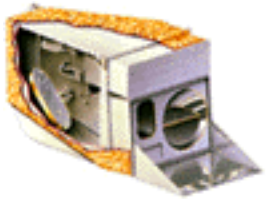
Initial Assessment of JPSS-1 (N20) VIIRS Reflective Solar Bands Using Vicarious Approaches

Aisheng Wu



Outline

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  - **MODIS example**
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- **Results**
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VIIRS and MODIS

VIIRS RSB			MODIS RSB		
Band	CW (nm)	BW	Band	CW (nm)	BW
M1	412	20	B8	412	15
M2	445	18	B9	443	10
M3	488	20	B10	488	10
M4	555	20	B4	555	20
M5	672	20	B1	645	50
M6	746	15	B15	748	10
M7	865	39	B2	858	35
M8	1240	20	B5	1240	20
M9	1378	15	B26	1375	30
M10	1610	60	B6	1640	24
M11	2250	50	B7	2130	50
I1	640	80	B1	645	50
I2	865	39	B2	858	35
I3	1610	60	B6	1640	24

NOAA-20/SNPP VIIRS

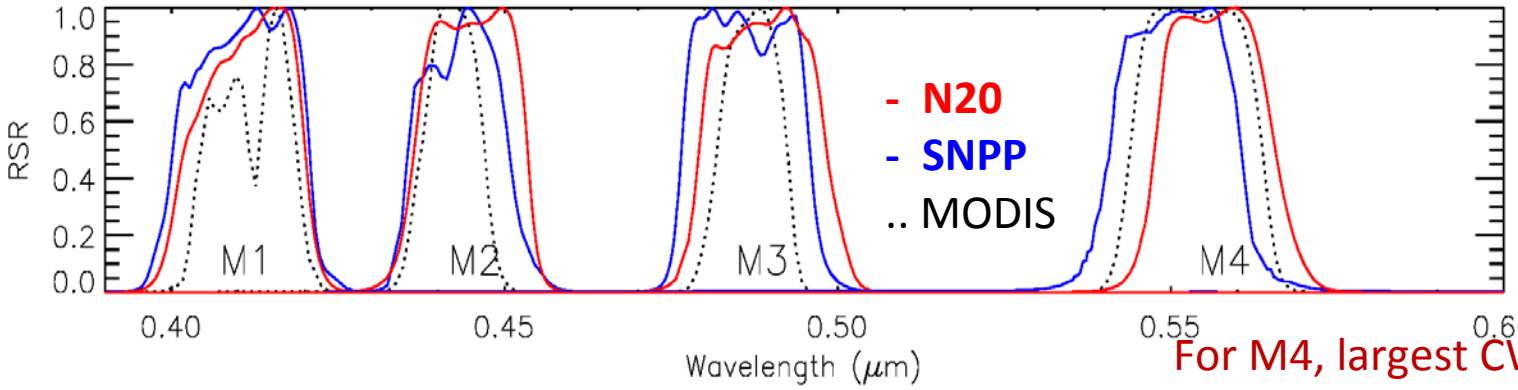
- Scanning radiometer
- 22 bands between 0.4 and 12 μm
- Afternoon polar orbit
- Swath distance of 3000 km
- Nadir resolutions: 0.375, 0.750 km
- Launched Nov 18, 2017 & Oct 28, 2011
- Aggregation, dual-gain, less crosstalk impact

Terra/Aqua MODIS

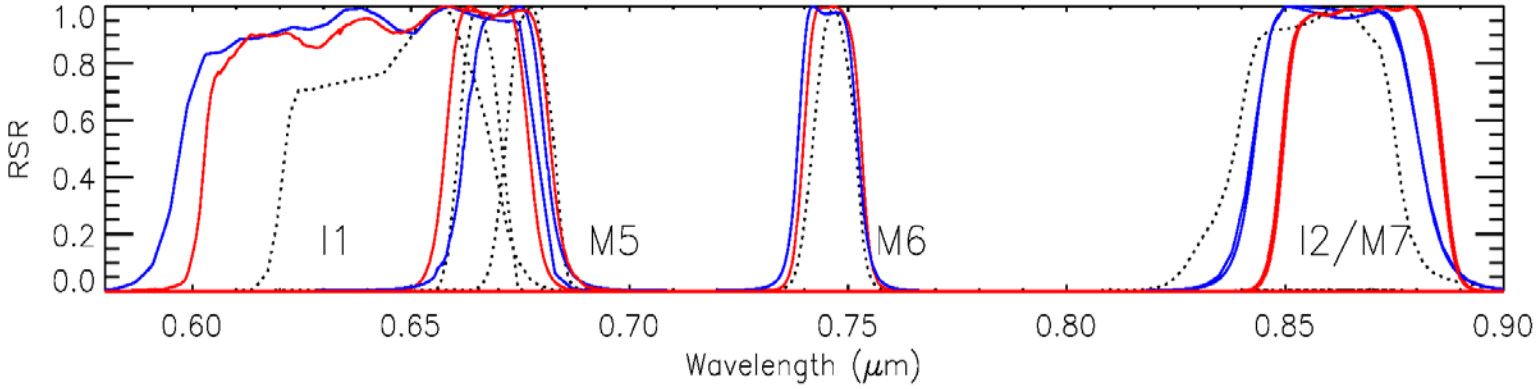
- Scanning radiometer
- 36 bands between 0.4 and 14 μm
- Morning/afternoon polar orbits
- Swath distance of 2330 km
- Nadir resolutions: 0.25, 0.5, 1.0 km
- Launched Dec 1999 & May 2002

Relative Spectral Response (RSR)

NOAA-20, SNPP VIIRS and MODIS

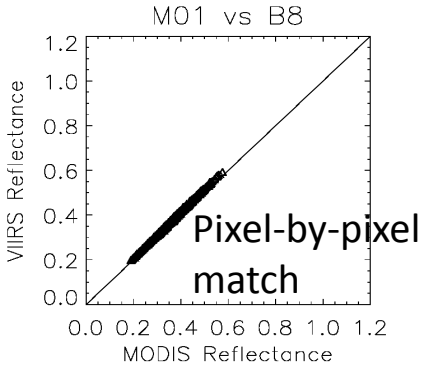


For M4, largest CW shift and SNPP OOB contribution

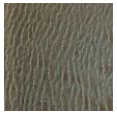


Methodology

SNO
(VIIRS & MODIS)



Libya 4 Desert
(28.55ºN, 23.39ºE)



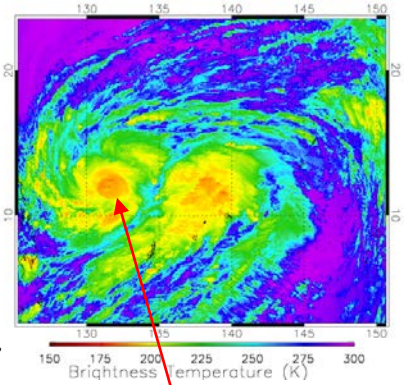
20 x 20 km

Crossing time (16-D)
N20/SNPP ~11:30
A-MODIS: ~11:40

Dome C Site
(75.1ºS, 123.4ºE)

Image from NOAA/NCDC Paleoclimatology Program

DCC
(tropical & subtropical)

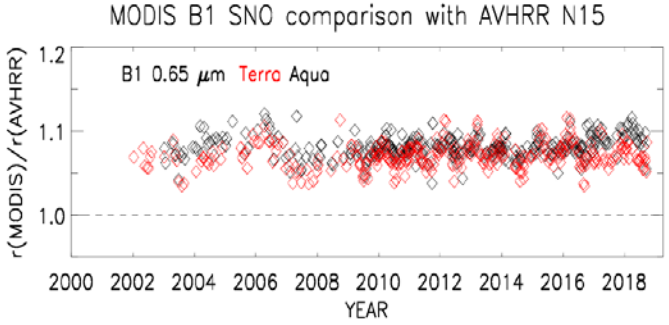


Uniform pixel bins with BT31 < 205K

- Comparison with SNPP VIIRS from various approaches (SNO, Desert, Dome C and DCC)
- SNO approach based on a double difference relative to Aqua MODIS
- PICS approach based on site-specific BRDF (MODIS or VIIRS)

Aqua MODIS band 1 reflectances from vicarious approaches

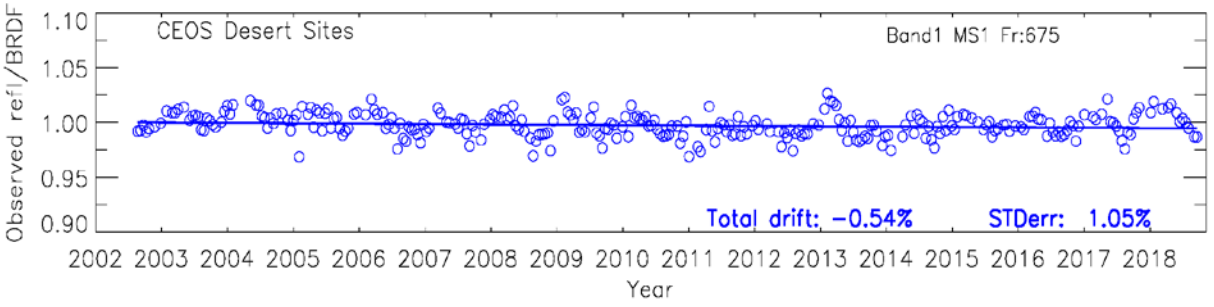
SNO between MODIS & AVHRR)

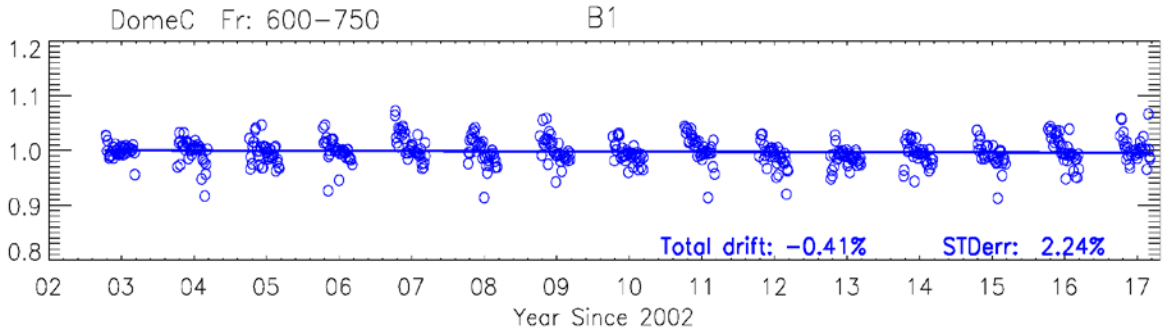


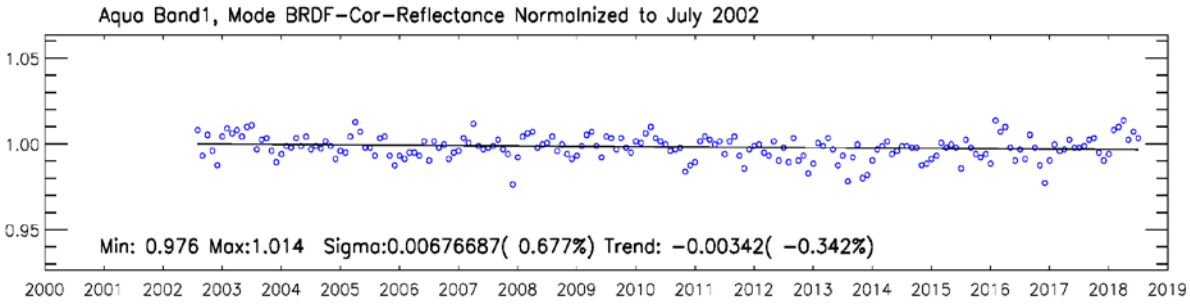
Terra B1 < **Aqua** by **1.0 ± 1.4**%

- Both Terra and Aqua reflectance trends are stable within **1.0%** over scan angles of ±45.0º
- Radiometric biases between Terra and Aqua are within **2.0%** using these vicarious approaches.

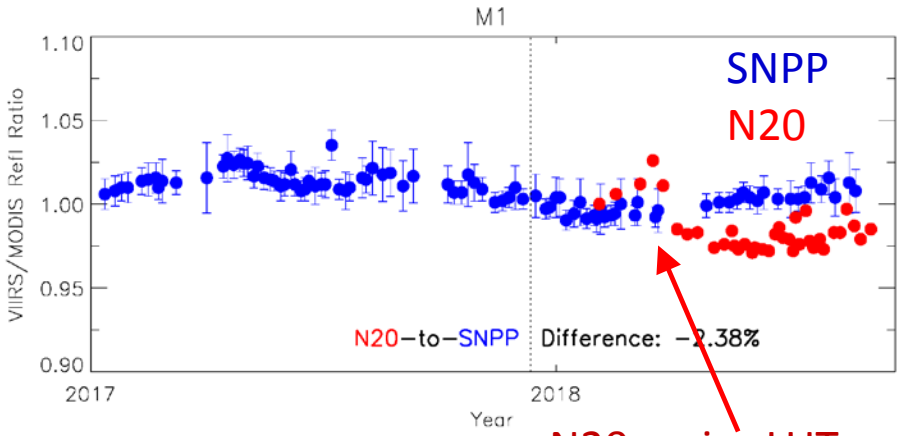
PICS (desert, Dome C & DCC)

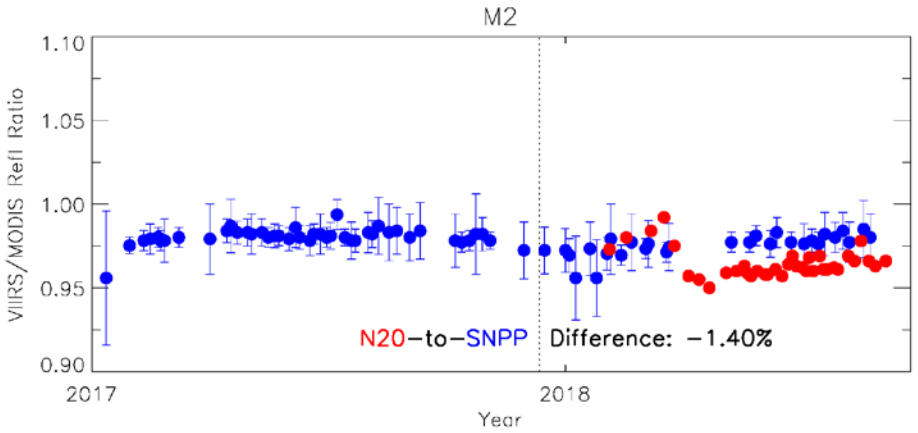




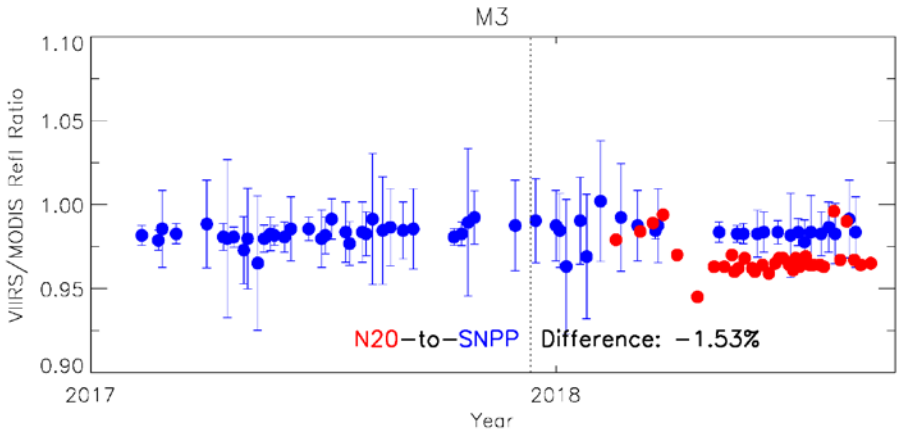


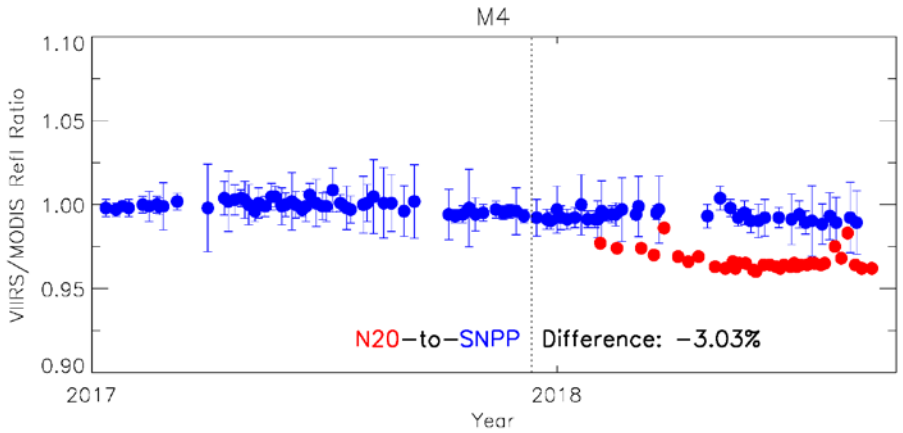
Reflectance Ratios from SNO





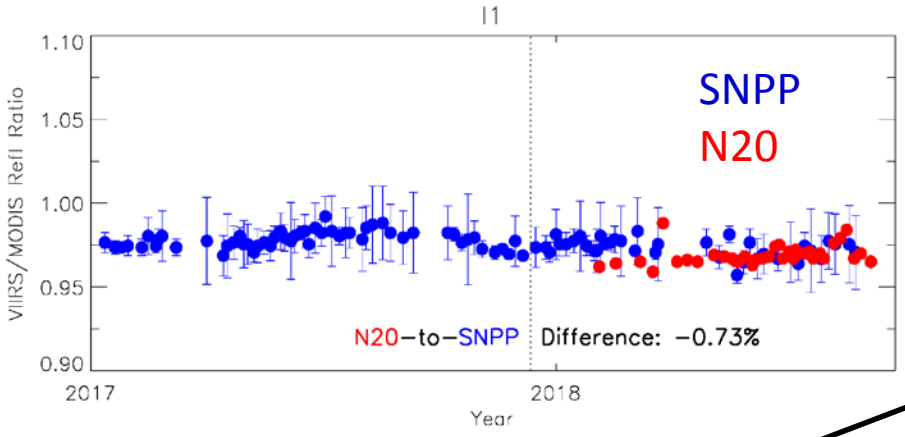
N20 major LUT update
in March 2018



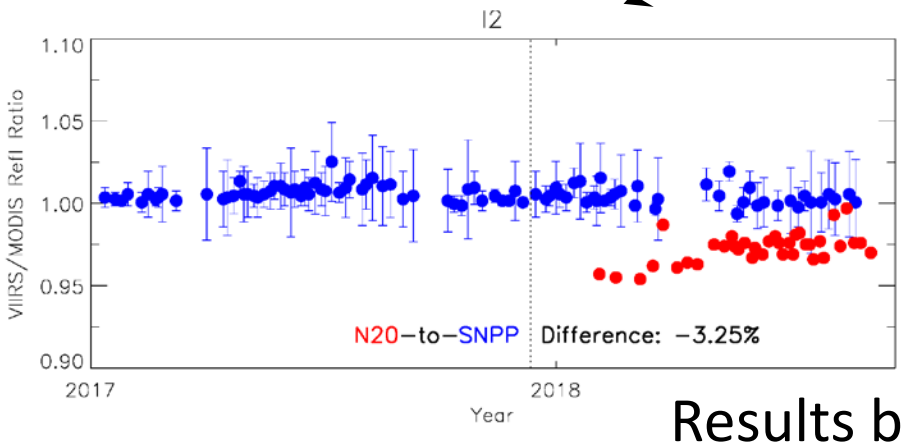


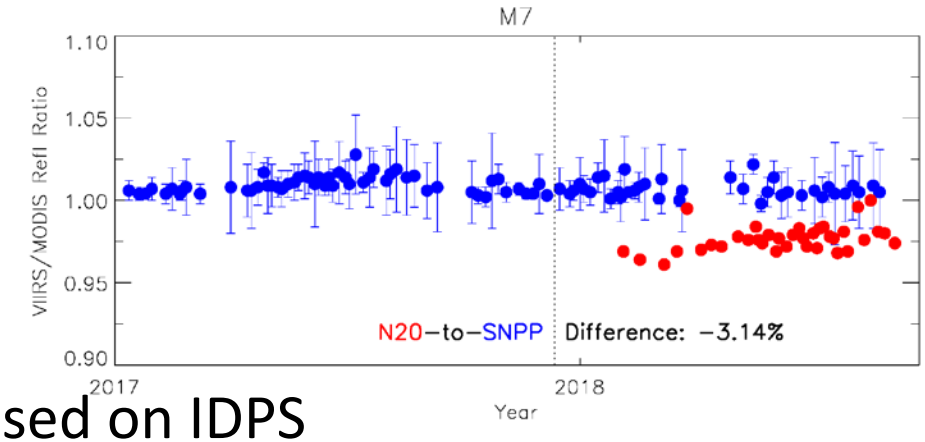
Results based on IDPS

Reflectance Ratios from SNO



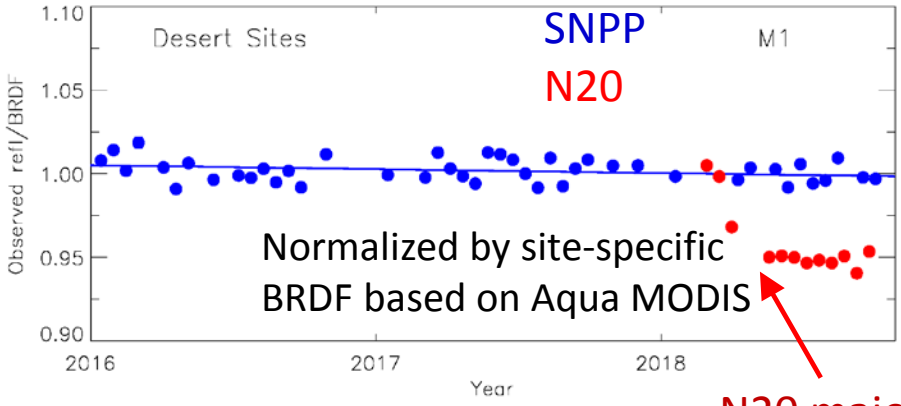
Close spectral match between I2 and M7

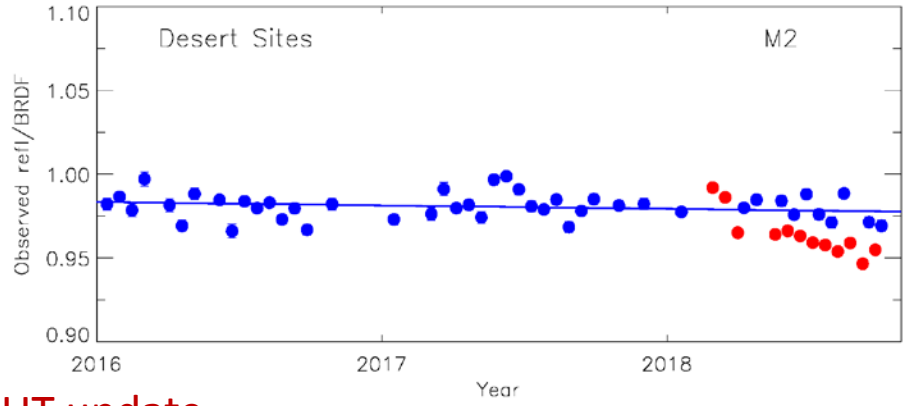




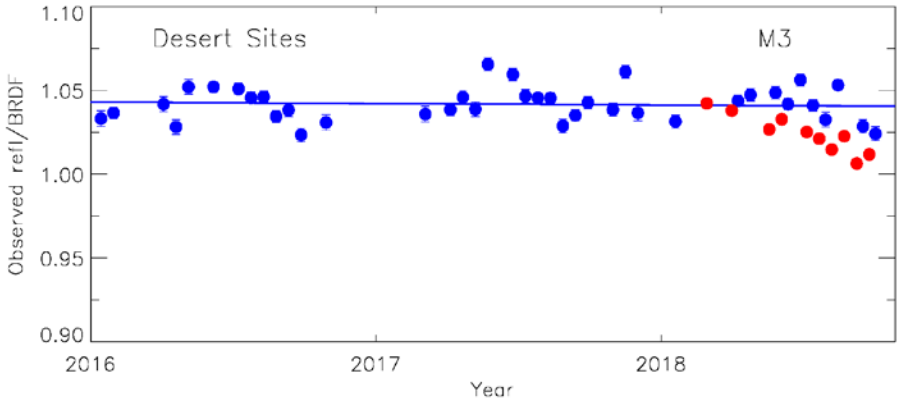
Results based on IDPS

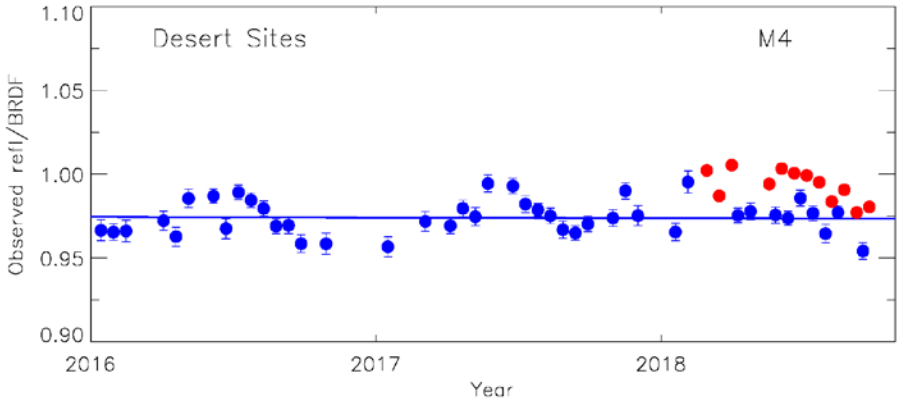
Reflectances for Libya 4





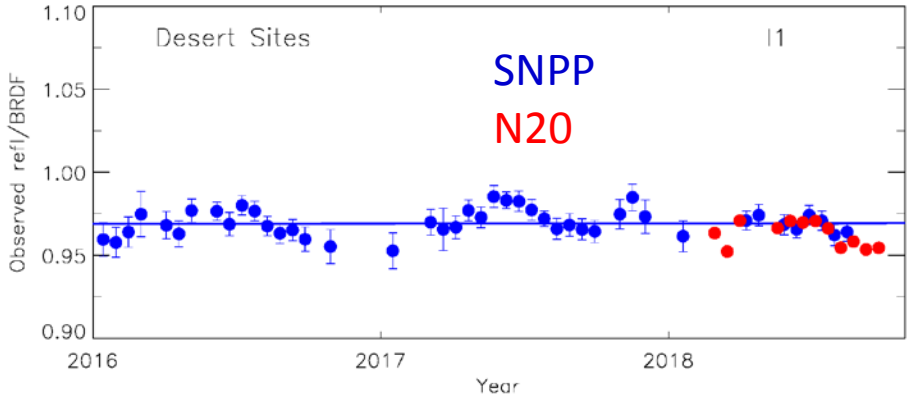
N20 major LUT update
in March 2018

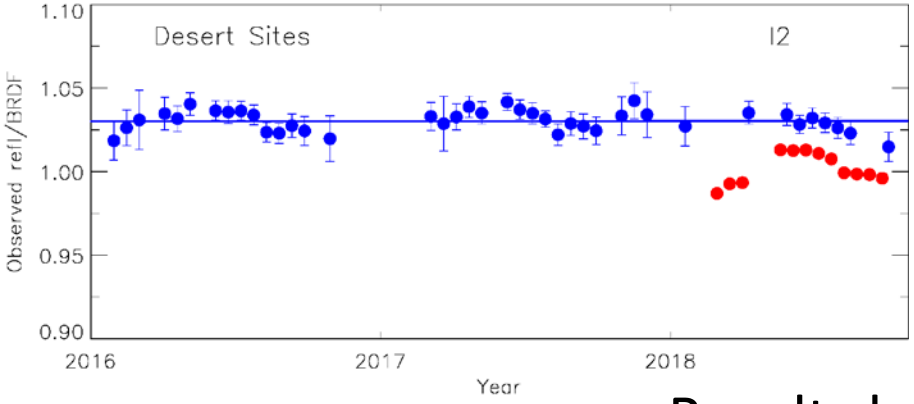


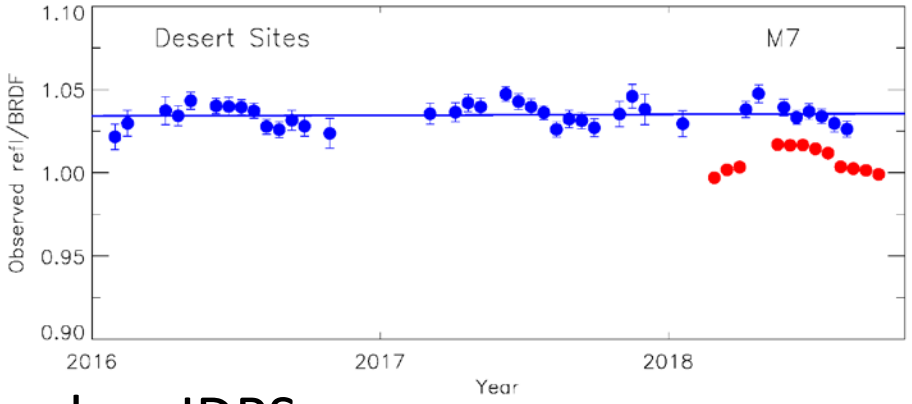


Results based on IDPS

Reflectances for Libya 4

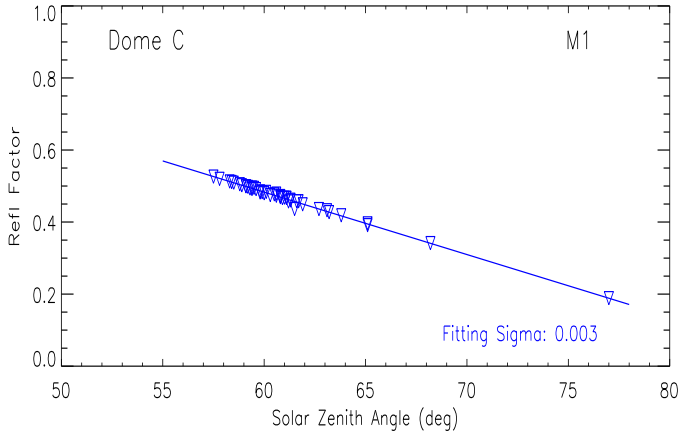


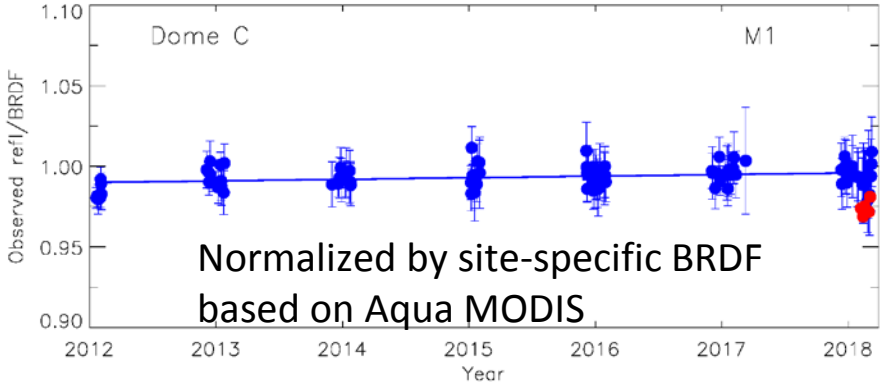


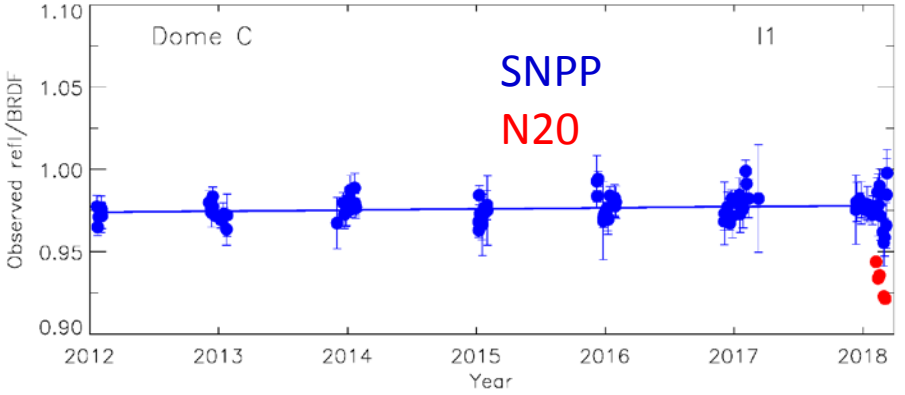


Results based on IDPS

Reflectances for Dome C

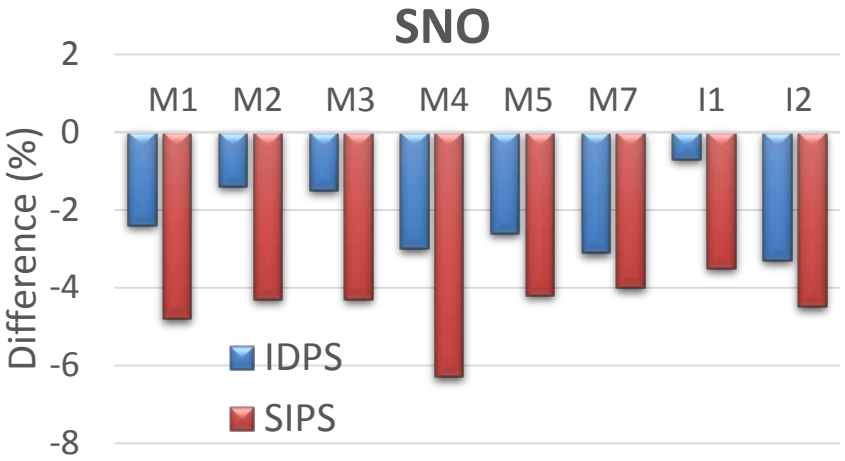


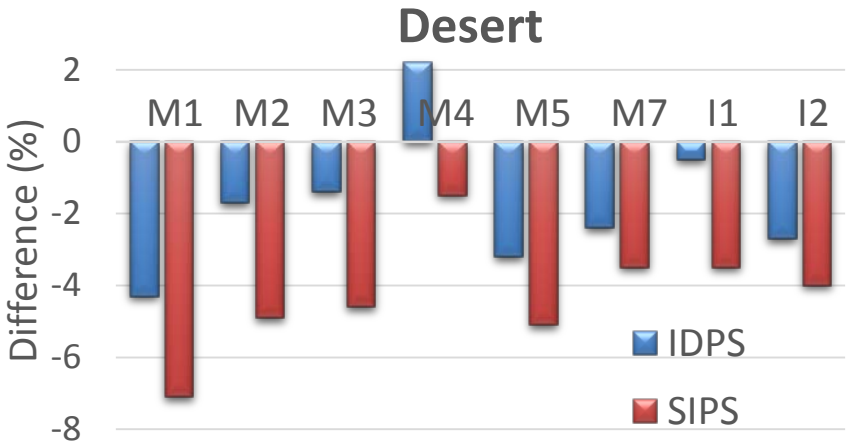


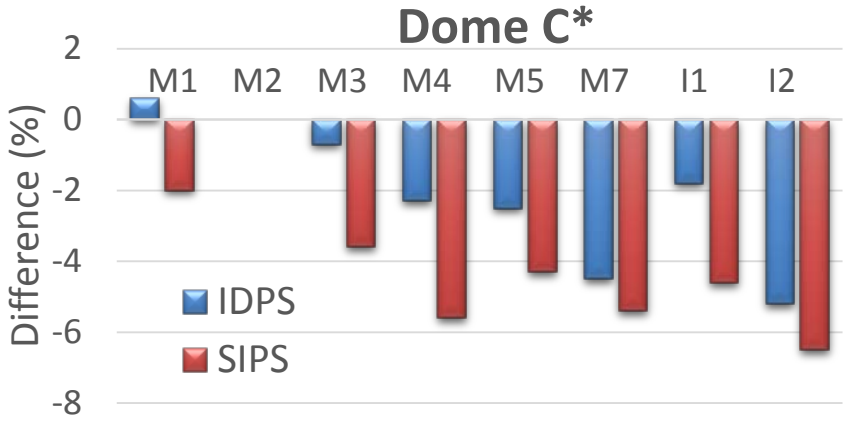


Results based on IDPS

N20 and SNPP Reflectance Difference







Results based on both IDPS and SIPS

- **N20 L1B from SIPS based on IDPS since both calibration results are close**
- **No RSR correction applied**
- **Averaged reflectance difference (N20-SNPP)/N20 in percentage (%)**
- ***For Dome C, less available points, M1-M3 are less reliable from initial calibration**

RSR Impact

NOAA-20 and SNPP VIIRS to MODIS reflectance ratios for M4, determined using MODTRAN (v.5.2.1.0) simulations and SCIAMACHY hyperspectral observations (ESUN based on SNPP SDR)

**SCIAMACHY Level-1B spectral data was provided by the European Space Agency*

Surface Type	MODTRAN			SCIAMACHY*		
	SNPP	N20	N20/SNPP	SNPP	N20	N20/SNPP
Ocean	1.008	0.992	0.984	1.031	0.983	0.953
Desert	1.000	0.999	0.999	0.996	1.013	1.017
Snow	1.006	0.994	0.988	1.013	0.995	0.982
Cloud	1.005	0.995	0.990	1.020	0.989	0.970

Variations in N20/SNPP ratio for other bands shown in previous table are within 2%

Summary

- This study provides initial assessment of the NOAA-20 VIIRS RSB by inter-comparison with SNPP VIIRS using various vicarious approaches (SNO, desert and Dome C)
- Except for M4 for the desert due to a large RSR impact, NOAA-20 is consistently lower than SNPP from -2 to -4% (more from SIPS) for the VIS and NIR spectral region
- Further investigation of prelaunch test data is worth considering the baseline calibration is referenced to the prelaunch characterization.
- More on-orbit data is required to have reliable analysis of NOAA-20 calibration stability.