



Integrated Cal/Val System (ICVS) for OMPS and SNPP OMPS SDR Data Reprocessing

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- OMPS performance monitoring at STAR ICVS
 - Calibration principle
 - Key performance parameters monitoring
 - Bias/Smear
 - Dark current/readout noise
 - Dark LUTs
 - Solar degradation monitoring
 - Instrument health and safety related parameters monitoring
 - Alerts
- STAR ICVS-beta website for S-NPP and J01
- S-NPP OMPS science SDR reprocessing





$$Q_{jk}^{c} = \frac{Q_{jk}^{ADC} - Q_{0}}{g \ m_{jk}} - Q_{k}^{s} - Q_{jk}^{dark} - Q_{jk}^{SL}$$

 Q_{jk}^{ADC} : raw counts at the output of the analog-digital-converter

g : non-linearity of the electronics chain

 $Q^{\scriptscriptstyle dark}_{\scriptscriptstyle jk}$: observed dark

$$L_{jk}^{m} = \frac{Q_{jk}^{r} k_{jk}^{r}}{\tau_{jk}(t)}$$

 L_{jk}^{m} : Observed earth radiance Q_{jk}^{r} : corrected earth view counts k_{jk}^{r} : radiance calibration coefficient

 au^{r}_{jk} : sensor response changes

 Q_0 : zero input response

- m_{jk} : relative pixel gain level
- Q_{ik}^{SL} : stray light

 Q_k^s : observed smear(contain the offset)

$$E_{jk}^{m}(t) = \frac{Q_{jk}^{i} k_{jk}^{i}}{g_{jk}(\theta, \phi) \rho_{jk}(t) \tau_{jk}(t)}$$

- E_{jk}^{m} : Observed solar irradiance
- Q_{jk}^{i} : corrected solar view counts
- $k_{jk}^{r^{n}}$: irradiance calibration coefficient
- g_{jk} : goniometric response
- ρ_{jk} : long-term solar diffuser reflectivity changes





ICVS monitoring of electronic bias and mean value and standard deviation for smear







ICVS monitoring of readout noise and mean value and standard deviation for dark current





NM/NP Dark Current LUT Updates



ICVS monitoring of NM/NP dark current LUT updates:

- Timely weekly updates of the dark current LUT for calibration
- Implementation of the weekly dark LUT (transition from red to green) into the Earthview SDR
- Expected steady increase of the dark current







NM/NP Dark Current LUT Updates



ICVS monitoring of NM/NP dark current LUT updates:

•Statistical plots and histograms are also included



Bin Starting Value (Counts/Second)



Normalized Solar Flux for NM and NP



• Solar flux time series are used to monitor diffuser degradation as well as sensor optical degradation

• Working diffuser data reflects both diffuser and optical degradation

 Reference diffuser measurement is used to estimate optical degradation



Solar Flux value are normalized by the first day measurement. Solar Flux Measurements show minimal degradation in NM and NP.

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Normalized Solar Flux from NP Diffuser





Solar Flux value are normalized by the first day measurement.



Normalized Solar Flux from NM Diffuser



SNPP OMPS Nadir Mapper Diffuser Position 4 Normalized Reference Diffuser Solar Flux Created at 08/03/2016 - 15:02:15 UTC



SNPP OMPS Nadir Mapper Diffuser Position 4 Normalized Working Diffuser Solar Flux Created at 08/03/2016 - 15:02:34 UTC



Solar Flux from NM diffuser position 1 and normalized by the first day measurement.





ICVS monitoring of parameters important to instrument health and safety, such as temperatures, electronic voltages and currents, and scan motor encoder output.







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S-NPP OMPS Dark LUTs Anomaly



•Green symbols were missing since 3/31 indicating bad dark data. Incorrect version (LE) of the OMPS-TC-DARKS-GND-PI was delivered to OPS.

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• IDPS reverted to table delivered on 3/21 and then reused the old LUT back two weeks ago. (Fig. 2)

• A new function has been implemented in ICVS to send out email warnings when there is bad dark current in SDR





OMPS EV Radiance Anomaly



• Anomalous EV radiance with many NAN values (blank in right map) was discovered on 4/4. The root cause is the little-endian TC dark LUT was accidently uploaded on 3/31.

•ICVS is implementing a near realtime monitoring algorithm to watch the quality of SDR products and send out email warnings when there is bad radiance in SDR Suomi-NPP OMPS Total Column Radiance at 331 nm, 2016/04/04









•ICVS is implementing a near real-time algorithm to monitor missing data, erroneous data and notapplicable data

•Filling value of -999.8 in radiance indicates missing data

•The granules with missing scans have none zero quality flag of N_Percent_Missing_Data

•Low latitude missing scan can be found in nearby granule



2015/12/28



2016/06/07



Fig 1. S-NPP OMPS TC missing scan color coded by solar zenith angle



Expected Anomaly Detection



Automated anomaly detection and email warnings are established for radiance and key performance parameters



uomi NPP OMPS Nadir Mapper Smear Counts Standard Deviation Updated: 05/19/2015 – 05:27:47 UTC

Time series of average OMPS NM dark smear counts for ten days



Transient in OMPS NP dark smear on orbit 18362 and image 24 for May 14, 2015

NM Solar Eclipse SDR Flags for 2015/03/20, Color Indicates View Angle



Solar eclipse as identified by OMPS eclipse flag



S-NPP Drag Maneuver

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Many OMPS parameters exhibited atypical behavior during/after S-NPP drag maneuver on Aug. 8, 2014. For example, Fig. 1 shows the CCD temperature abnormal for both NP and NM on Aug. 10, 2014. Most parameters are back to normal after the S-NPP drag maneuver. However, dark current increases permanently for both NP and NM as show in Fig. 2.



Figure 1. CCD temperature abnormal after Aug.10, 2014 S-NPP drag maneuver. Figure 2. Dark current increases after Aug.10, 2014 S-NPP drag maneuver.



STAR ICVS BETA Website

SNPP, J01 OMPS TC and NP Radiance images at STAR ICVS BETA website:

http://www.star.nesdis.noaa.gov/icvs-beta/





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OMPS Parameters Monitored by ICVS



Module	Parameters	Description
OMPS	EV Radiance	Global radiance map
SDR	Sensor Performance	Average and standard of Dark current, offset, smear
	Chasing Orbit Comparison	Reflectance comparison between SBUV/2 and OMPS
	SDR Quality Flags	solar eclipse events
	Dark Look-Up Table	Dark LUT statistics
	Linearity Calibration Reference LED	Reference LED counts statistics: left side, right side, earth view, full frame
	Solar Degradation	Solar flux Working diffuser and reference diffuse
OMPS	SDR Data Flags	Linearity correction, gain correction, bin imager, reorder image
RDR	Instrument Operational State	Fixed coadd count,
	SDR Table Version and ID	Gain correction, linearity correction, sample
	Instrument Temperatures	Housing, window, conduction bar, CCD
	Instrument Voltages	TEC error
	Instrument Currents	TEC, CCD output reset bias, CCD output drain bias
	OMPS Nadir System Operational State	Active Nadir Profile ID
	OMPS Nadir System Table Version and ID	Active timing pattern table version, timingpattern table ID
	OMPS Nadir System Temperatures	Signal board, timing board, telescope, calibration housing, diffuser motor
	OMPS Nadir System Voltages	CCD, signal board, timing board
	OMPS Nadir System Currents	Phase A motor drive, phase B motor drive
	OMPS Suite Software Version Control	Flight software version
	OMPS Suite Operational State	Calibration LED state, active main electronics box side
	OMPS Suite Temperatures	Motor driver board, SBC board, processor interface board
	OMPS Suite Voltages	TEC driver/reference, motor driver, CPE, motor/resolver electronics
	OMPS Suite Currents	Active calibration LED, CPE, TEC total





- ADL5.3
- Weekly updates of Dark LUTs
- Up-to-date static LUTs:

NP Table Name
OMPS-NP-OSOL-LUT
OMPS-NP-CALCONST-LUT
OMPS-NP-WAVELENGTH-GND-PI
OMPS-NP-BIAS-GND-PI
OMPS-NP-SDR-CC
OMPS-NP-CF-EARTH-GND-PI
OMPS-NP-STRAYLIGHT-LUT
OMPS-NP-LINEARITY-GND-PI

OMPS-NP-TIMING-PATTERN-GND-PI

TC Table Name
OMPS-TC-OSOL-LUT
OMPS-TC-CALCONST-LUT
OMPS-TC-WAVELENGTH-GND-PI
OMPS-TC-BIAS-GND-PI
OMPS-TC-SDR-CC
OMPS-TC-CF-EARTH-GND-PI
OMPS-TC-STRAYLIGHT-LUT
OMPS-TC-LINEARITY-GND-PI
OMPS-TC-TIMING-PATTERN-GND-PI

OMPS SDR Reprocessing Preliminary Results

- Tested run ADL4.2 with up-to-date LUTs
- OMPS daily nadir view N-value trending
 - OMPS daily nadir view N-value over Tropical Pacific region (20S-20N,90W-180W).



Fig. 1 OMPS NP daily nadir view N-value over Tropical Pacific region (20S-20N,90W-180W). Black: Operational; Red: Reprocessed



Fig. 2 OMPS TC daily nadir view N-value over Tropical Pacific region (20S-20N,90W-180W). Black: Operational; Red: Reprocessed





- Comprehensive near real time and long term instrument status and performance monitoring
- Real time support for sensor calibration activities
- Automated anomaly detection and email warnings are established for radiance and key performance parameters
- New parameters will be monitored according to requirements from OMPS SDR team
- S-NPP and J01 OMPS will be monitored at STAR ICVS-beta website
- ADL5.3 will be used in SNPP OMPS SDR Reprocessing





- Test run using ADL4.2 with up-to-date Look-Up-Tables.
- NP daily nadir view N-value over Tropical Pacific region
- N-value does not show obvious increasing with time after reprocessing.



02/12/2013: Start of weekly updates to NP dark LUT 03/18/2014: NP Stray Light correction

Fig. 1 OMPS NP daily nadir view N-value over Tropical Pacific region (20S-20N,90W-180W). Black: Operational; Red: Reprocessed

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NP daily nadir view N-value over Tropical Pacific region





Fig. 1 OMPS NP daily nadir view N-value over Tropical Pacific region (20S-20N,90W-180W). Black: Operational; Red: Reprocessed





- Test run using ADL4.2 with up-to-date Look-Up-Tables
- TC daily nadir view N-value over Tropical Pacific region
- N-value does not show obvious increasing with time after reprocessing.



Fig. 2 OMPS TC daily nadir view N-value over Tropical Pacific region (20S-20N,90W-180W). Black: Operational; Red: Reprocessed



NOAA





Fig. 2 OMPS TC daily nadir view N-value over Tropical Pacific region (20S-20N,90W-180W). Black: Operational; Red: Reprocessed

Some Missing Scan can be Found in nearby Granule



• Radiance and geolocation of a TC SDR granule with missing scan. Time stamp is d20160607_t0548498_e0549272_b23890

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•The above missing scan can be found in a nearby granule. Time stamp is d20160607_t0548198_e0548572_b23890

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