VIIRS Block 2.0 System Verification

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NOAA/NESDIS/STAR

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Outline

- Background
- Verification of Block 2.0 system using SNPP data
  - Comparing Block 2.0/Block 1.2 GEO, SDR, and RDR products.
- Verification of Block 2.0 system using proxy J1 RDRs
  - J1 code change verification;
  - Verification of J1 SDR production.
- Summary

Background

- SNPP VIIRS SDRs is currently produced using Block 1.2 IDPS;
- JPSS-1 (J1) will be launched in 2017;
- Block 2.0 system that supports both SNPP and J1 SDR product generation is under extensive testing:
  - New code changes and SDR product improvements have been integrated to Block 2.0 for VIIRS SDRs
- SNPP ground processing will be switched to Block 2.0 IDPS
  - After Operational Readiness Review (ORR)
- Verification of Block 2.0 system test results is on going.

Purpose

To verify Block 2.0 system for VIIRS SDR production:

- Through Block 1.2/2.0 comparison, verify if SNPP VIIRS SDR products can be generated correctly using the Block 2.0 system

  In the Block 2.0 system, SNPP and J1 VIIRS share the same SDR science code, the SNPP comparison results will also apply to J1 VIIRS SDR products that are not changed.

- Using J1 proxy RDRs to verify if Block 2.0 can produce J1 VIIRS SDR products as expected.

Part 1 Block 1.2 and Block 2.0 Comparison

- **OBSAT (Operational Based Site Acceptance Test) test results verification (November 2015)**
  - Focused on # of VIIRS SDR product files

- **LG2 (L3AT/GPAT/GSAT) test results verification (June 2016)**
  - Block 2.0 and Block 1.2 SNPP VIIRS SDR products were compared in detail:
    - # of VIIRS SDR product files
    - I-bands, M-bands, DNB radiances
    - Geolocation
    - M11 at night
    - Sector rotation data

Part 1 Block 1.2 and Block 2.0 Comparison

- **OBSAT test results verification:** **issue of missing granules (esp. for M-band) in Block 2.0 was identified and the feedback sent to the program.**
- **LG2 test results verification:** **Small # of missing granules still exist, but significantly less than OBSAT.**

VIIRS SDR Products	20160408		20160409	
	BLK2	BLK1.2	BLK2	BLK1.2
I-bands SDR	1044	1013	986	1014
DNB	1044	1013	986	1014
M-bands SDR	1012	1013	939	1014
GIMGO/GITCO	1012	1013	939	1014
GDNBO	1012	1013	939	1014
GMODO/GMTCO	1012	1013	939	1014

Part 1 Block 1.2 and Block 2.0 Comparison

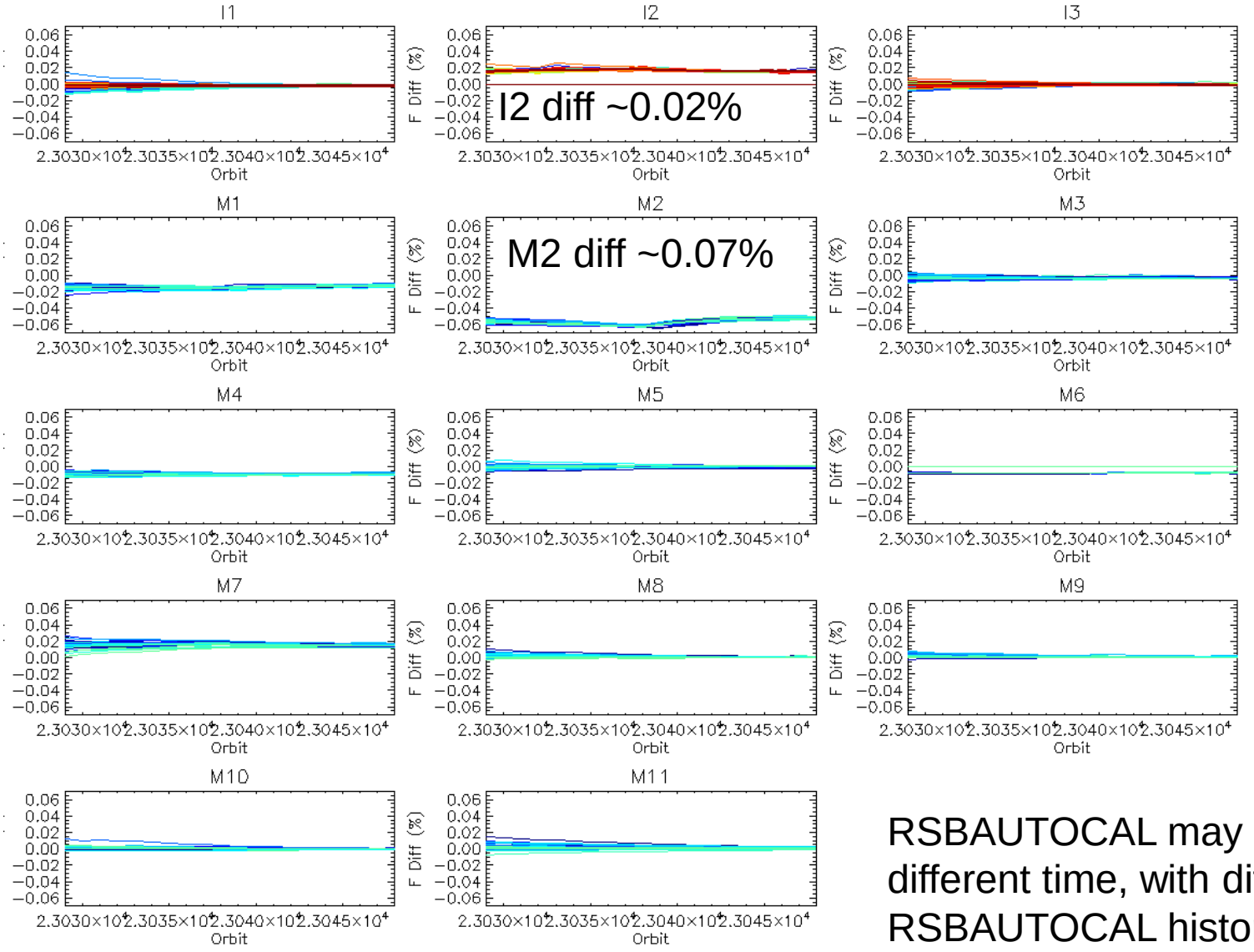
- **Block 2.0 I-bands, M-bands, DNB radiances are generally consistent with those produced by Block 1.2:**
  - RSB differences are less then 0.1% in worst cases (M2, I2);
  - DNB differences are less than 0.5%, and differences become smaller over time;
  - TEB radiances are consistent.

- **Geolocation:**
  - Block 2.0 and Block 1.2 are consistent in majority of data
  - NOVAS update in Block 2.0 causes small differences (not an issue);
  - **More TLE usages/gap interpolation were found in Block 2.0 →cause differences geolocation.**

- **Sector rotation data from Block 2.0 and Block 1.2 are consistent.**

- **M11 at night SDR from Block 2.0 are generally good.**

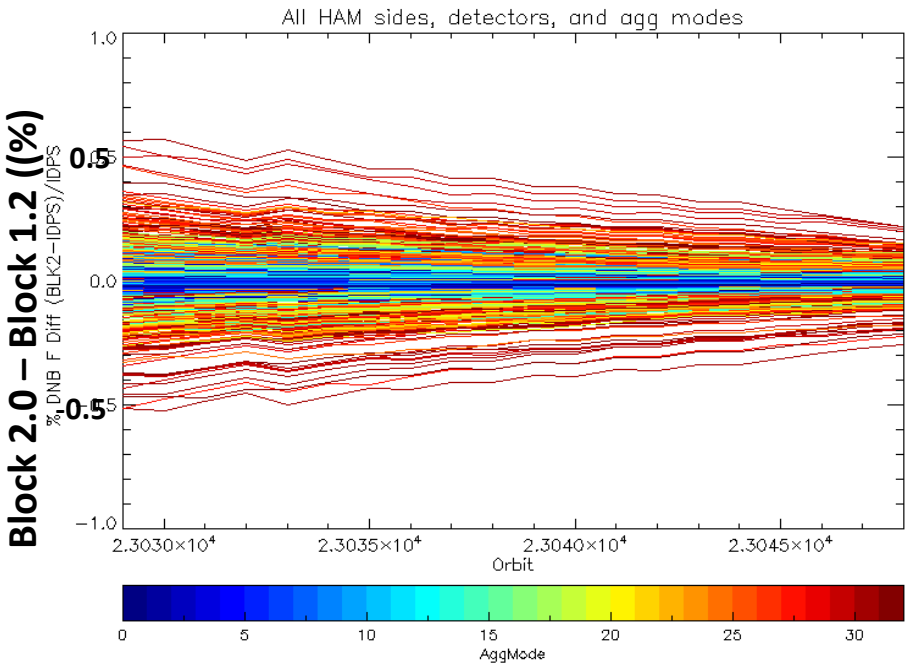
Comparing RSB F-factors (Block 2.0 versus Block 1.2)

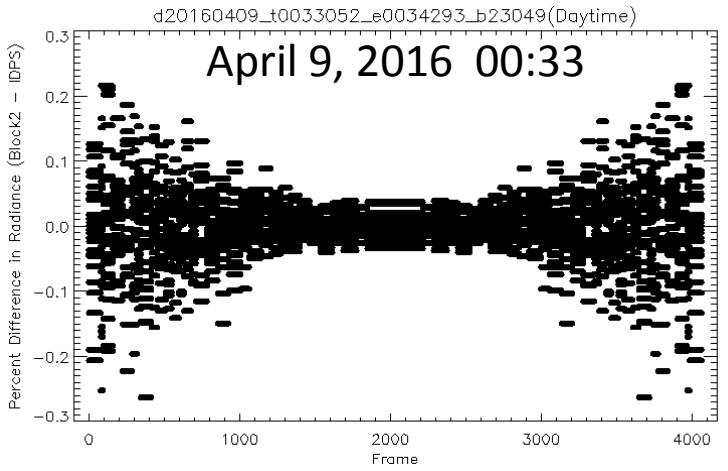


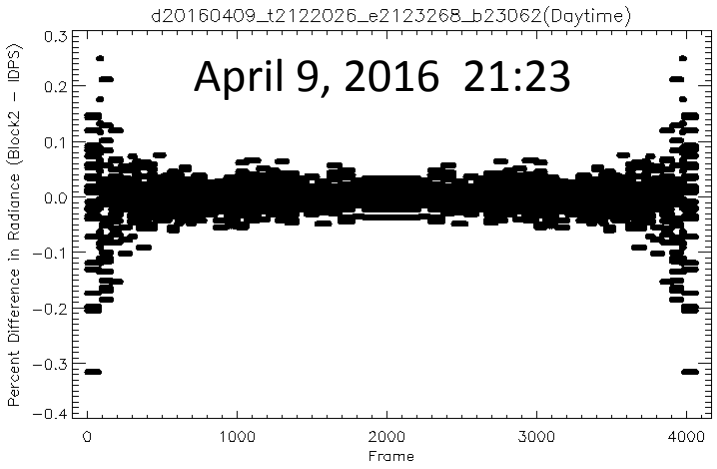
RSBAUTOCAL may started at a different time, with different RSBAUTOCAL history.

Comparing DNB LGS gain (Block 2 versus Block 1.2)

DNB LGS differences are less than 0.5%
Differences become smaller over time



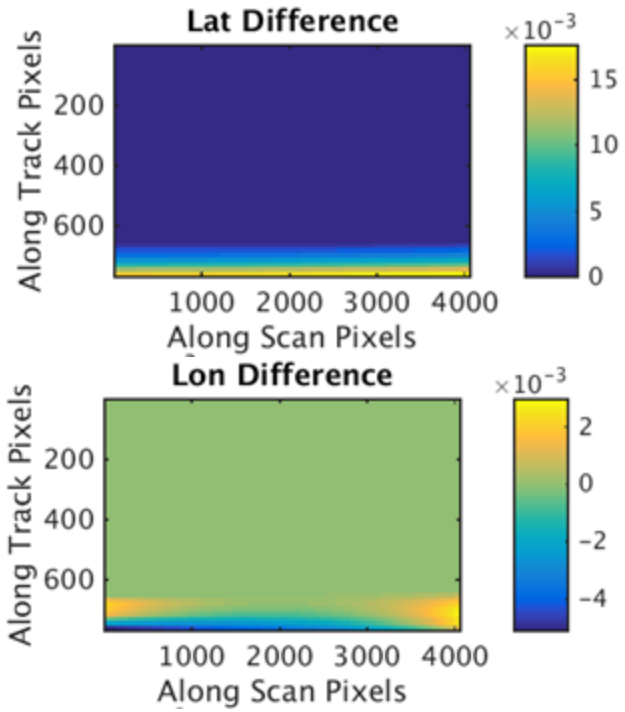




All other DNB calibration LUTs are consistent.

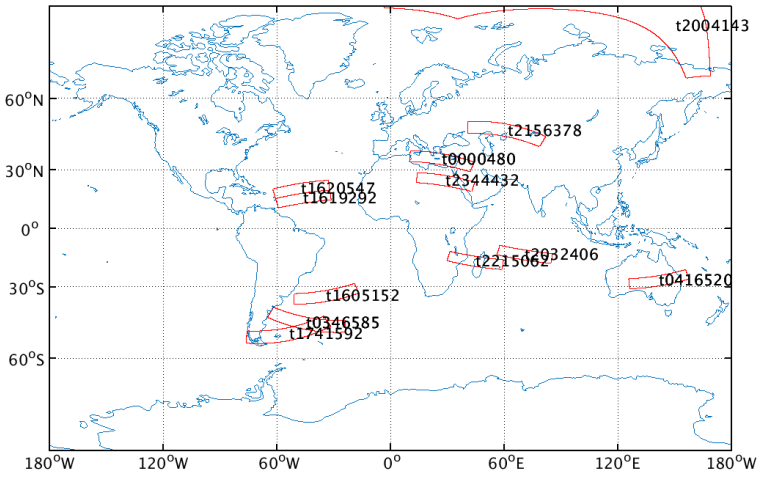
Geolocation (Non-Terrain Corrected)

April 8, 201616:19



- **Large latitude differences (0.017 degree) at low latitude were observed;**
- The large differences are due to TLE usage or gap interpolation based on quality flags.

20160408	TLE Usage	GAP Interpolation
Block 2.0	4	57
Block 1.2	1	12

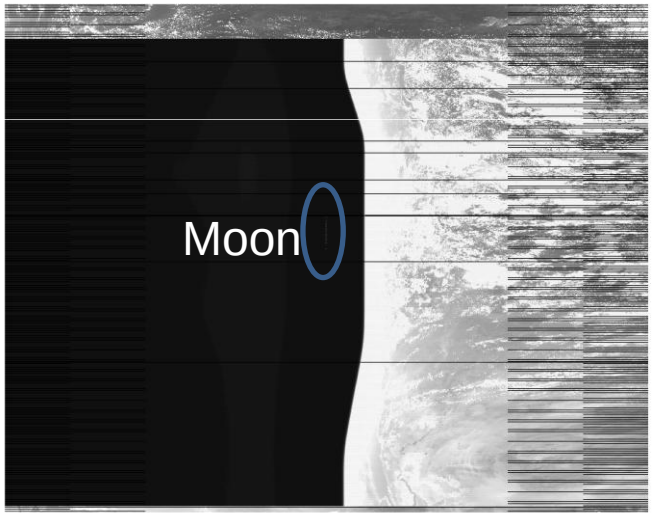


Sector Rotation Data Comparison

d20160417_t1136483_e1151018

M1 DNs

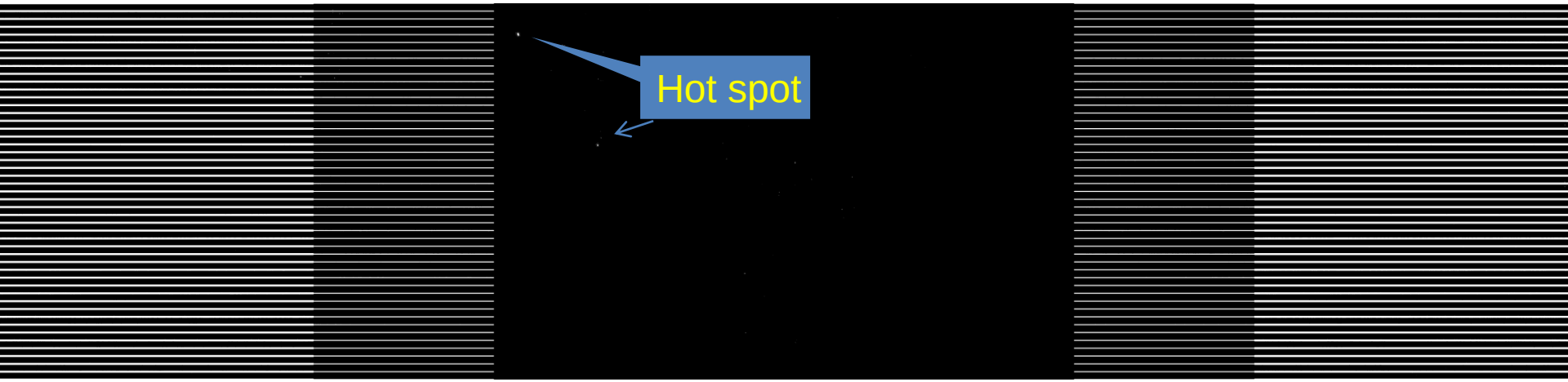
M15 DNs



- Sector rotation data between Block 2.0 and Block 1.2 are consistent.

VIIRS M11 at Night

- Block 2.0 M11 nighttime radiances are generally good.
  - Block 1.2 does not support M11 nighttime data.



- Minor issues:
  - Block 2 M11 nighttime reflectance is a mixture of 0s and filling values, should be all fill values.
  - QF1 “reflectance out of range” bit should always be set to 1.

Part 2: Block 2.0 Verification Using Proxy J1 VIIRS RDRs

- Four proxy J1 RDRs were generated by the Raytheon Test Data Working Group;
- MDR_27, MDR_39, and MDR_47 were used for verification.

Name	Description	Note
MDR_28	Canned SNPP data	Cannot represent J1 conditions in some cases.
MDR_27	J1 Day-in-life, TVAC, cold/hot	Good for GEO testing and verification; HAM start enc not very stable in SCE Side-A; DNB CAL : good; RSB/TEB CAL: Tdet&Telec out of range.
MDR_39	J1 FP-X nadir alignment test, Ambient	Good for GEO testing and verification, esp. for DNB SCE Side-B RDR only HAM start enc is stable DNB: not good dp_dnb_dark_sub_eth disabled; RSB/TEB: Tdet out of range.
MDR_47	J1, Flight Operation (FOP), TAVC	Good for GEO testing and verification; Two granules that are good for CAL verification.

Note: S-NPP spacecraft ephemeris and attitude data were used in all 4 proxy J1 RDRs.

Verification of J1 GEO code changes

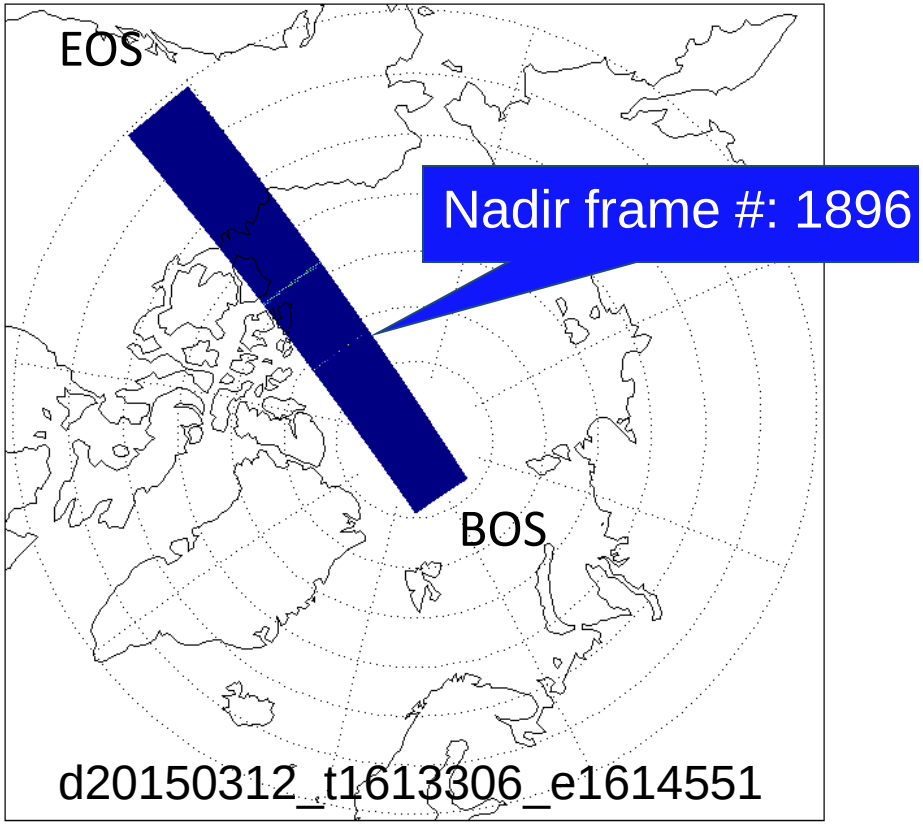
- Two J1 VIIRS GEO code changes have been developed and integrated to Block 2.0 to accommodate:
  - J1 DNB aggregation mode change (PSAT17)
  - Different TEL/HAM start encoder nominal, identify by Gary Lin from VCST (PSAT21)

- The GEO code changes were verified using:
  - ADL_5.3_PSAT21 ;
  - MDR 27, MDR_39, and MDR_47;
  - J1 prelaunch GEO PARAM LUTs.

- Both code changes perform as expected.

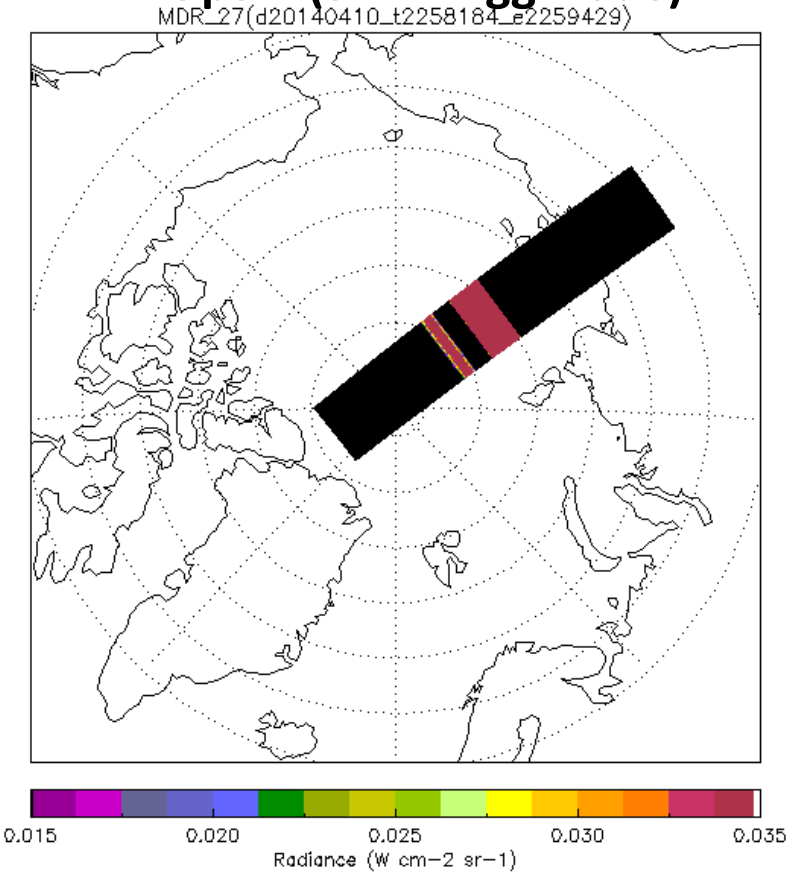
Verification of J1 GEO Code Change to Accommodate J1 DNB AggMode Change

MDR_39
DNB Op21 (baseline option for J1)



MDR_39 DNSs were used for plotting due to limitations in this proxy J1 RDR.

MDR_27
DNB Op32 (SNPP AggMode)



MDR_27 is good for GEO and DNB CAL verification.

Verification of J1 GEO Code Change

to Accommodate Different Start TEL/HAM Encoder Nominal

- Block 2 VIIRS SDR science code support both SNPP and J1 TEL/HAM start encoder nominal values.
  - J1 VIIRS geolocation products can be generated successfully using thress proxy J1 VIIRS RDRs that contain real J1 engineering data (MDR_27, MDR_39, MDR_47)

MDR 27

Side-A:

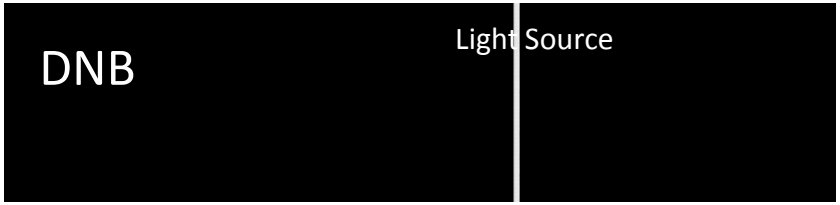
```
Check_Tel_Start_Not_Nominal: start value: 31002 sensorModel:3  SCEside:0 NOMINAL:31002
Check_Tel_Start_Not_Nominal: start value: 31002 sensorModel:3  SCEside:0 NOMINAL:31002
Check_Tel_Start_Not_Nominal: start value: 31002 sensorModel:3  SCEside:0 NOMINAL:31002
 Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:0 NOMINAL:10579
 Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:0 NOMINAL:10579
 Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:0 NOMINAL:10579
 Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:0 NOMINAL:10579
 Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:0 NOMINAL:10579
 Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:0 NOMINAL:10579
 Check_Ham_Start_Not_Nominal: start value: 10580 sensorModel:3 SCEside:0 NOMINAL:10579
 Check_Ham_Start_Not_Nominal: Non Nominal Value Detected
 Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:0 NOMINAL:10579
```

Side-B:

```
Check_Tel_Start_Not_Nominal: start value: 30986 sensorModel:3  SCEside:1 NOMINAL:30986
Check_Tel_Start_Not_Nominal: start value: 30986 sensorModel:3  SCEside:1 NOMINAL:30986
Check_Tel_Start_Not_Nominal: start value: 30986 sensorModel:3  SCEside:1 NOMINAL:30986
: Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:1 NOMINAL:10579
: Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:1 NOMINAL:10579
: Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:1 NOMINAL:10579
: Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:1 NOMINAL:10579
: Check_Ham_Start_Not_Nominal: start value: 10579 sensorModel:3 SCEside:1 NOMINAL:10579
```

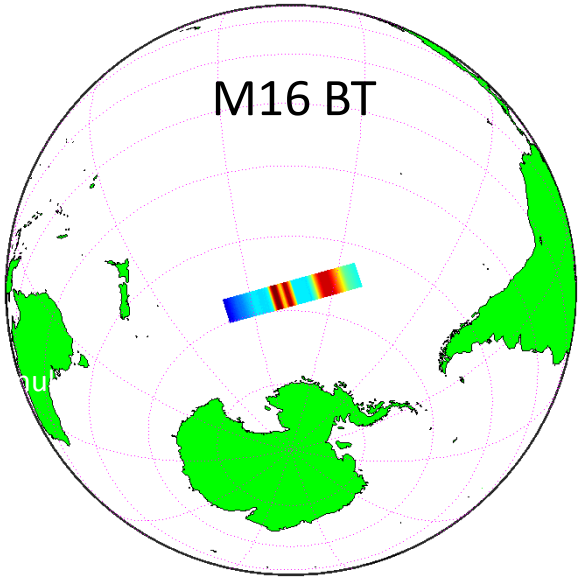
- The code change was backward compatible with SNPP (verified using SNPP RDRs).

Verification of J1 SDR Production



By Slawomir Blonski, STAR VIIRS SDR team

- GEO and RSB/DNB/TEB SDR products were generated successfully using:
  - ADL5.3_PSAT21
  - MDR_47 J1 VIIRS proxy RDRs:
  - Version 2 of J1 prelaunch calibration LUTs (recently delivered to the JPSS program on July 15, 2016)



Verification of J1 SDR Production (Minor Issue with TEB QF)

- In MDR_47, cold FPA temperature was near the nominal value of 80.5 K;
- *Poor quality flag for all pixels were triggered due to non-nominal LWIR-FPA temperatures, occurs for all LWIR bands: M14-M16;*
- **Nominal LWIR-FPA temperatures are hardcoded, SNPP and J1 have different values but use the same addresses;**
- *Require code change.*

Nominal Cold FPA temperature settings :

- S-NPP (EDD154640-104_R_V8)

1.	78 K	0 0
2.	80 K	1 0
3.	82 K	0 1

FT_LW_80K_SETPT

FT_LW_82K_SETPT

JPSS-1 vs. S-NPP: different names,

- JPSS-1 (EDD154640-109D_v13)

1.	80.5 K	0 0
2.	82.0 K	1 0
3.	83.5 K	0 1

FT_LW_82_0K_SETPT

FT_LW_83_5K_SETPT

but the same addresses (IDs)

By Slawomir Blonski, STAR VIIRS SDR team

Summary

- Block 2.0 system has been verified through:
  - Comprehensive comparisons of Block 2.0 and Block 1.2 SDR products for SNPP VIIRS using OBSAT and LG2 test data.
  - Using proxy J1 VIIRS RDRs.
- Block 2.0 system works well for SNPP/J1 SDR productions, with only some minor issues:
  - Small # of missing granules;
  - More TLE usage/gap interpolation;
  - Hard-coded nominal LWIR-FPA temperature.
- VIIRS SDR team will continue to support the program on further verification actives:
  - Post LG2 verification in September 2016;
  - When new J1 test data become available, J1 spacecraft TVAC data based RDRs will be very valuable for further Block 2.0 verification.