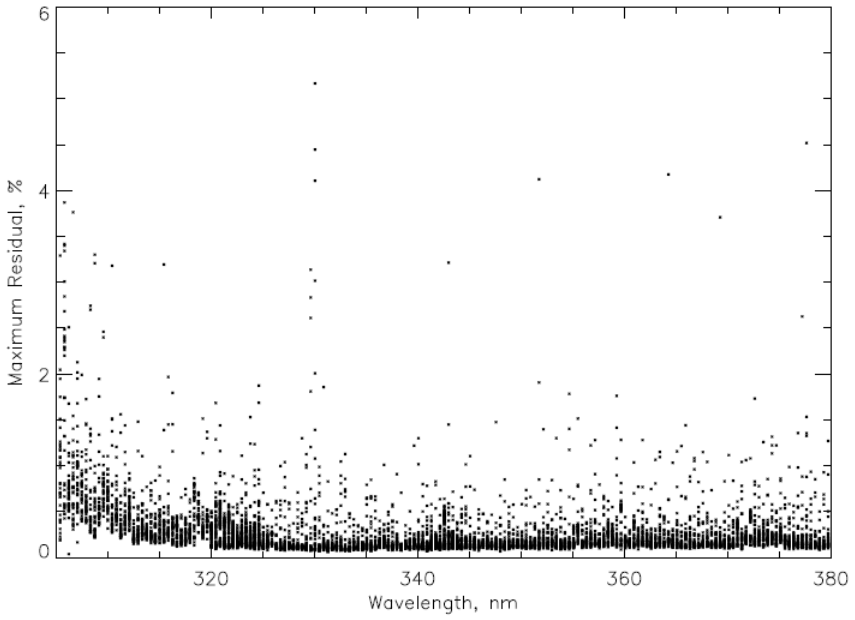


EOF/SNR analysis for six orbits (~1800 scans) OMPS NM on 1/28/2012 using three wavelength ranges (305-325, 320-345, 340-380) for 35 CT

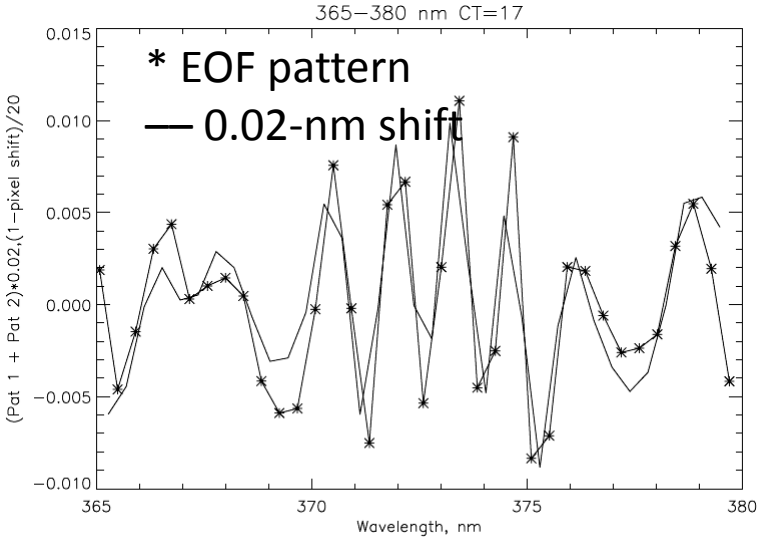


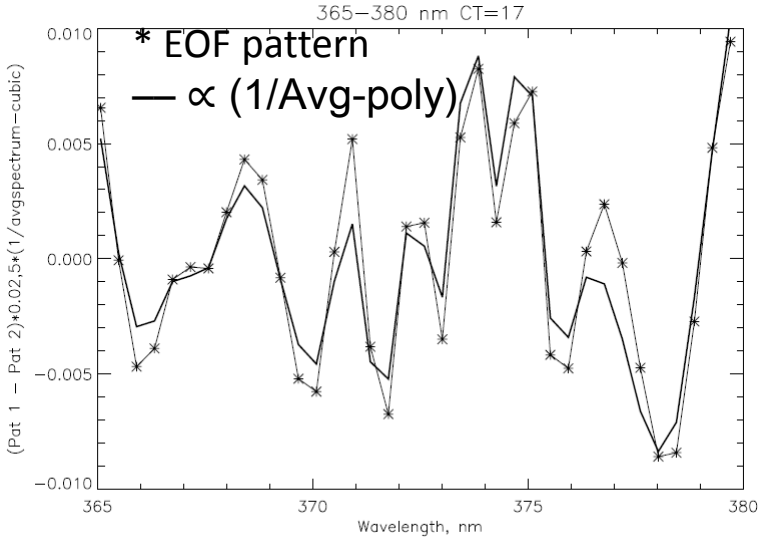


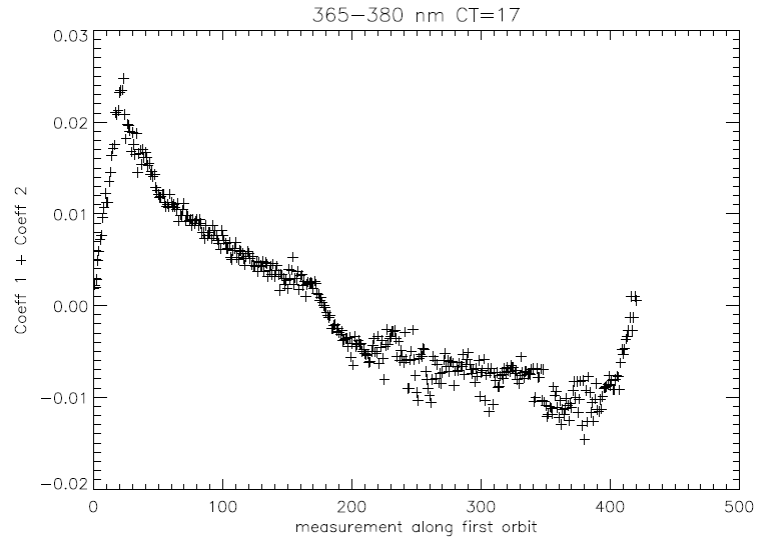


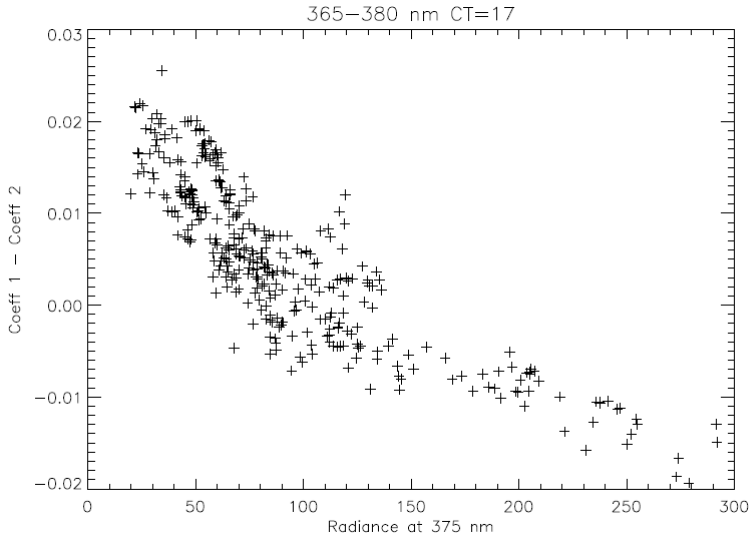


Wavelength Shift and Ring Effect/Stray Light







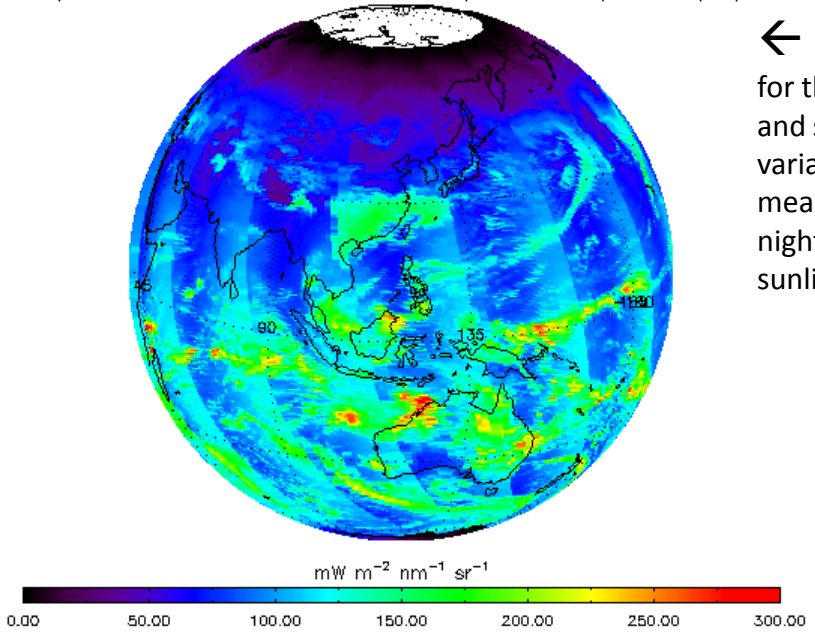


EOF analysis 365 to 380 nm for parts of six orbits on 1/28/2012. The first two patterns contain 90% of the variability after removing a 3rd order polynomial from Rad/AvgRad. They are combinations of a Wavelength Scale Shift and Ring Effect/Stray Light. Given the radiance levels, a 0.01 in the figures at the top equates to approximately 1% variation.

20120202
OMPS
Initial Performance Evaluation
and
First Images

Summary Bullets (Compiled by L. Flynn 2/2/2012)

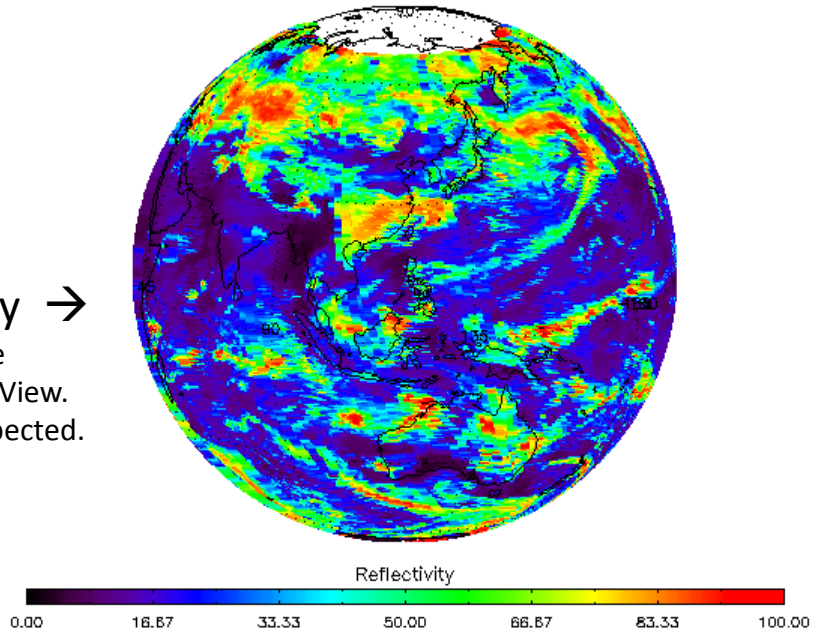
- OMPS NM SDRs
  - SNRs as expected (EOF and NN analysis)
  - Provide reasonable ozone and reflectivity (IDPS IP)
  - Geolocation is good at 5-KM level (Small FOV)
  - Intra-orbit Wavelength scale stability of 0.02-nm (EOF)
  - First Solar at 1% relative to laboratory
- OMPS NP SDRs
  - SNRs as expected (EOF and NN analysis)
  - No wavelength scale in product; all zeros
  - Will need corrections/filtering in SAA as expected
  - Stray light is present (correlation of 280-nm variations with 305-nm variations gives 3%::50% response ratio)
  - First Solar at 5% relative to laboratory (possible 1-pixel offset in wavelength scale from expected)



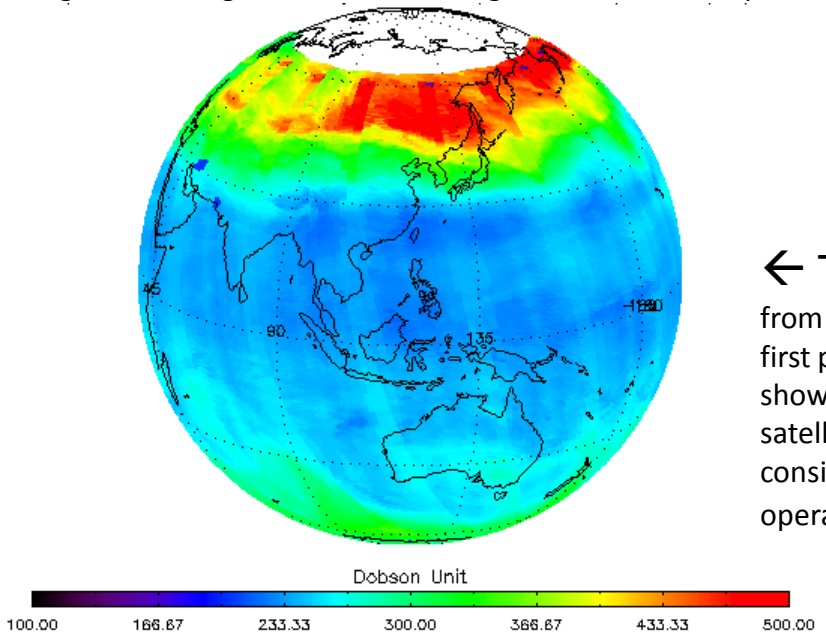
← 331-nm Channel Radiances

for the first eight orbits of OMPS Nadir Mapper measurement (end of 1/26/2012 and start of 1/27/2012). This image shows the expected range of values and variations across the orbital track and with solar zenith angles at the times of the measurements. The white circle around the North Pole is the region of polar night during the Northern Hemisphere Winter. The OMPS needs scattered sunlight to make its measurements, so there are no data there.

Effective Reflectivity →



from the multiple triplet retrieval algorithm in IDPS for the same eight orbits. The quantity represents the UV reflectivity of the clouds and surface in each Field-of-View. Again, the range of values from bright clouds to dark open ocean scenes is as expected.

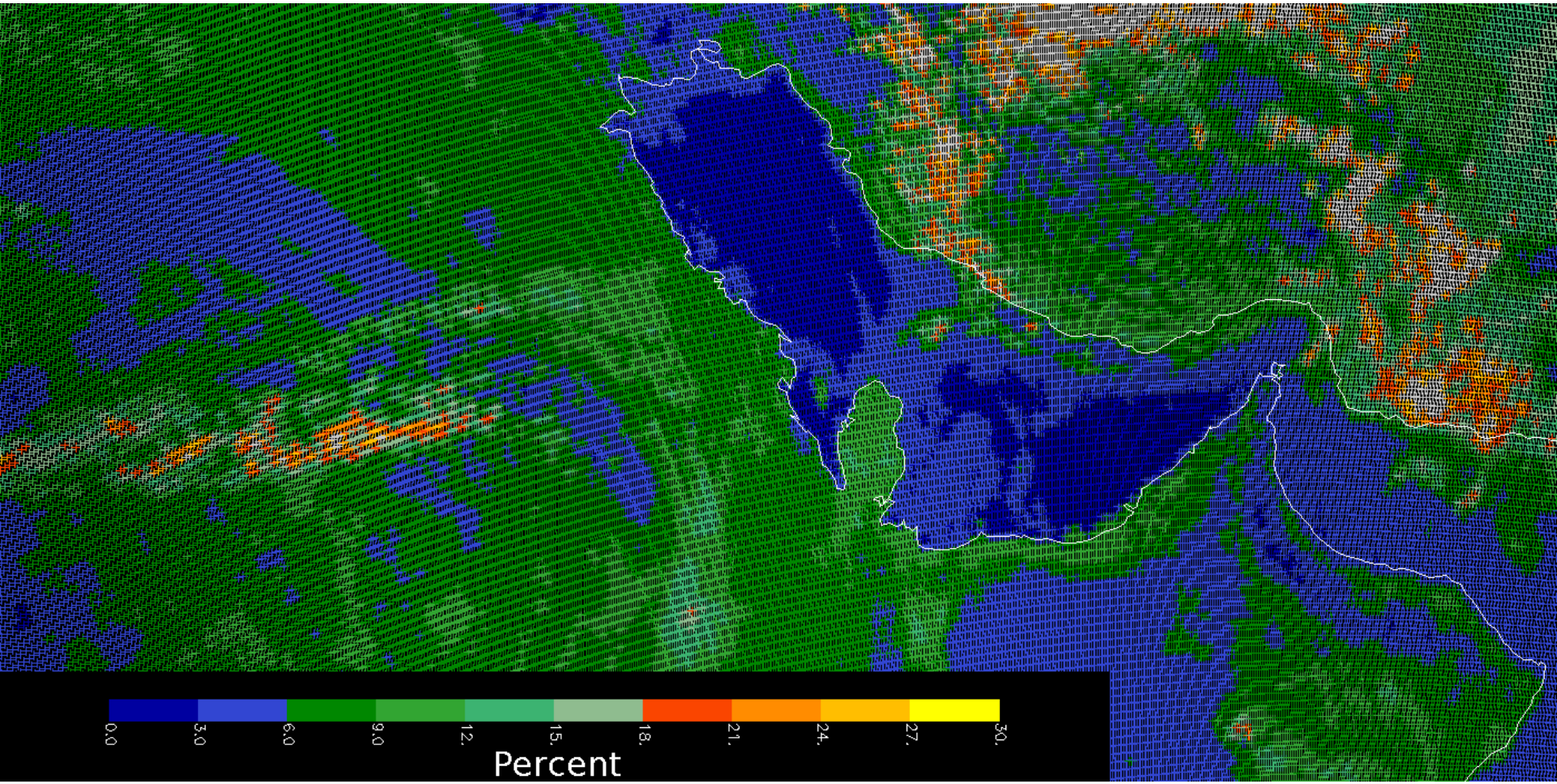


← Total Ozone

from the multiple triplet retrieval algorithm in IDPS for the same eight orbits for the first pass ozone retrieval (IP product without CrIS or VIIRS information). The values show some cross track variations and are offset approximately 5% from another satellite ozone product. These uncertainty levels for preliminary products are consistent with the use of prelaunch calibration parameters and tables in the initial operational system.

Figures: J. Niu, NOAA/STAR (ERT) 1/26-27/2012

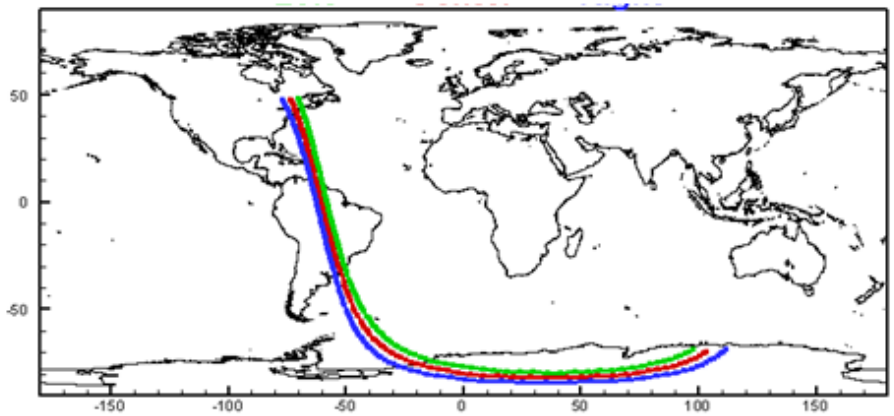
OMPS Geolocation

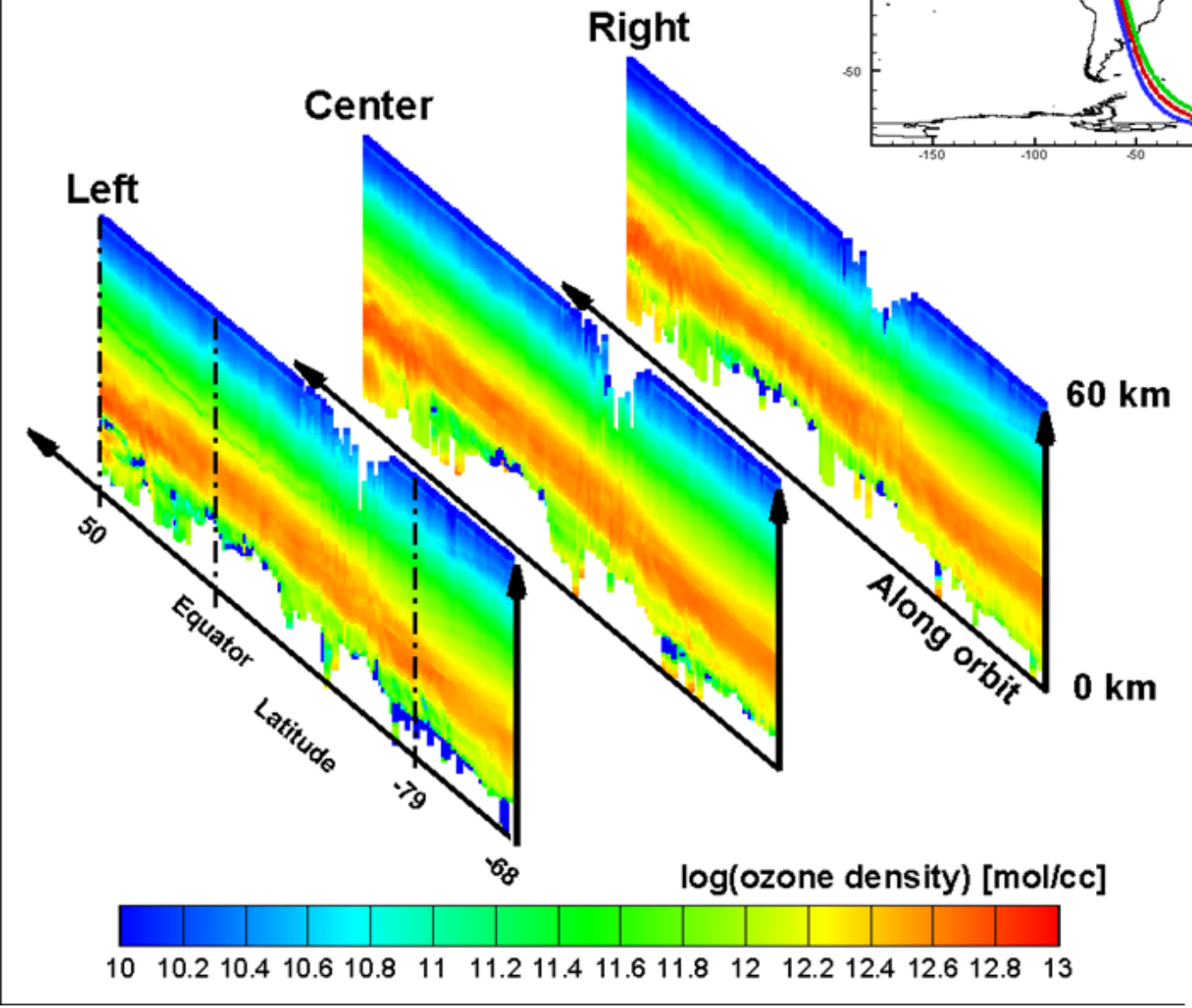


This image shows the effective reflectivity for the 380-nm Channel for part of an orbit of small Field-of-View (5 KM X 10 KM at Nadir) made by the OMPS Nadir Mapper in a special diagnostic mode. The Qatar peninsula sticking into the Persian Gulf in the middle of the picture lies along the nadir view of the orbital track and gives a preliminary assurance of the geolocation at better the 5 KM.

C. Seftor, NASA/GSFC (SSAI) 1/26-27/2012

OMPS/LP retrieved ozone profile
Jan 10, 2012





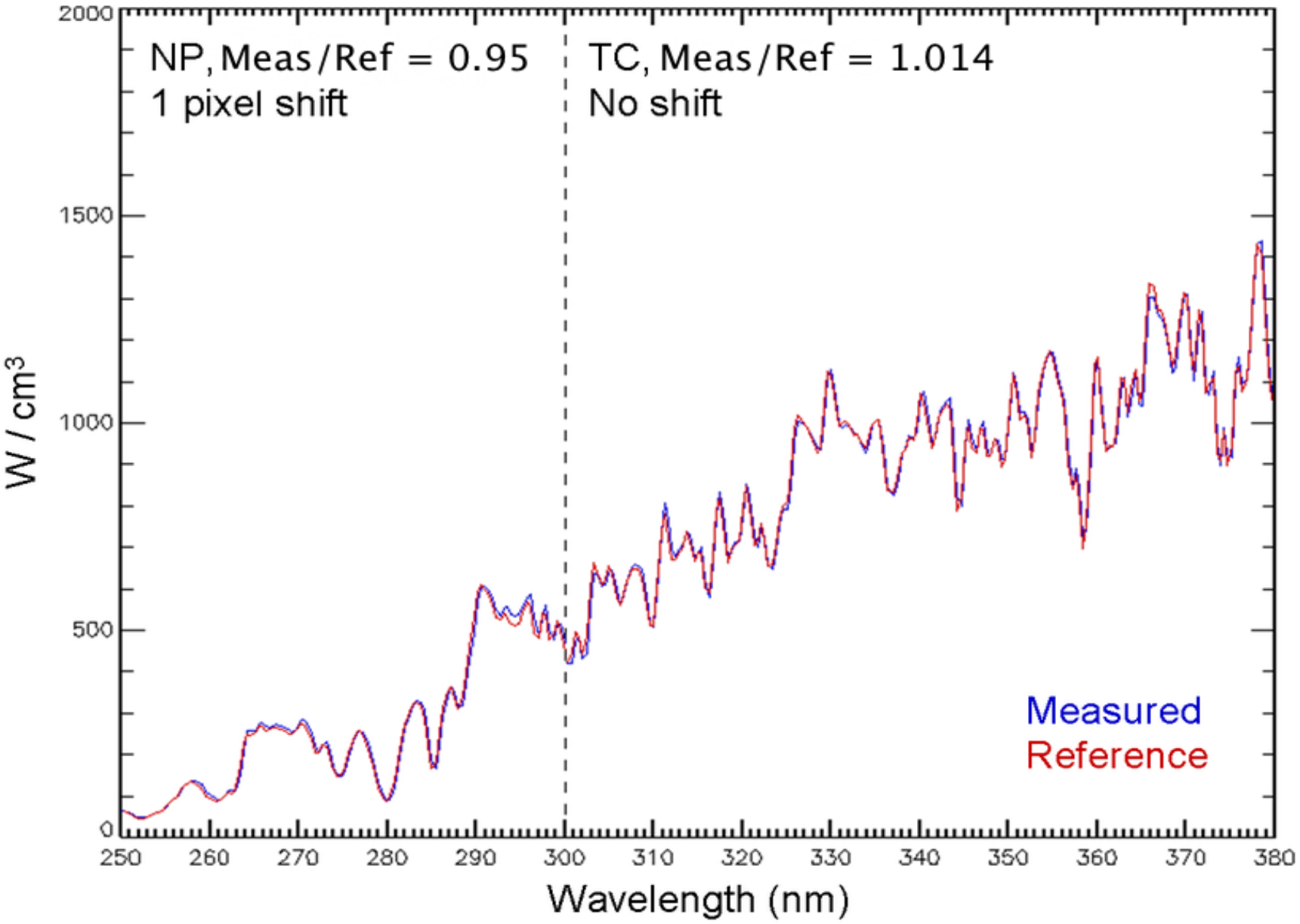
← OMPS Limb Profiler

These curtains represent the ozone profile in vertical slices through the atmosphere along the three paths shown above. They demonstrate the ability of the research retrieval algorithm for the OMPS Limb Profiler in use at the NASA Ozone PEATE. The gaps at the top in the middle of the plots occur when the satellite encounters charged particles as it passes through the South Atlantic Anomaly; these are consistent with the modeled effects.

The profiles regularly extend down below 15 KM in altitude.

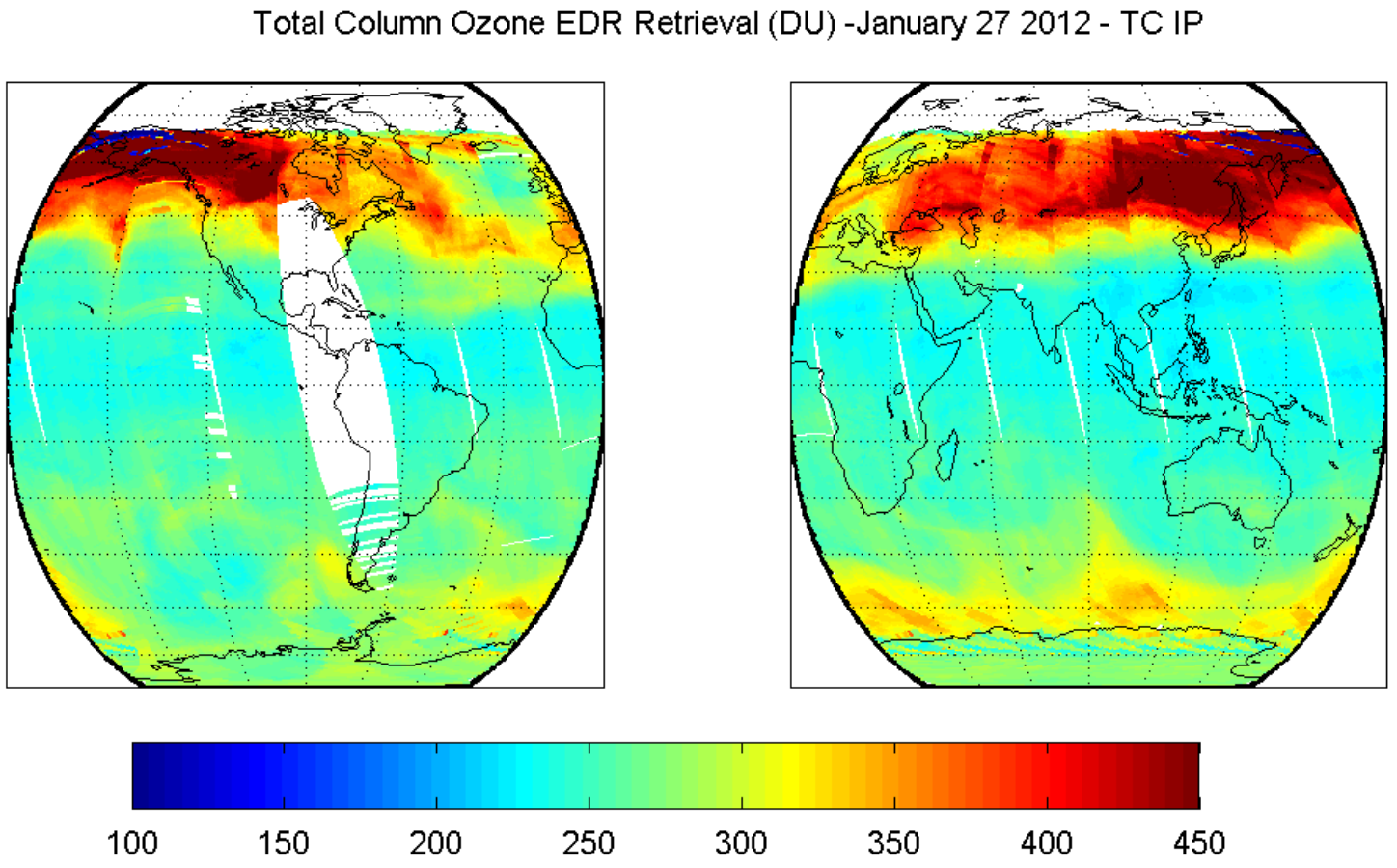
Figures: D. Rault, NASA LaRC

OMPS Nadir Mapper and Nadir Profiler First Solar



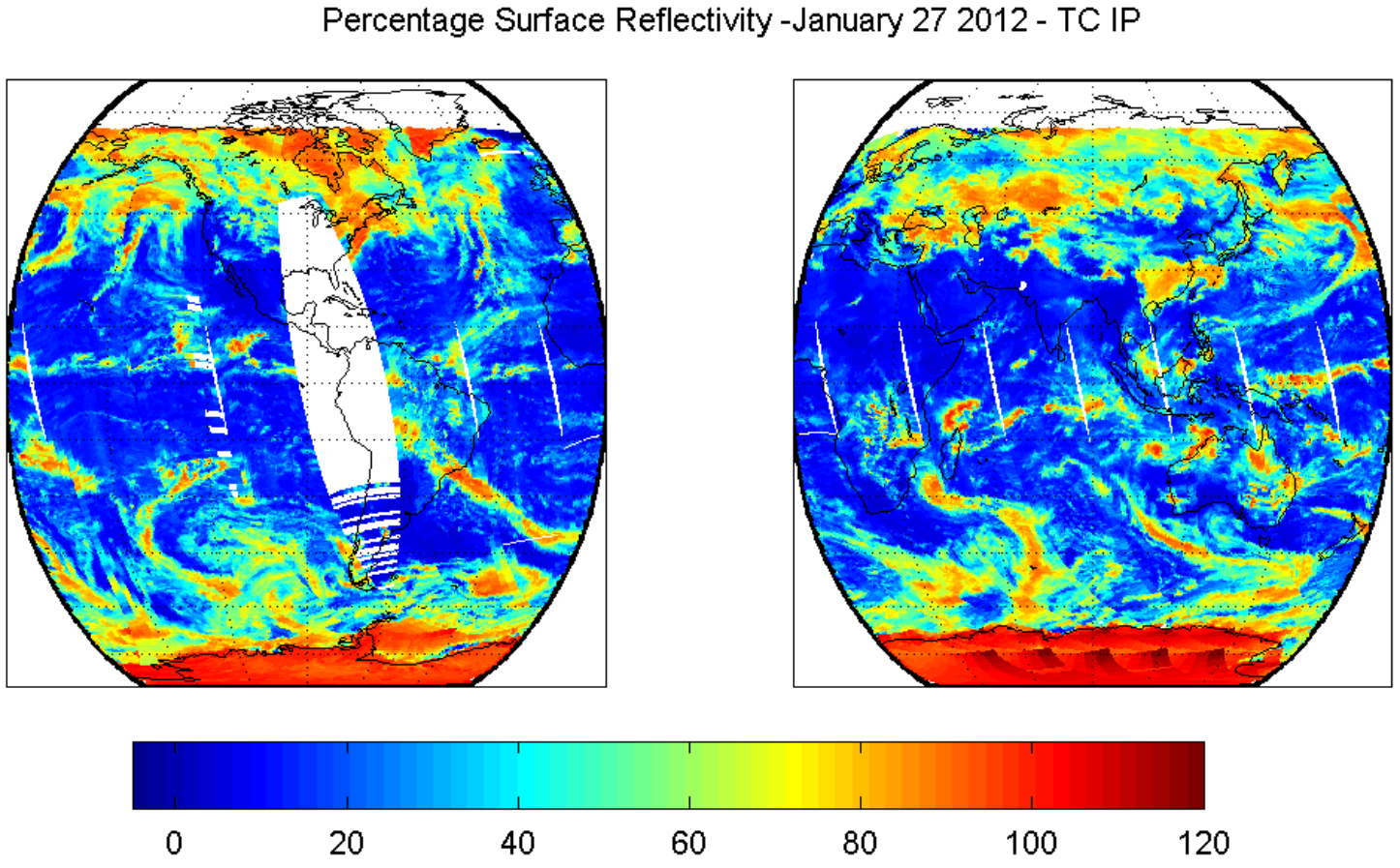
C. Seftor NASA/GSFC SSAI

OMPS TC IP Retrieval – January 27, 2012



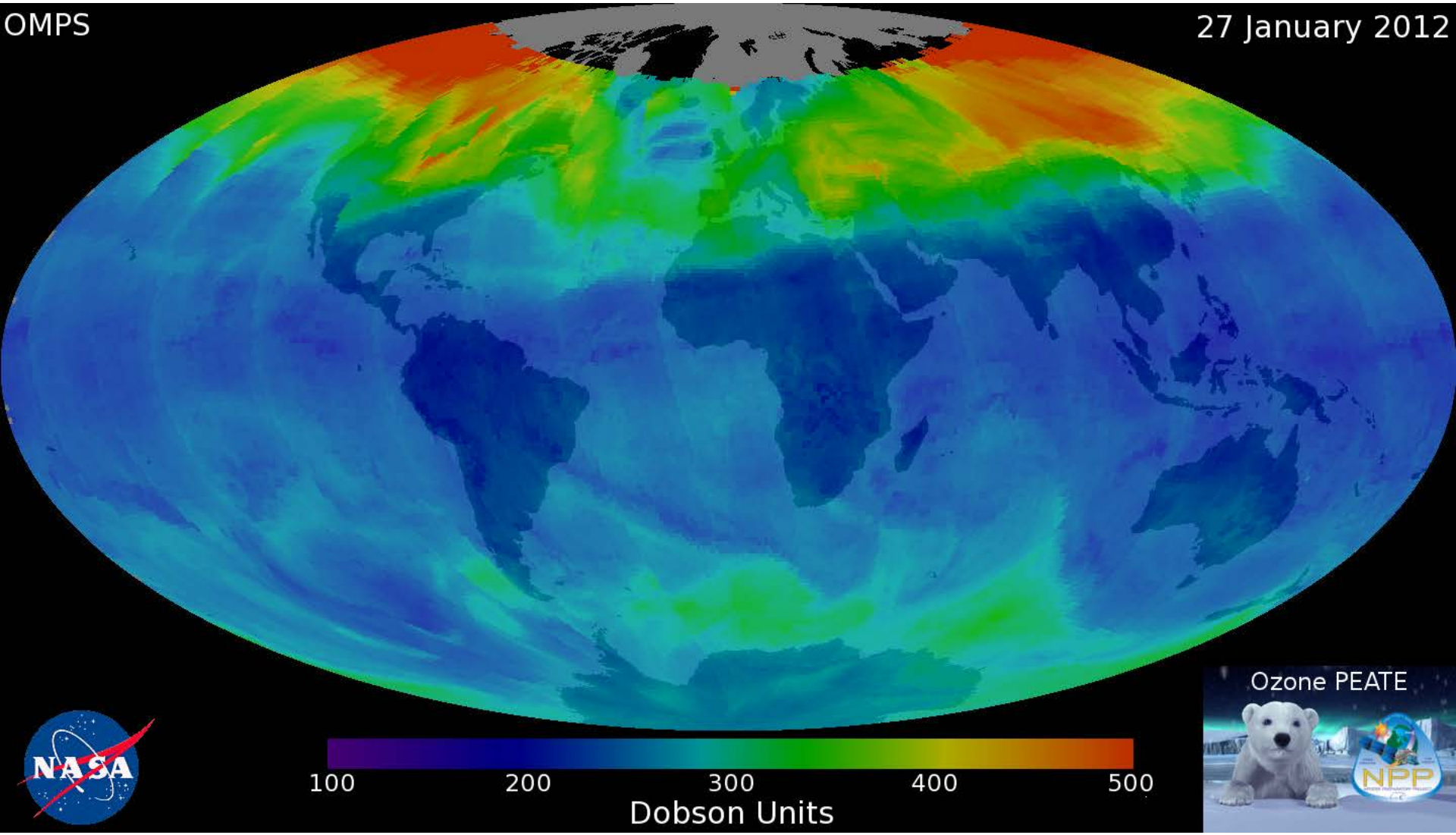
OMPS TC IP ozone values are plotted between 100 and 450 DU. Data as available on January 27. There are values outside of this range that need to be investigated. (M Novicki and B Sen, NGAS)

OMPS TC Surface Reflectivity – January 27, 2012



Surface reflectivity values between -5% and 120% are allowed by the OMPS TC EDR operational algorithm. Investigating ≈120% surface reflectivity values at high SZAs over Antarctic, southern Greenland and Hudson Bay. (M Novicki and B Sen, NGAS)

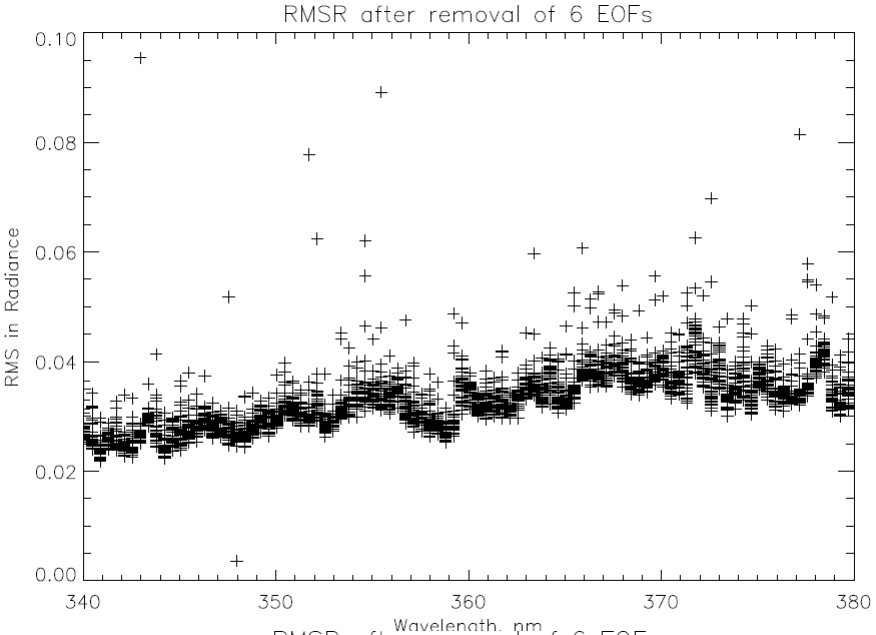
V8.6 Ozone Retrieval from NASA Ozone PEATE

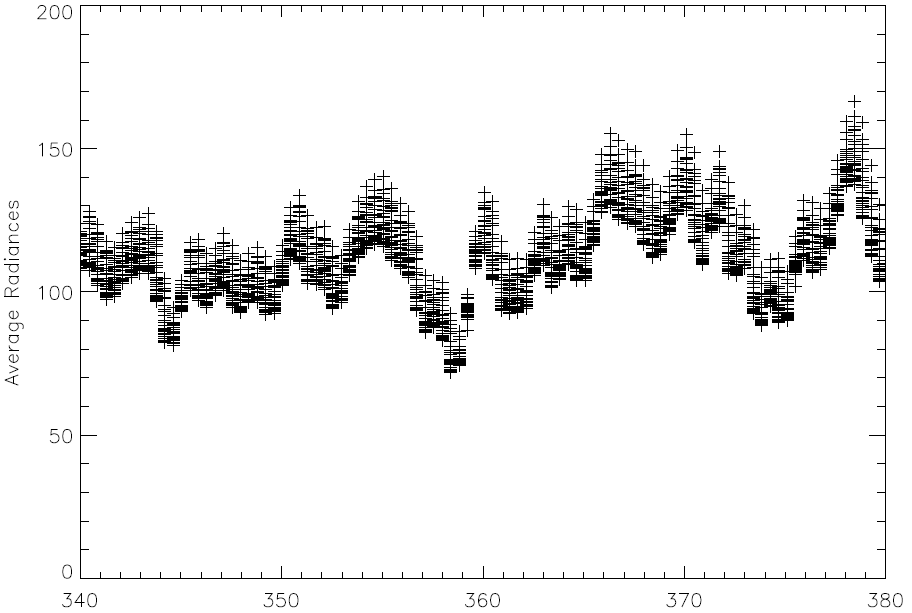


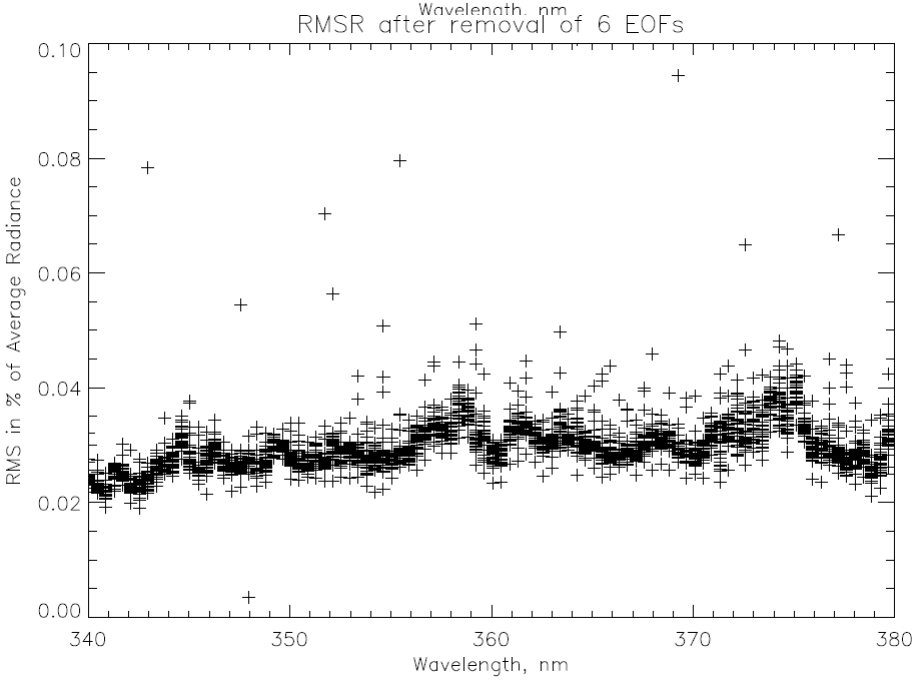
C. Seftor NASA/GSFC SSAI

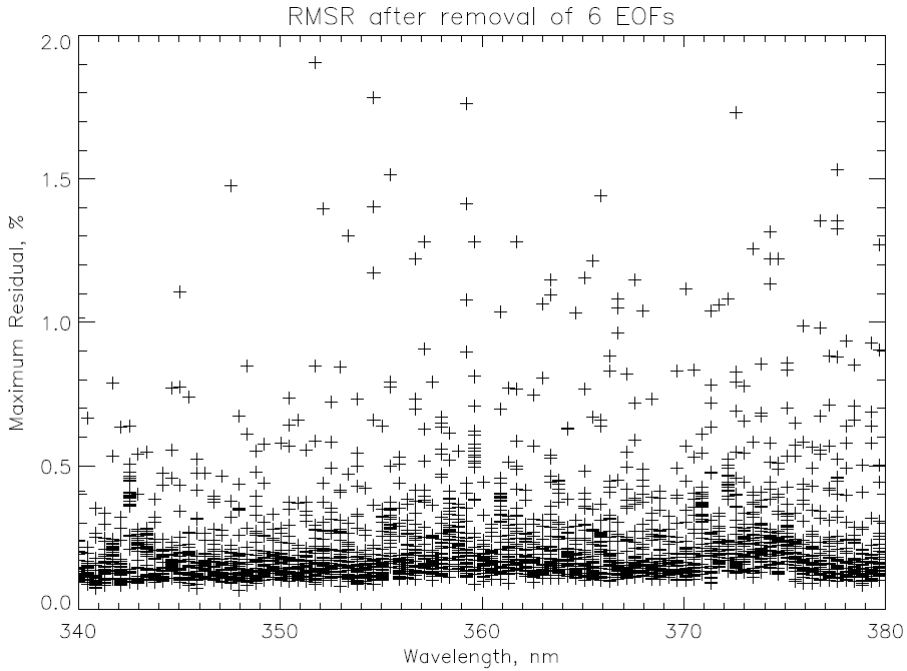
Backup

EOF/SNR analysis for six orbits OMPS NM on 1/28/2012

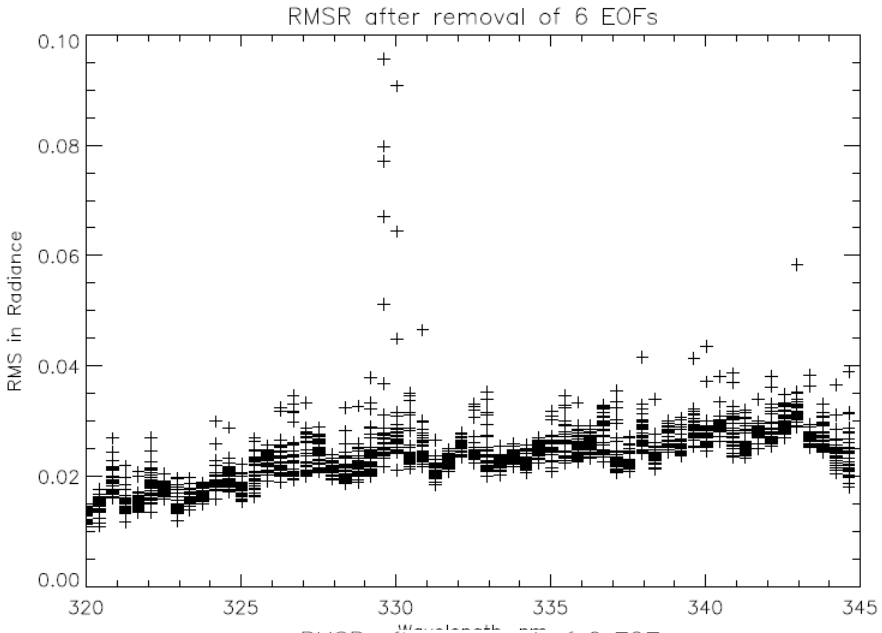


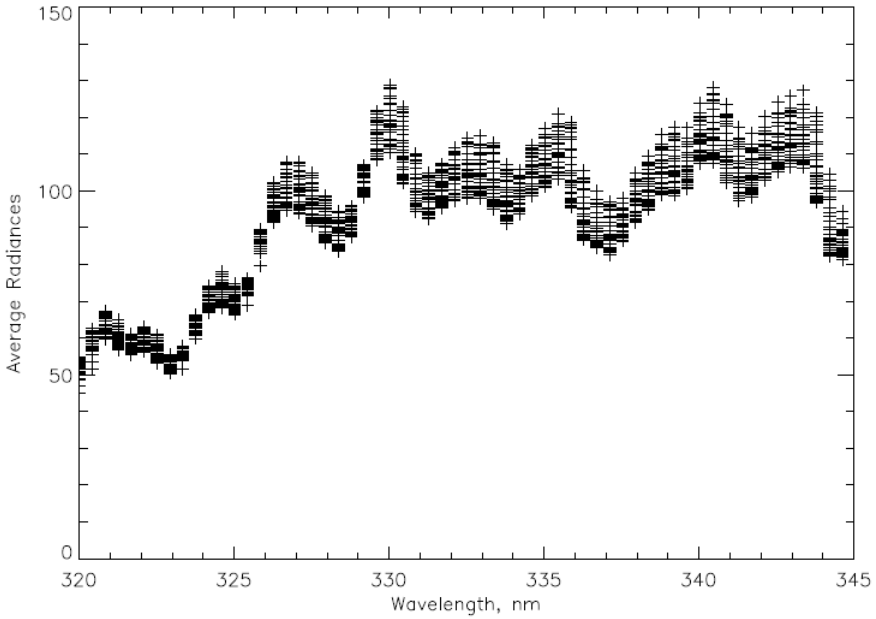


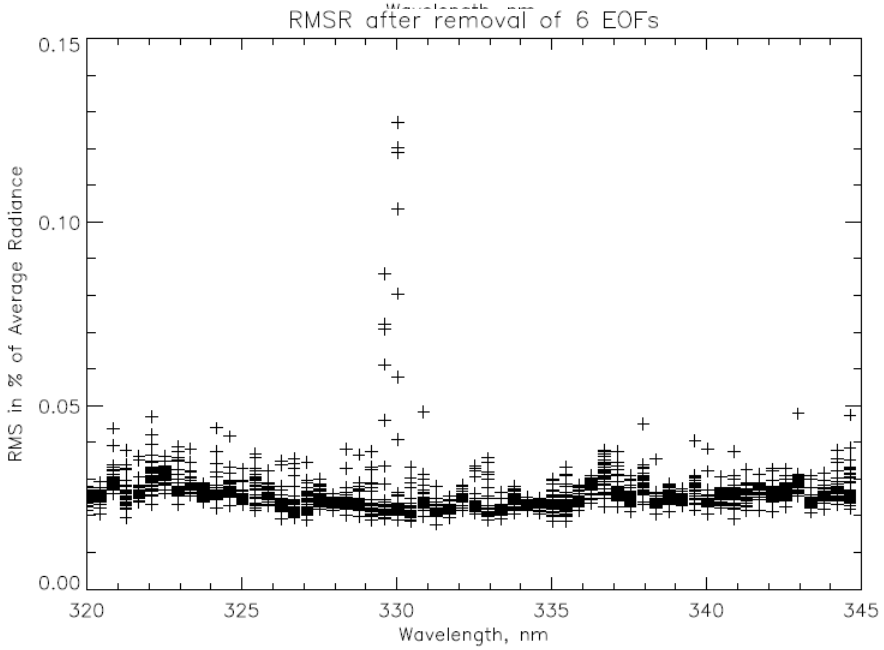


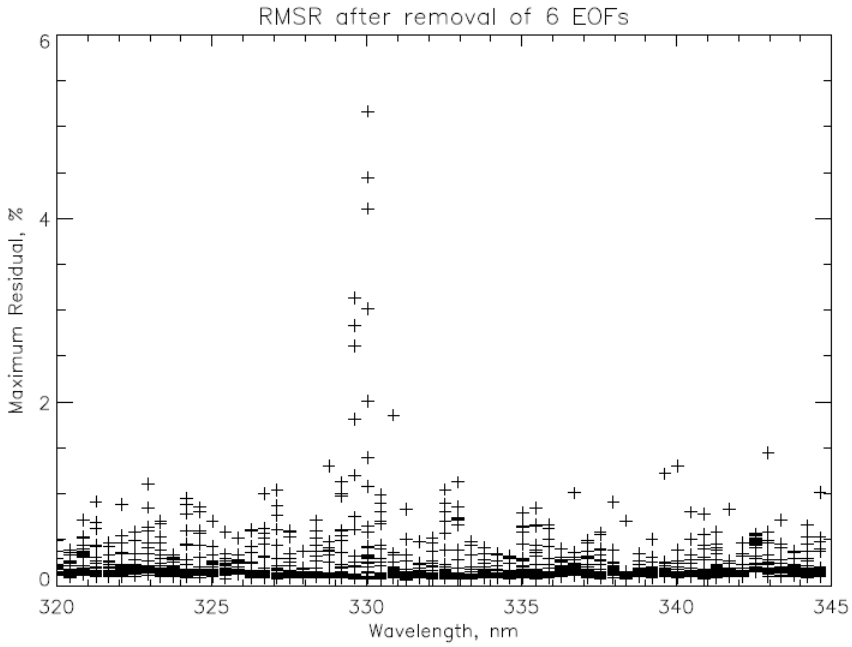


EOF/SNR analysis for six orbits OMPS NM on 1/28/2012

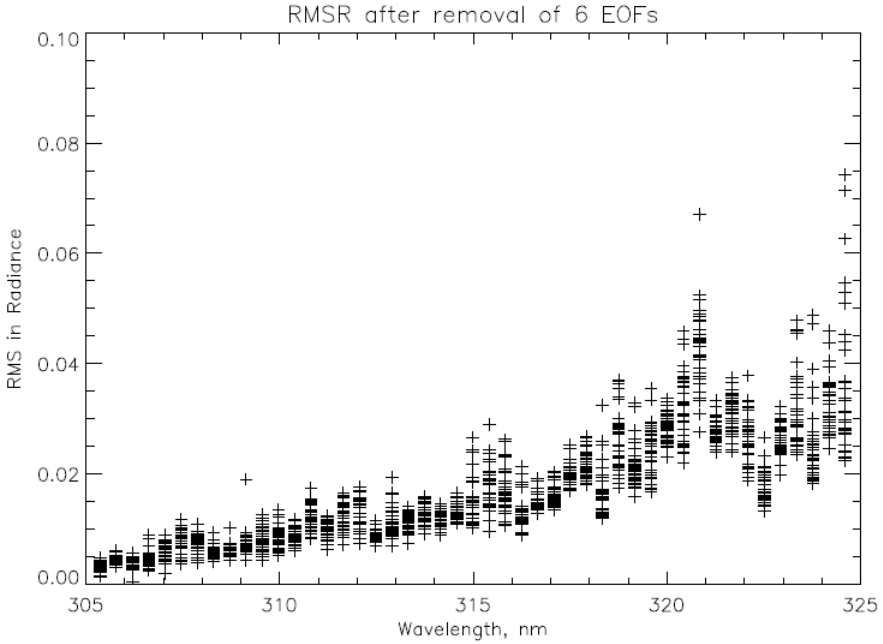


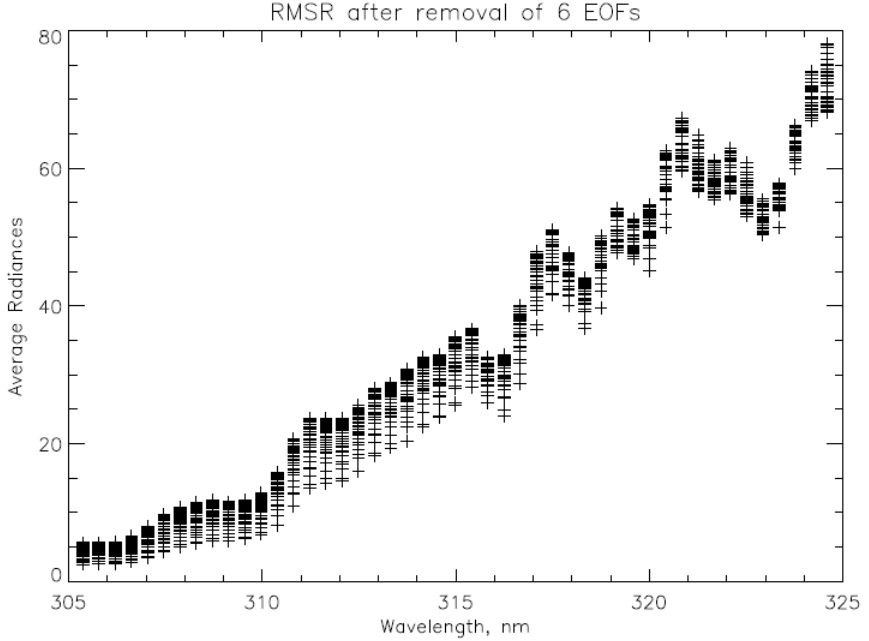


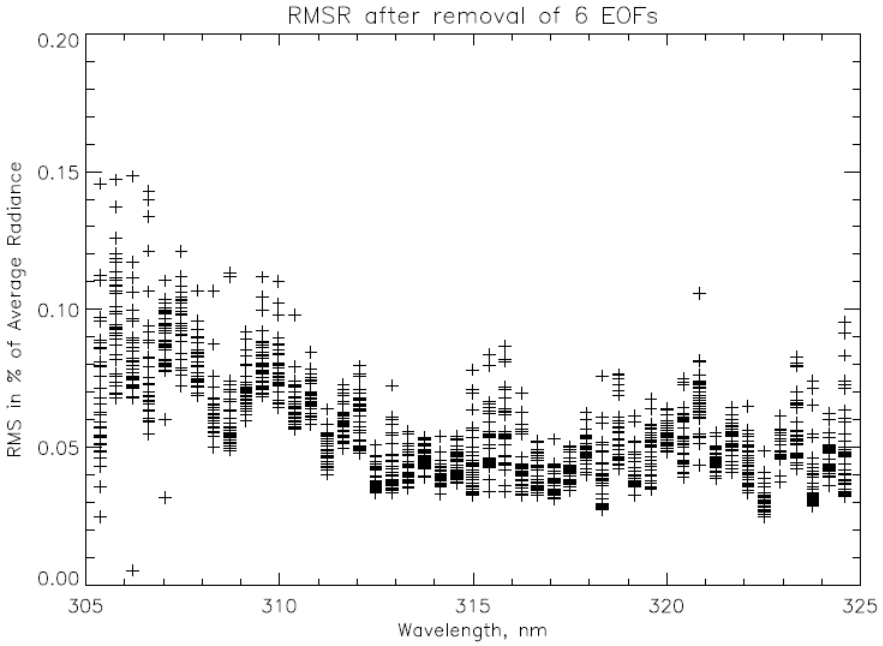


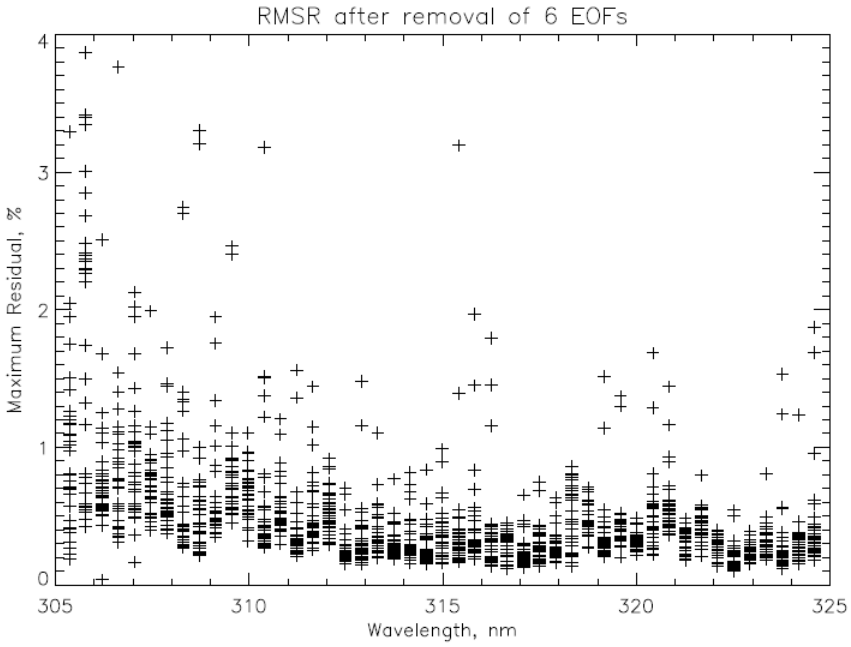


EOF/SNR analysis for six orbits OMPS NM on 1/28/2012









OMPS	RDR						
OMPS	SDR - Ozone TC Cal/EV	Science team rewriting code to sever ties between SD and EV components of code, and that will not be done before Build Mx1.6 freeze date	DO + 1m Mar 12	DO + 12m Feb 13	DO + 15m May 13		
OMPS	SDR - Ozone NP Cal/EV	No issues	DO + 1m Mar 12	DO + 12m Feb 13	DO + 15m May 13		
OMPS	SDR - Ozone TC Geo	No issues	DO + 1m Mar 12	DO + 3m May 12	DO + 6m Aug 12		
OMPS	SDR - Ozone NP Geo	No issues	DO + 1m Mar 12	DO + 3m May 12	DO + 6m Aug 12		
OMPS	EDR - Ozone TC	Post-launch verification required; anticipate the need for post-launch adaptation of the TOMS-EP Version 8 algorithm to OMPS TC to satisfy JPSS L1RD accuracy and precision requirements	DO + 2m Apr 12	DO + 6m Aug 12	DO + 8m Oct 12	DO + 10m Dec 12	DO + 15m May 13
OMPS	EDR(IP) - Ozone NP	No heritage performance requirements; post-launch verification of operability required and anticipate the need for post-launch adaptation of the SBUV/2 Version 8 algorithm to OMPS NP to satisfy JPSS L1RD accuracy and precision requirements	DO + 2m Apr 12	DO + 6m Aug 12	DO + 8m Oct 12	DO + 10m Dec 12	DO + 15m May 13
OMPS	X-Sensor Mapping - VIIRS to OMPS	No issues					
OMPS	X-Sensor Mapping - CrIMSS to OMPS	No issues					