N-20 VIIRS L1B Calibration and Data Collection (NASA Land SIPS VIIRS L1B C1 and C2)

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Contributions:

NASA VIIRS Characterization Support Team (VCST)

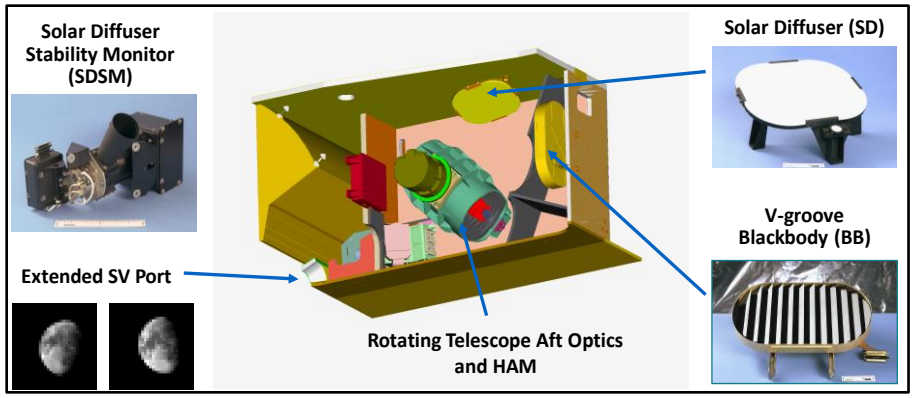
Outline

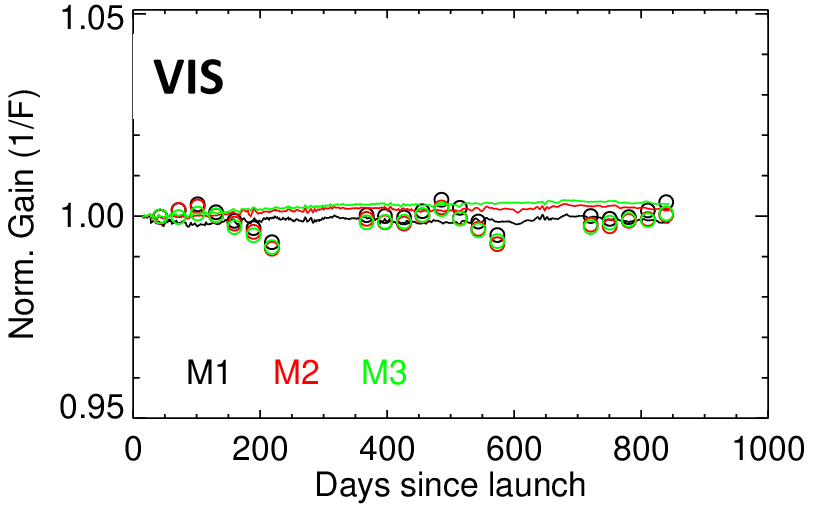
- N-20 VIIRS Reflective Solar Band (RSB) Calibration Performance
- N-20 VIIRS L1B Improvements for RSB
- Status of N-20 VIIRS L1B Collections 1 and 2 (C1 and C2)
- Data Availability and Access
- Path Forward

- Backup Slides (NASA and NOAA RSB Calibration Differences)

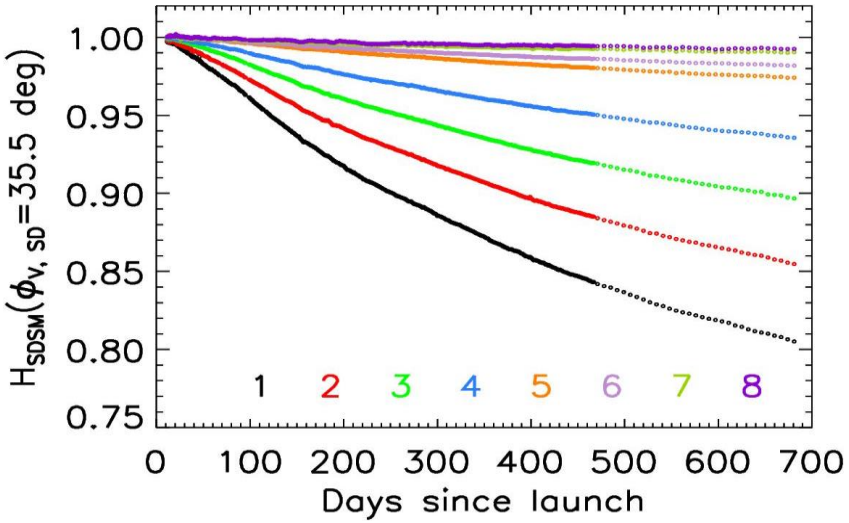
A similar presentation was given on March 18, 2020 at the GSICS VIS/NIR Web Meeting

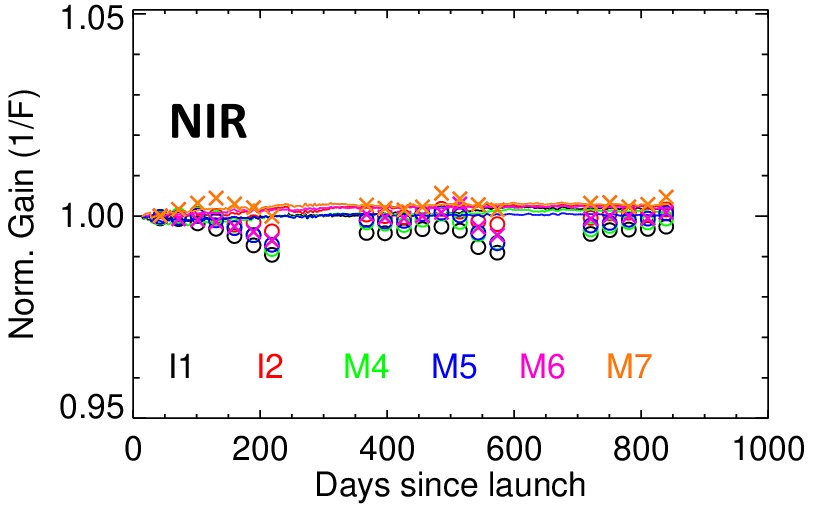
N-20 VIIRS RSB Calibration Performance





SD Degradation from SDSM

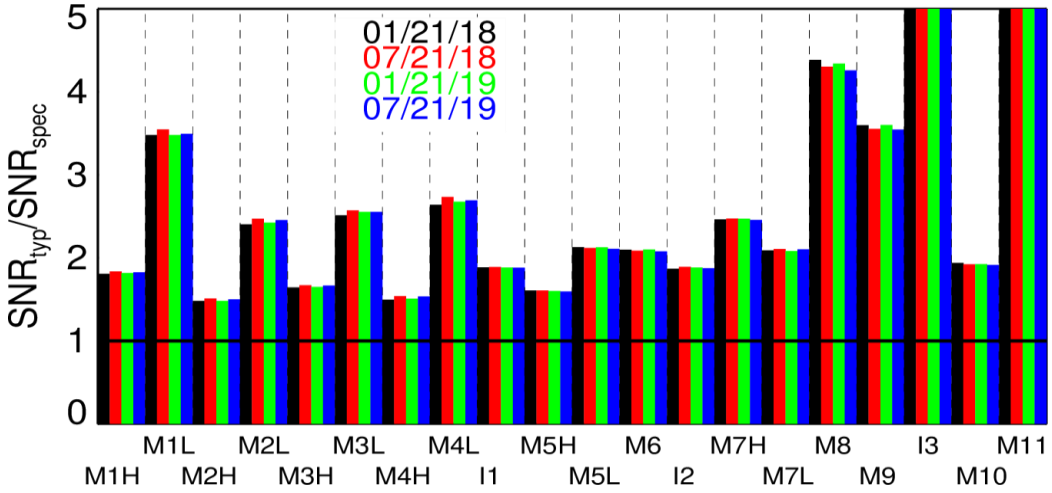


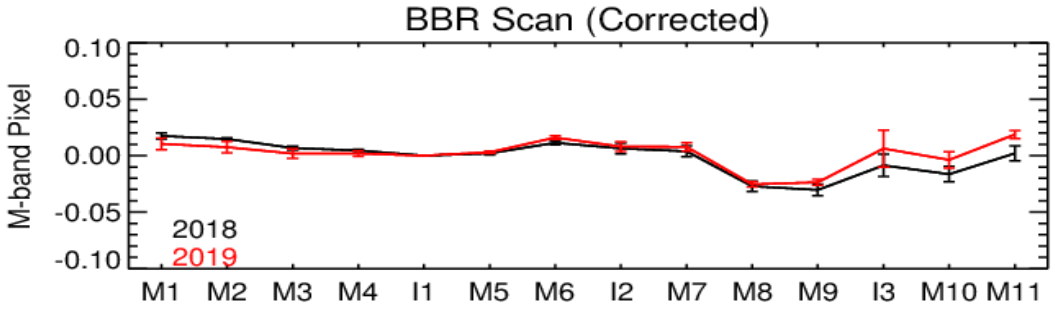


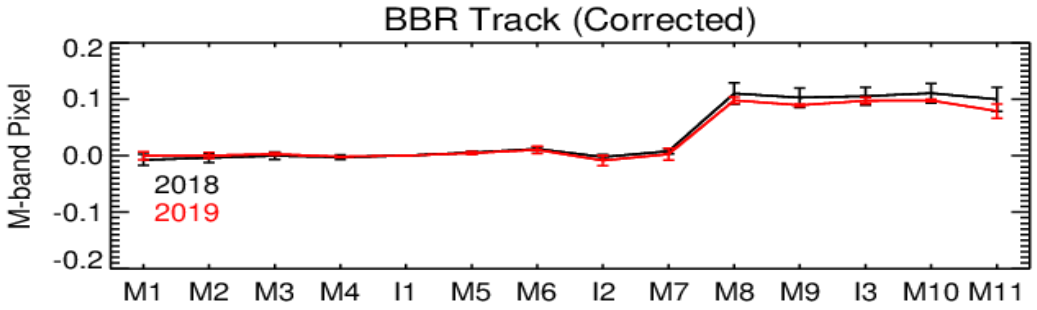
Most degradation at short wavelengths (similar to S-NPP VIIRS and MODIS)

RSB responses: extremely stable (better performance than S-NPP VIIRS)

N-20 RSB Radiometric and Spatial Performance







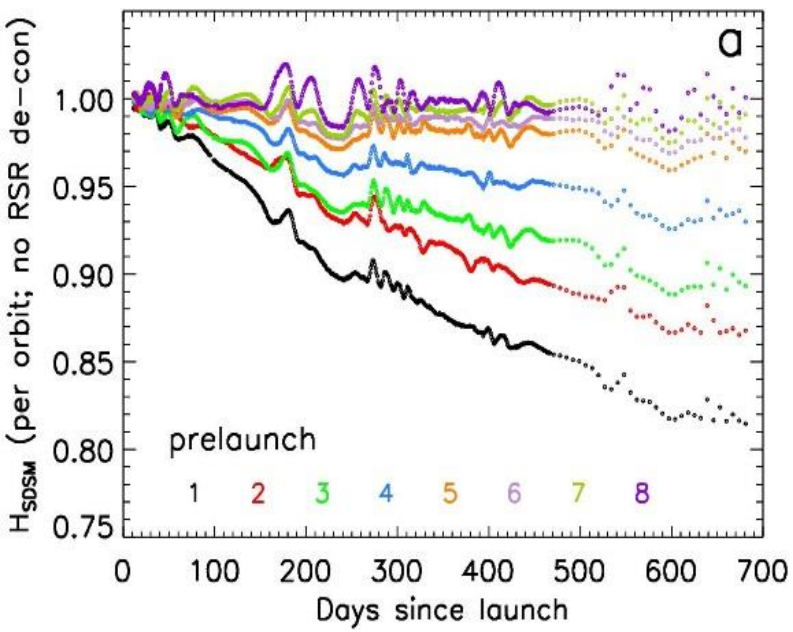
SNRs are well above requirements and are expected to remain so for the foreseeable future

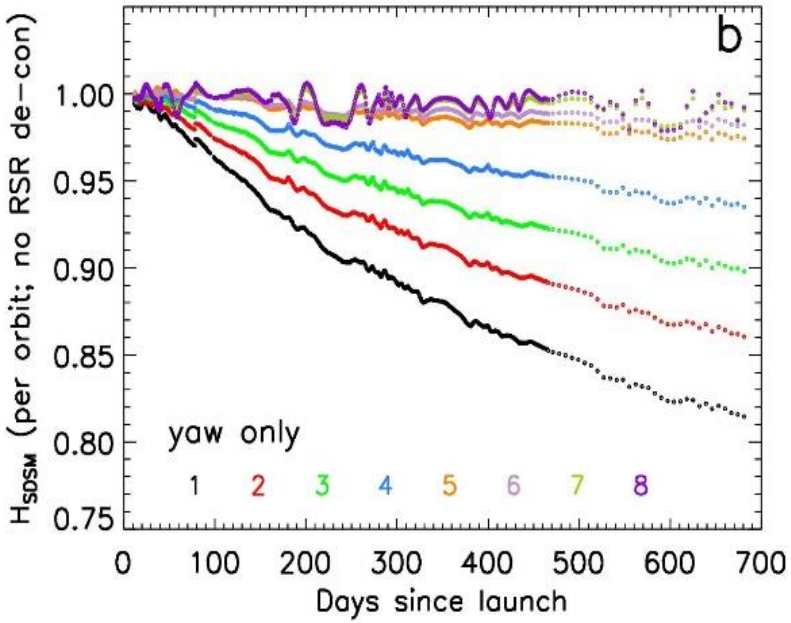
Stable band-to-band registration (BBR) in both along-scan and along-track directions

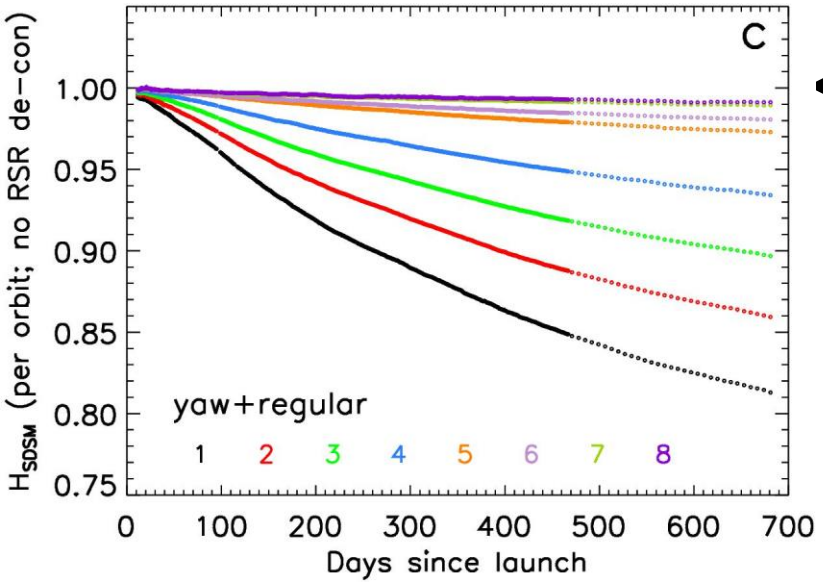
N-20 VIIRS L1B Improvements for RSB

- SD Screen transmittance functions further improved
  - higher quality regular on-orbit data + yaw maneuver data
- SD degradation (H-factor) improvements: angular dependence using SNPP VIIRS trends
- Noisy detector flag added to the L1B products
  - I3 D29 identified as a noisy detector since prelaunch
- C2 mission-long LUTs delivered in April 2019 and forward updates continued on an as needed basis
- L1B code transition from V3.0.0-rc to V3.0.0

N20 VIIRS Screen Characterization Improvements







Collection 2

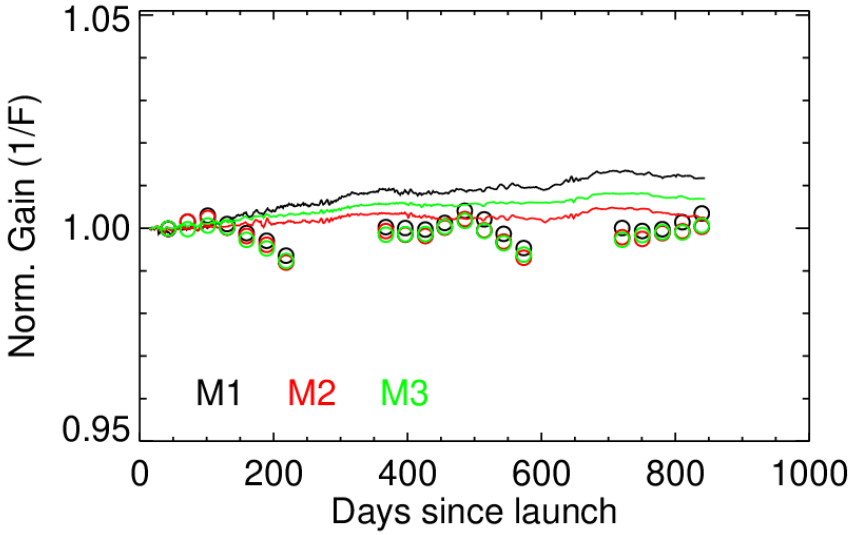
Improvement in the SDSM screen BRDF*tau by supplementing the yaw measurements with higher quality on-orbit measurements. C1 used the same approach with fewer early mission on-orbit measurements

N-20 VIIRS H-factor Improvements

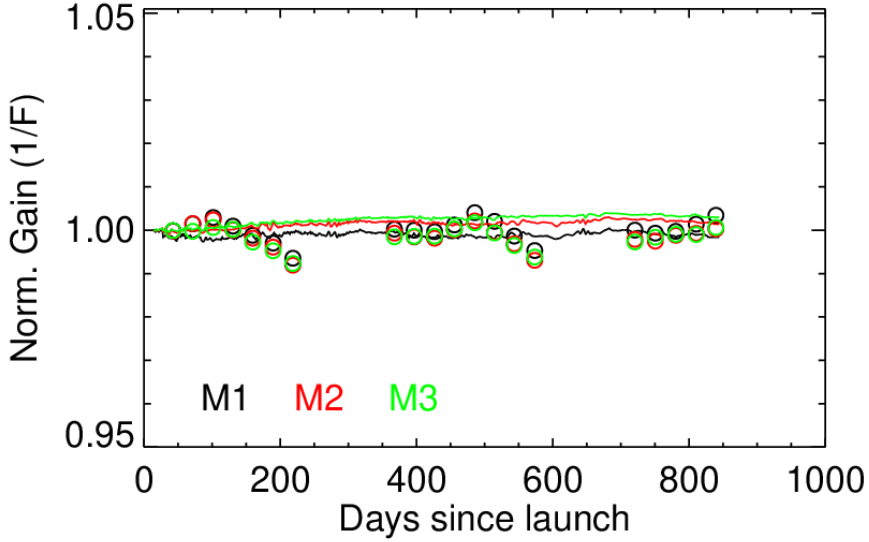
$$H_{\mathrm{RTA}} = H_{\mathrm{SDSM}} \times \frac{1 + \alpha_{\mathrm{RTA}}(\lambda)(1 - H_{\mathrm{SDSM}})}{1 + \alpha_{\mathrm{H}}(\lambda)(1 - H_{\mathrm{SDSM}}) \times (\phi_{\mathrm{H,SD}} - \phi_0)}$$

- Gains (C2) agree much better with lunar results than C1
- Improvements as large as 1.0% for M1

C1



C2



Status of N-20 VIIRS L1B Collections 1 and 2

- NASA SIPS L1B for N-20 (J-1)
  - C2: L1B V3.0.0 software (officially released in August 2018 to support both NOAA-20 and S-NPP), with C2 mission LUTs released by VCST with 2 months forward prediction (April 2019); AS 5200
  - C1: L1B V3.0.0-rc software (until Oct. 2018), V3.0.0 software (from Oct. 2018), with C1.0 LUTs (until May 2019) and C2 LUT (from May 2019); AS 3194

LUTs	Code Base	# of LUTs	Delivery Time	Note
C1	L1B V3.0.0-rc +V3.0.0	5	2018.06 - 2019.02	Run for both S-NPP and J1 (N-20). Add different RTA encoder start value for J1. Modify J1 DNB GEO over extended mode. Introduce M11 process at Ops Night. Improve M13 radiometric resolution. Add moon phase and illumination for DNB pixel.
C2	L1B V3.0.0	9	2019.04 - 2020.03	improved screens, improved H-factor, and noisy detector flag

Data Availability and Access

- N-20 (J1) **Collection 2** L1Bs data archive set (AS) is AS5200, currently available at: https://ladsweb.modaps.eosdis.nasa.gov/archive/allData/5200/
- N-20 (J1) **Collection 1** L1Bs data archive set (AS) is AS3194
  POC for VIIRS Level-1 data: Carol Davidson <carol.c.davidson@nasa.gov>
- The NASA Land products (C2) are available at LAADS DAAC (Level-1 and Atmosphere Archive & Distribution System; Distributed Active Archive Center) via Earthdata (https://earthdata.nasa.gov/).
  POC for Earthdata account and data download: Gregory Ederer <gregory.a.ederer@nasa.gov>

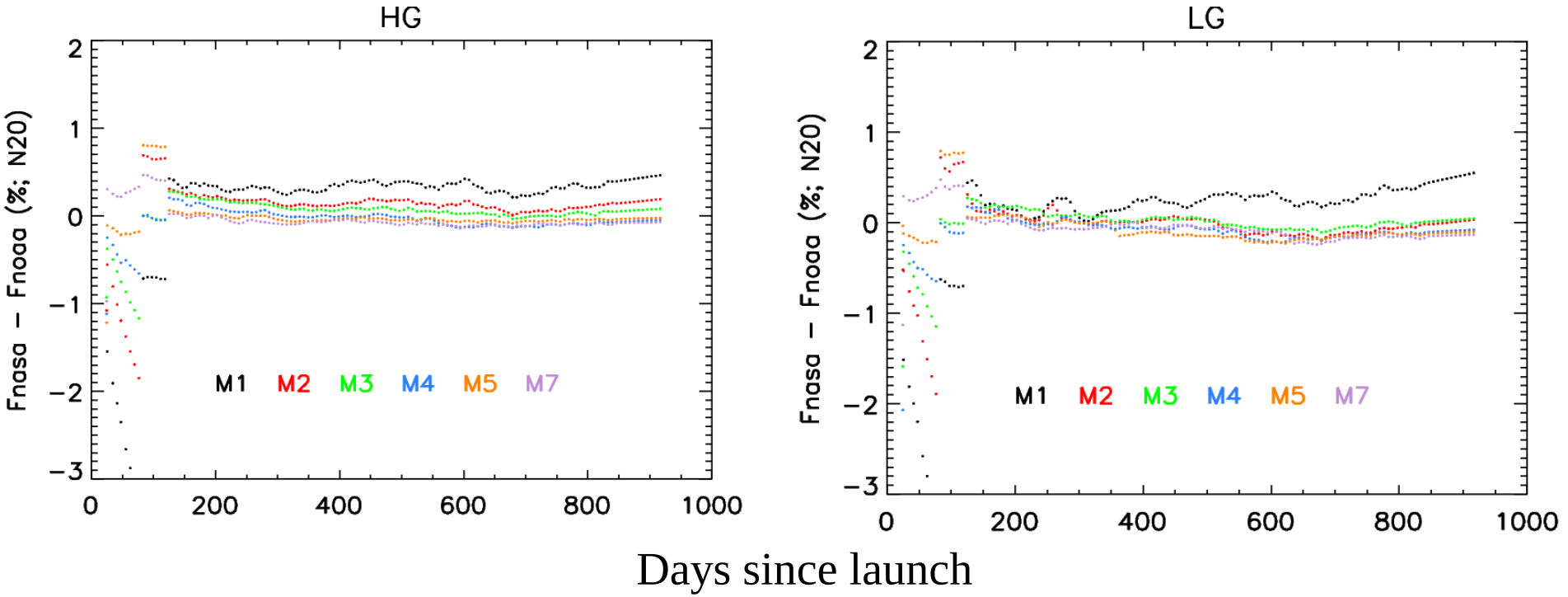
Path Forward

- Use multi-year lunar measurements to adjust H_{RTA} model parameters on a regular basis
- Apply H-factor with SD positional dependence on an as needed basis
- Monitor calibration long-term stability, including detector-to-detector difference, using vicarious targets (desert, DCC) and make corrections if necessary
- Investigate and document calibration consistency with Aqua MODIS and SNPP-VIIRS in support of use of calibration reference sensor(s) in VIS/NIR region and generation of consistent long-term data products using multi-sensor observations

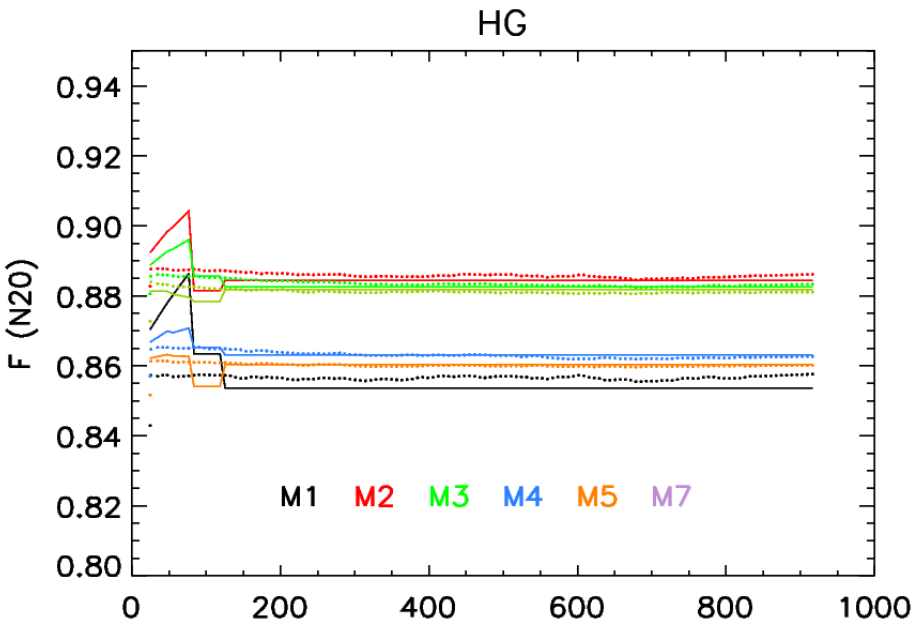
Backup Slides

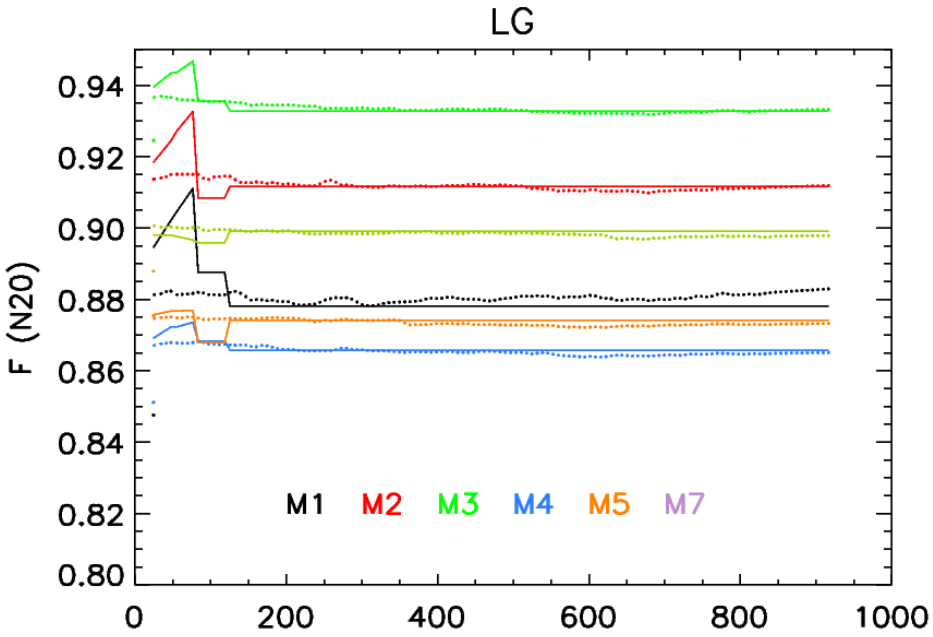
Differences between NASA (C2) and NOAA N-20 VIIRS F-factors

Except at the mission beginning, the differences are small with M1 being the largest (0.5%)



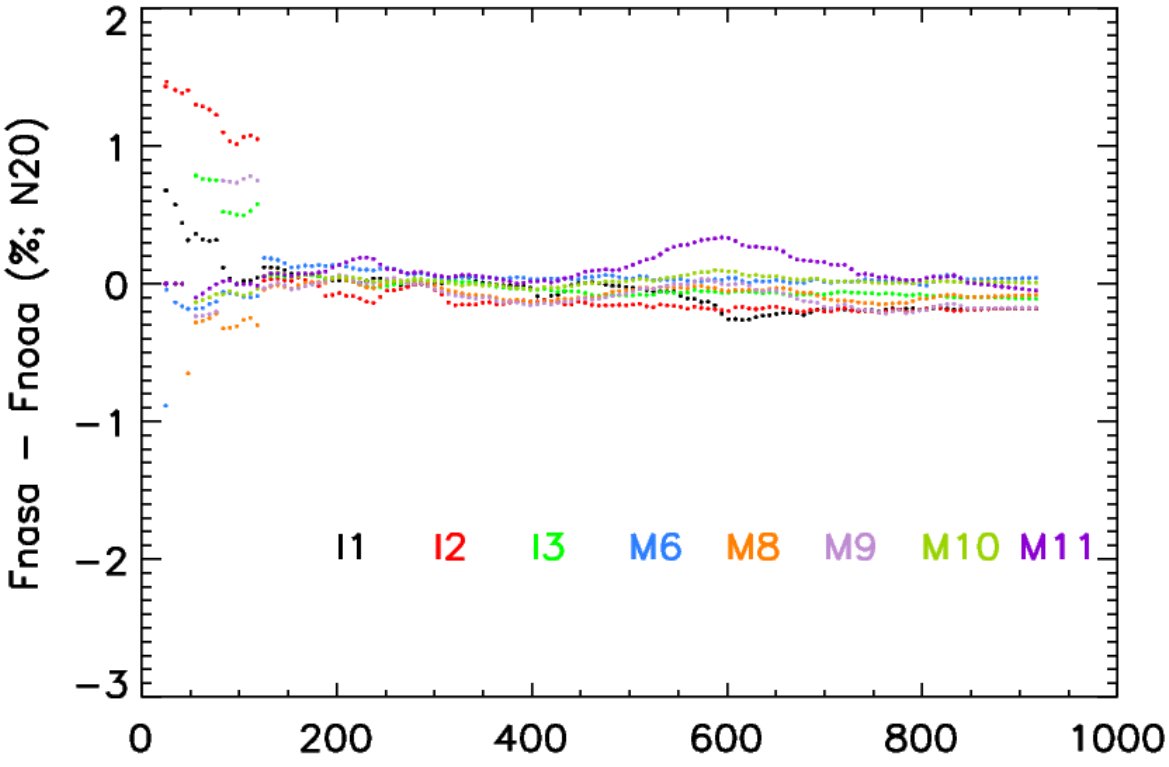
NASA C2 (dots) and NOAA (solid lines) N-20 VIIRS F-factors





Days since launch

Differences between NASA (C2) and NOAA N-20 VIIRS F-factors



VIIRS L1B Software V3.0.0

- Changes in V3.0.0 compared to V2.0.0

  V3 software provides full support for VIIRS NOAA-20 (JPSS-1)

  – Modified scaling and brightness temperature table for M13 to improve radiometric resolution, especially at the low scene level.
  – Add moon phase and illumination for each L1B DNB pixel.
  – Add lunar calibration option where background data is derived from EV, instead of SV sector, for granules captured during lunar maneuver sector rotation.
  – Update DNB geolocation and move RTA and HAM encoder start from hardcoded value to element in GEO LUT.
  – Add attitude, position and velocity vectors for the start and end of each scan.
  – Update/correct several metadata elements.
  – Consolidate files, remove redundant and unused code, reformat code to eliminate duplication and improve maintainability.