

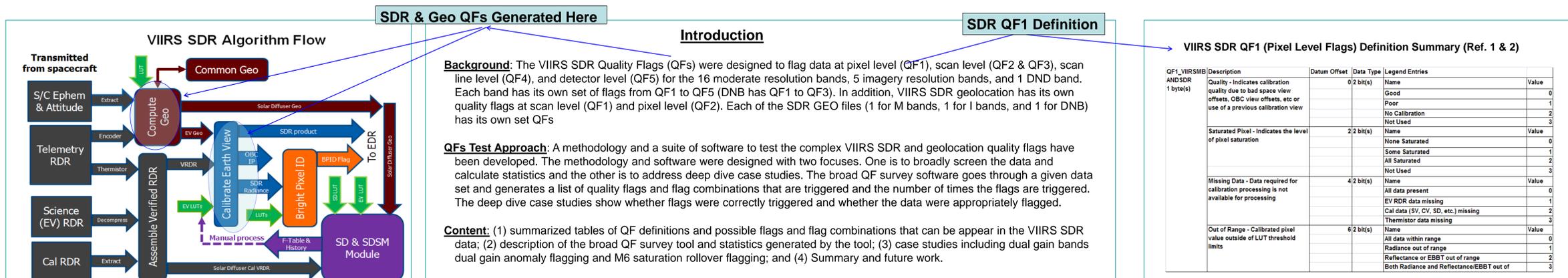


S-NPP VIIRS SDR Quality Flags Testing Methodology



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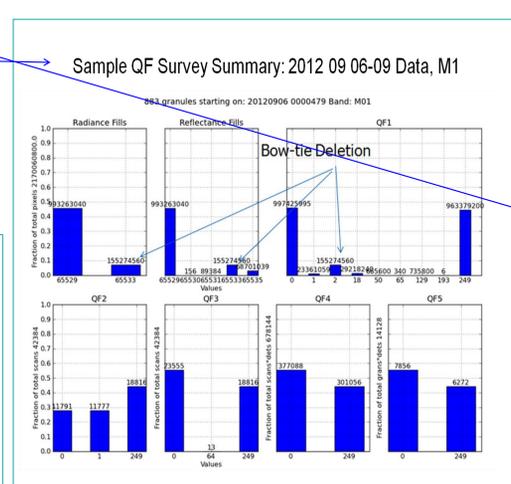
- Broad QF survey tool**
- generate a list of quality flags and flag combinations that are triggered
 - keep track of the fill values
 - calculate statistics
 - keep track of granules in which a particular flag was triggered
- Data Set Screened**
- 20120308: 73 granules, (in 1 orbit) Data Set Screened
 - 20120308: 73 granules, 39 Day time & 34 night time (in 1 orbit)
 - 20120318: 73 Granules, 40 day time & 33 night time (in 1 orbit)
 - 20120402: 309 day time granules
 - 20120811-13: 952 granules
 - 20120906-08: 883 granules
- Problems Found**

VIIRS SDR QF1 Common Flags Observed

| QF1 Definition | Decimal | Binary | Observed | Comments |
|--|---------|----------|----------|---|
| Poor Cal, DGA (DGB), stray light (DNB), Moon convoluted Space view | 1 | 1 | Y | DGA is confirmed: Stray light flag to be implemented: Moon in Space View is confirmed |
| No Cal, Bow-tie deletion | 2 | 10 | Y | Confirmed |
| Poor Cal, Some pix Sat | 8 | 101 | Y | DG bands only. The information is lost for 5G bands. Seen from M7, M6, M4, M3 52 granules case. |
| Poor Cal, All pix Sat | 9 | 1001 | Y | Have seen from M6, M6, M10, M11, M12. Not seen from DG |
| Poor Cal, Cal Data Missing, Replacement found | 33 | 100001 | Y | Seen from data screened |
| Poor Cal, Therm Data Missing, Replacement found | 48 | 110001 | Y | Seen from data screened |
| Poor Cal, Ref out of Range | 65 | 1000011 | Y | Seen from data screened |
| Poor Cal, Refl out of Range | 129 | 10000001 | Y | Seen from data screened |
| Poor Cal, Both Rad & reflBT out of range | 193 | 11000001 | Y | Seen from data screened |
| No Cal, RDR Data Missing | 18 | 10010 | Y | Seen from data screened |
| No Cal, Cal Data Missing, replacement not found | 34 | 1001010 | Y | Seen from data screened |
| No Cal, Therm Data Missing, replacement not found | 50 | 110010 | Y | Seen from data screened |

VIIRS SDR QF1 Flags Combinations Explained

| Quality Flag | Value | Estimated Pixel Flag | Value |
|---|-------|---|-------|
| Name | Value | Name | Value |
| None Saturated | 0 | None Saturated | 0 |
| Some Saturated | 1 | Some Saturated | 1 |
| All Saturated | 2 | All Saturated | 2 |
| Not Used | 3 | Not Used | 3 |
| Missing Data | 4 | Missing Data | 4 |
| All data present | 5 | All data present | 5 |
| EV RDR data missing | 6 | EV RDR data missing | 6 |
| Cal data (SV, CV, SD, etc.) missing | 7 | Cal data (SV, CV, SD, etc.) missing | 7 |
| Radiance out of range | 8 | Radiance out of range | 8 |
| Reflectance or EBBT out of range | 9 | Reflectance or EBBT out of range | 9 |
| Thermistor data missing | 10 | Thermistor data missing | 10 |
| Both Radiance and Reflectance/EBBT out of range | 11 | Both Radiance and Reflectance/EBBT out of range | 11 |
| None Saturated | 12 | None Saturated | 12 |
| Some Saturated | 13 | Some Saturated | 13 |
| All Saturated | 14 | All Saturated | 14 |
| Not Used | 15 | Not Used | 15 |
| Missing Data | 16 | Missing Data | 16 |



SDR QF1 Quality Flag "not Used" Triggered (QF1 = 35)

Data Missing: Cal data missing Quality: Not Used

Binary: 100011

Decimal: 35

Therm Missing, replac found All Pix Sat QF1 Quality: Poor

Binary: 11111001

Decimal: 249

Both Rad and refl Out of Range

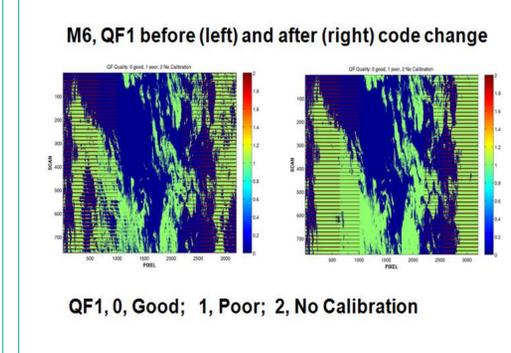
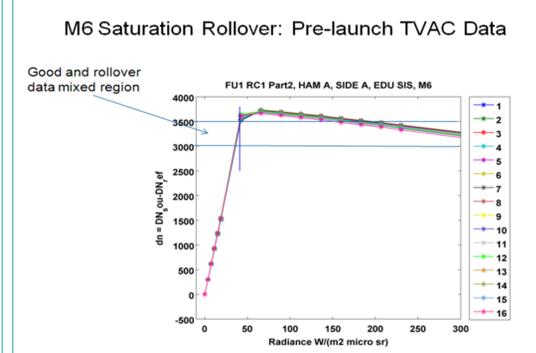
Flag 249 (11111001), representing "Poor Cal, Therm Data Missing, Replacement found, All pix Sat, Both Rad & reflBT out of range", is used as fill value

Case Study Example: M6 Saturation Rollover Flagging

- It was observed from histograms analysis that M6 SDR contains a large amount of saturation rollover data mixed with good data
- This discovery led to an operational software change to flag the mixed data region correctly (DR4698)
- The code change was delivered and incorporated into operational code (Mx6.2)

Good and roll over data mixed

Good data cut off 41



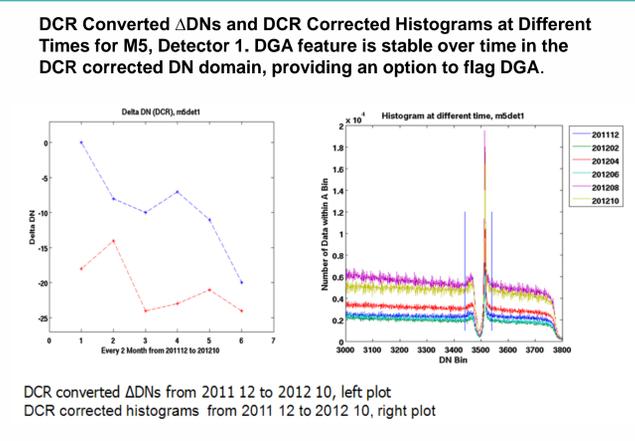
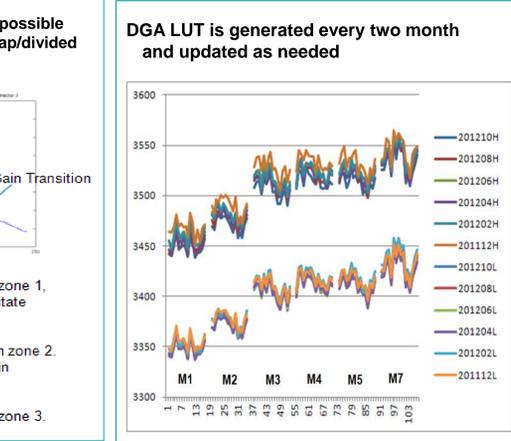
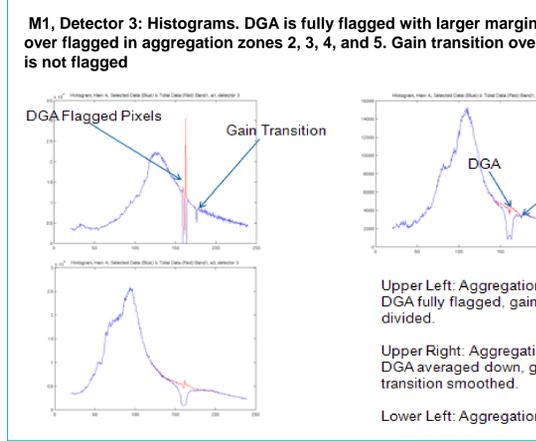
- Methodology to filter out saturation rollover data and keep the good data is being investigated
- Band pair M6 and M7 showed the best results (similar analysis was done for a number of granules, only one example shown)

VIIRS Band PairBand7 Radiance

Case Study Example: Dual Gain Anomaly (DGA) and Gain Transitions

- VIIRS dual gain bands DGA show in both raw RDR and SDR histograms
- NG has developed an algorithm support function to generate LUT to flag DGA
- Dual gain bands gain transition overlap/divided was observed post-launch with histograms analysis. The gain transition overlap/divided changes with the change of the calibration LUTs (Ref. 3)
- Gain transition overlap/divided is not flagged

Histogram for M5 Det1



Summary

- Common flags were verified. There are no major false alarm conditions discovered
- Anomalous conditions are usually being properly flagged
 - Maneuver events are indicated where the granule goes off the earth
 - Geolocations during maneuvers are properly flagged
 - Moon in space view is flagged coincident with actual event
- M6 saturation roll-over flagging: Roll-over data appropriately flagged after code change. Options to filter out roll over data and keep good data have been investigated
- DGA flagging: DGA fully flagged in aggregation zones 1 and 6, and over flagged in aggregation zones 2, 3, 4, and 5.
- DGA feature is stable in time in DCR corrected DN domain, providing an option to flag DGA in DCR corrected DN space
- SDR Quality Flag "Not Used" triggered at two different situations. One is seen from M13 and the other is seen from DNB (being addressed).
- Flag 249, representing "Poor Cal, Therm Data Missing, Replacement found, All pix Sat, Both Rad & reflBT out of range", is also used as fill value (being re-evaluated).

Future Work

- Modify broad QF survey tool to include SDR GEO QF flags
- Implement algorithm to filter out saturation roll over data and keep good data for M6
- Change DGA flagging algorithm to flag 2/2 and 3/3 pixels only in aggregation zones 2, 3, 4, and 5.
- Modify operation algorithm to flag DGA in DCR corrected DN space to avoid frequent DGA LUT update

References

- NPOESS Common Data Format Control Book - External Volume III - SDR/TDR Formats
- VIIRS SDR Robust Algorithm Processes Design, Design Documentation, NP-EMD-2007,510.0010, Feb. 7, 2007
- SDR_DGA_GainTran_F_Sun_NGC_2012_01_31.pptx
- VIIRS_SDR_QF_CASES_March_21_2012_NG_FrankSun_rev1.pptx

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