MODIS Instrument Operations Status

Terra Flight Operations

- Terra Spacecraft Status
  - **19+ years of successful operation. Since the last STM, the MODIS instrument has continued to operate nominally.**
  - Orbit Maneuvers: Drag Make-up #107-114, Inclination Adjustment #51-56
  - **Solid State Recorder – Currently 30 supersets allocated: 2 lost since last STM. Mitigation scenarios being discussed.**
  - **Ongoing efforts towards the planning for calibrations and maneuvers related to orbit exit/change in orbital position**

MODIS Instrument Operations (Terra)

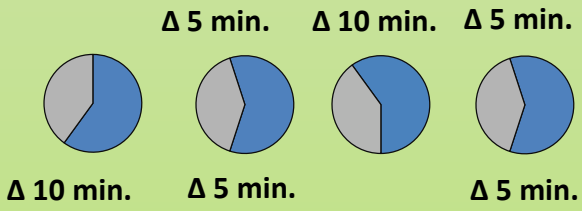
- **Terra MODIS is healthy and operating nominally**
- **Operational Configuration (No change since last STM)**
  - A-side: launch to Oct. 30, 2000
  - B-side: Oct. 30, 2000 to June 15, 2001
  - A-side: July 02, 2001 to Sept. 17, 2002
  - A-side electronics and B-side formatter: Sept. 17, 2002 to present
  - BB temperatures set at 290K
  - Cold FPA (SMIR and LWIR) controlled at 83K
  - SD door fixed to “open” position since July, 2003
- **Events**
  - Terra S/C safe mode February 2016
- **Concerns**
  - Reduced SSR allocation – further decrease could result in data loss
- **Special Operations**
  - Performed SRCA Crosstalk Tests

Terra PWA Status

- Terra launched with 58 Printed Wire Assemblies (PWA) (Memory Boards) for storing instrument data.
- MODIS has been allocated 16 PWAs, made up of 32 supersets of storage since the last MODIS PWA failure Oct. 14, 2014.
- On August 30, 2019 (2019/242) at 06:20:00z, Terra FOT noted a single-event upset which caused the failure of PWA-55, made up of supersets 108 and 109.
- Between 18:41:29z – 18:48:11z, all instrument recording was temporarily disabled to allow the PWA to be re-allocated (remove the bad supersets). MODIS now has 30 supersets.
- With fewer supersets, there is an increased chance of buffers being filled and data overwritten resulting in unscheduled, unrecoverable data losses.
- Terra FOT is able to schedule additional playbacks to prevent data losses at this point.
- Any further PWA losses will require a reduction in MODIS collection rates.

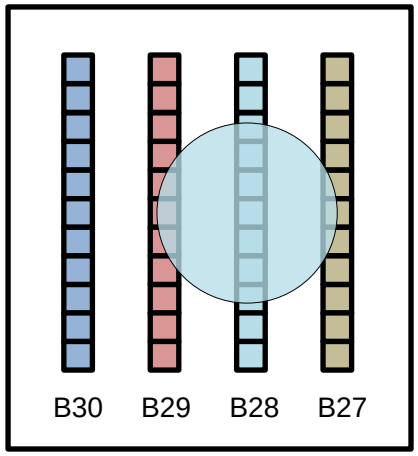
Terra Data Reduction Plan

- A future PWA failure would leave MODIS operating on 14 PWAs and require adjusting the Day/Night collection rate from 50/50 (used currently) to a 40/60 rate.
- MODIS IOT has been working with Terra FOT to create both a short term solution (to be implemented immediately upon PWA failure) and long term solution

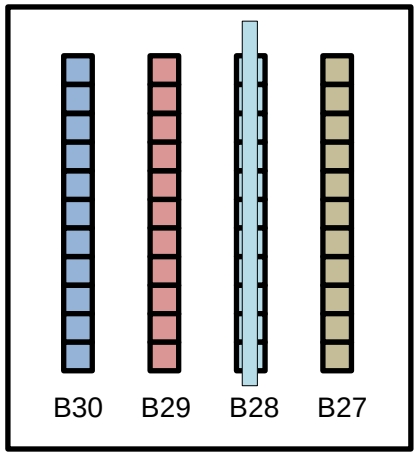
Current	• 50/50 Day/Night rate based on Nadir Terminator Crossing	
Short Term	• Every orbit uses identical 40/60 split • Fixed start time anywhere in orbit, can be manually adjusted for scheduled science requests	
Long Term	• MODIS IOT determines how the viewing sequence will be executed, generates One Day Schedule (ODS) which includes schedule times and resources needed, and delivers to FOT weekly or daily to be ingested into scheduling system	

Terra SRCA Crosstalk Test

- SRCA Crosstalk tests were performed early in both MODIS missions - mostly in efforts to characterize the SWIR crosstalk.
  - Terra 2001, Aqua 2003
- Since the Terra Safe-mode event of 2016, increased crosstalk has been observed in MODIS bands, specifically the PVLWIR bands (bands 27-30).
- Lunar observations have been used to characterize crosstalk for use in L1B calibration.
- The moon target is 7km x 7 km (IFOV) and can illuminate multiple bands at a time.
- The SRCA can generate a signal ~0.5 km wide to isolate the sending signal.



Moon image over MODIS PVLWIR bands

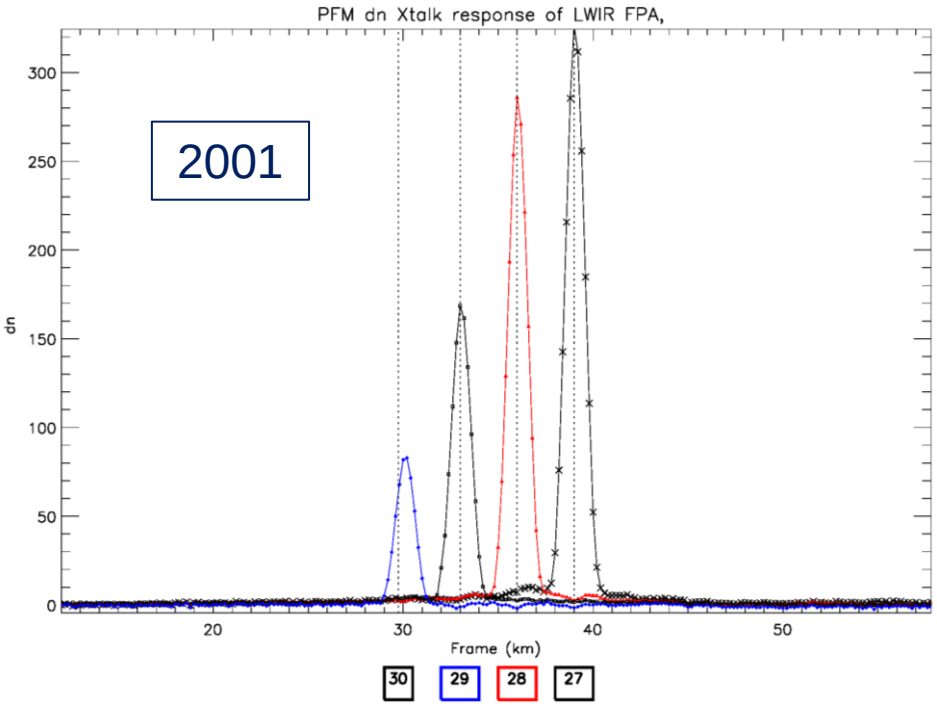


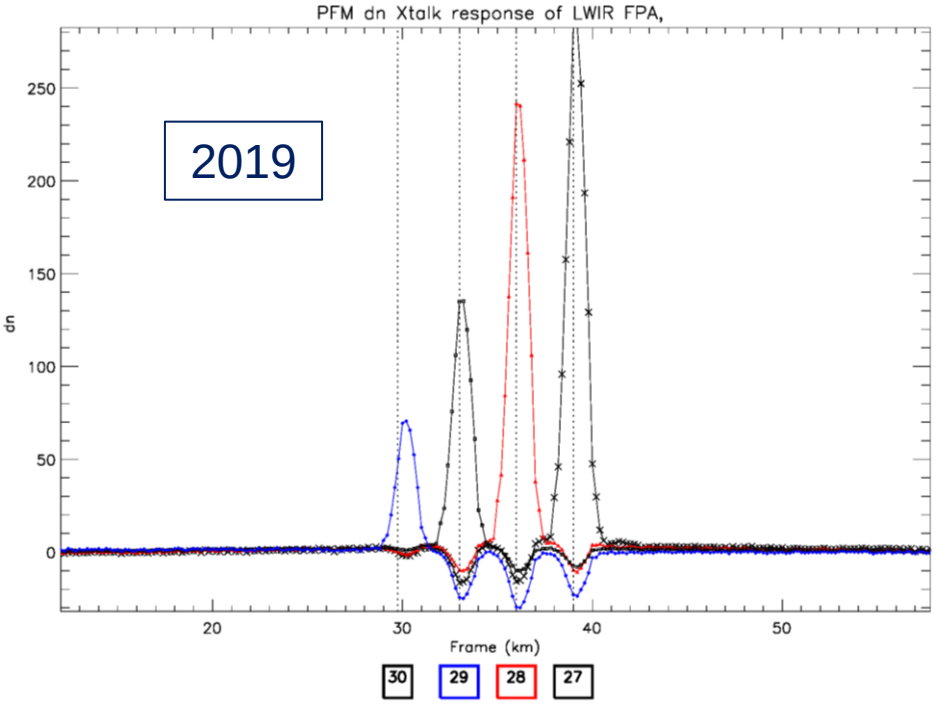
SRCA thin slit image over MODIS PVLWIR bands

Terra SRCA Crosstalk Test

- The SRCA Crosstalk Test configuration is based on the SRCA spatial mode calibration, which is the basis for characterizing the MODIS on-orbit the band-to-band registration (BBR).
- The spatial mode calibration samples MODIS detectors in 6 different phase-delay settings. These phase-delays allow measurements to be made at an offset in time for SRCA frames. Combining data from different phase-delays gives better resolution in the frame direction.
- The SRCA also has a thinner reticle (thin slit) used during spectral calibrations. By using the spectral slit, the SRCA can produce concentrated illumination of MODIS detectors ~0.5 km wide.
- The SRCA crosstalk test uses a combination of SRCA lamps and its thermal source to produce a variety of signal levels to measure sending and receiving crosstalk signals.
- To increase the view of the SRCA sector, 45 frames are ‘borrowed’ from the SD sector. This will give information on any crosstalk effects viewed beyond 5 frames on either side of the sending signal.

Terra SRCA Crosstalk Test





- Sample of band-profiles obtained with SRCA crosstalk test of Terra MODIS PVLWIR bands and associated crosstalk signal

- Analysis of these results will be used to improve and/or confirm the crosstalk correction using lunar data, currently implemented in Terra MODIS L1B C6.1

Terra Desired Maneuvers Prior to Orbital Exit

- In preparing for Terra's change in orbital position, we have a list of planned calibrations/maneuvers MODIS would like to investigate before leaving the nominal orbit:
  - BB temp at 285K
  - SDSM – SD screen open/close
  - SDSM – SD door open/close
  - Lunar rolls – phase angles beyond nominal range
  - Pitch maneuver – Phase angle same as July 2017 and new phase angles
  - SRCA full orbit: 20W, 10W
  - SRCA spectral, spatial, radiometric modes

Aqua Flight Operations

- Aqua Spacecraft Status
  - **17+ years of successful operations. Since the last STM, the MODIS instrument continues to operate nominally.**
  - **No major flight operation anomaly or extensive data losses since last STM**
  - Solid State Recorder – Full data allocation
  - Orbit Maneuvers: Drag Make-up #130-143, Inclination Adjustment #61-66.
  - Future IAMs planned using Reaction Wheel assembly (RWAs) to conserve fuel.

MODIS Instrument Operations (Aqua)

- **Aqua MODIS is healthy and operating nominally**

- **Operational Configuration (No change since last STM)**
  - Same B-side configuration since launch
  - BB temperatures set at 285K
  - Cold FPA (SMIR and LWIR) controlled at 83K
- **Events**
  - Formatter reset on January 4, 2018 at 04:48:28z
- **Concerns**
  - Passed projected lifetime limit on SD door movements

Future Operational Considerations

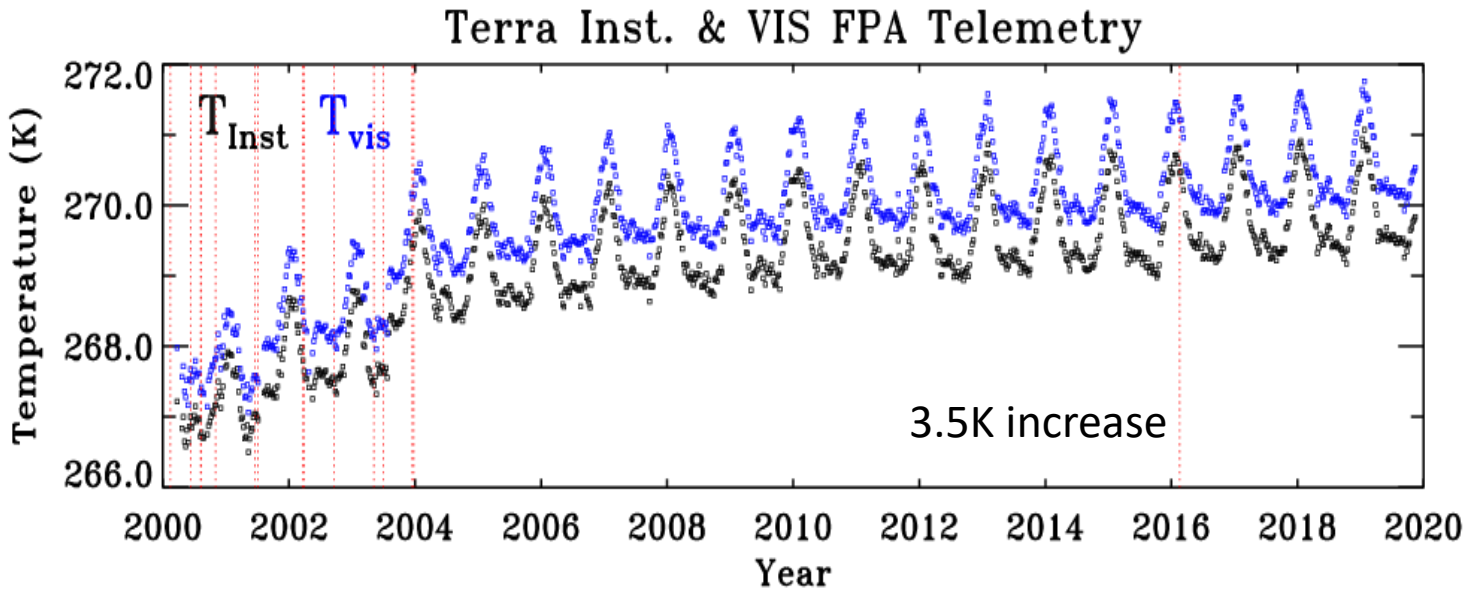
- Aqua MODIS CFPA temperature control
  - Currently set at 83K
  - Minimal impact on science data
- SRCA Lamps
  - Aqua currently has 1 working 10 W lamp
  - Frequency of all calibrations has been decreased
- Aqua SD door movements
  - Passed projected lifetime limit on movements
  - No change in current frequency of SD calibration activities planned at this time

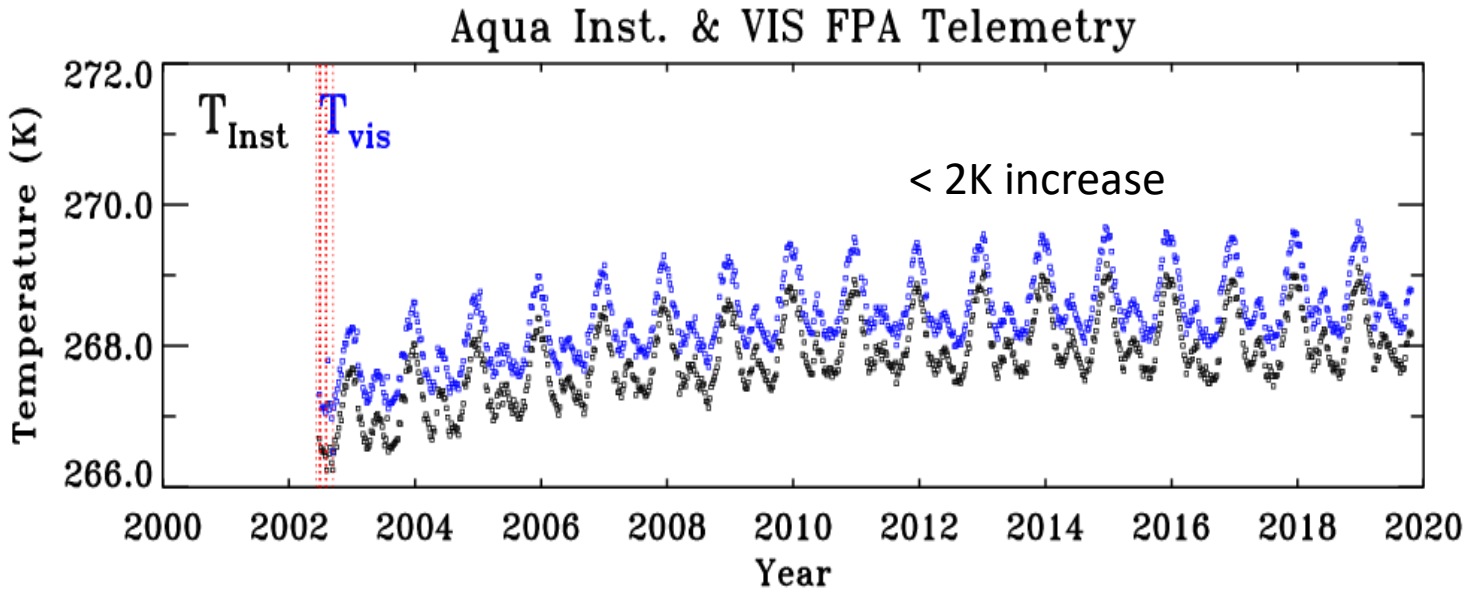
SD Door Movements	PL to 10/2018	10/2018 to present	Total	Design Lifetime	% Used
Terra*	2146	0	2146	3022	71.01
Aqua+	3418	127	3545	3022	117.3

* As of 07/02/2003, SD Door in fixed 'open' position with screen in place

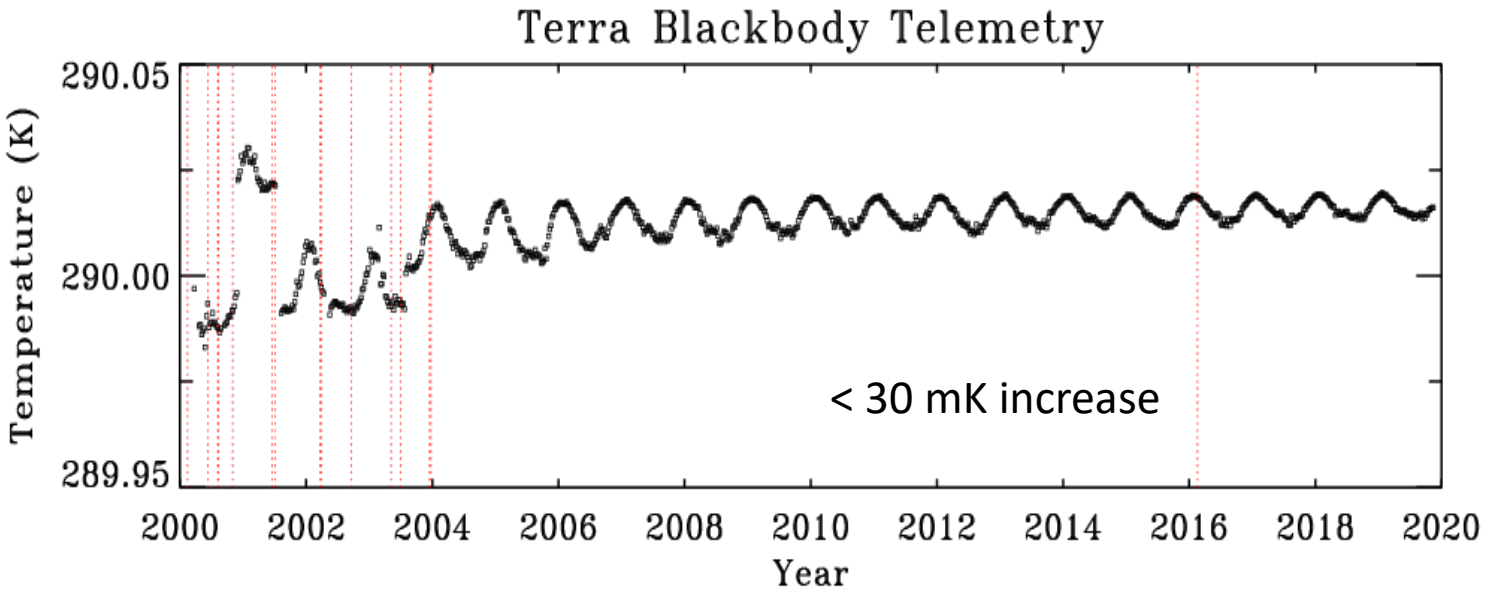
+ Aqua reached designed lifetime of door movement on DOY 2012/191 (July 2012).

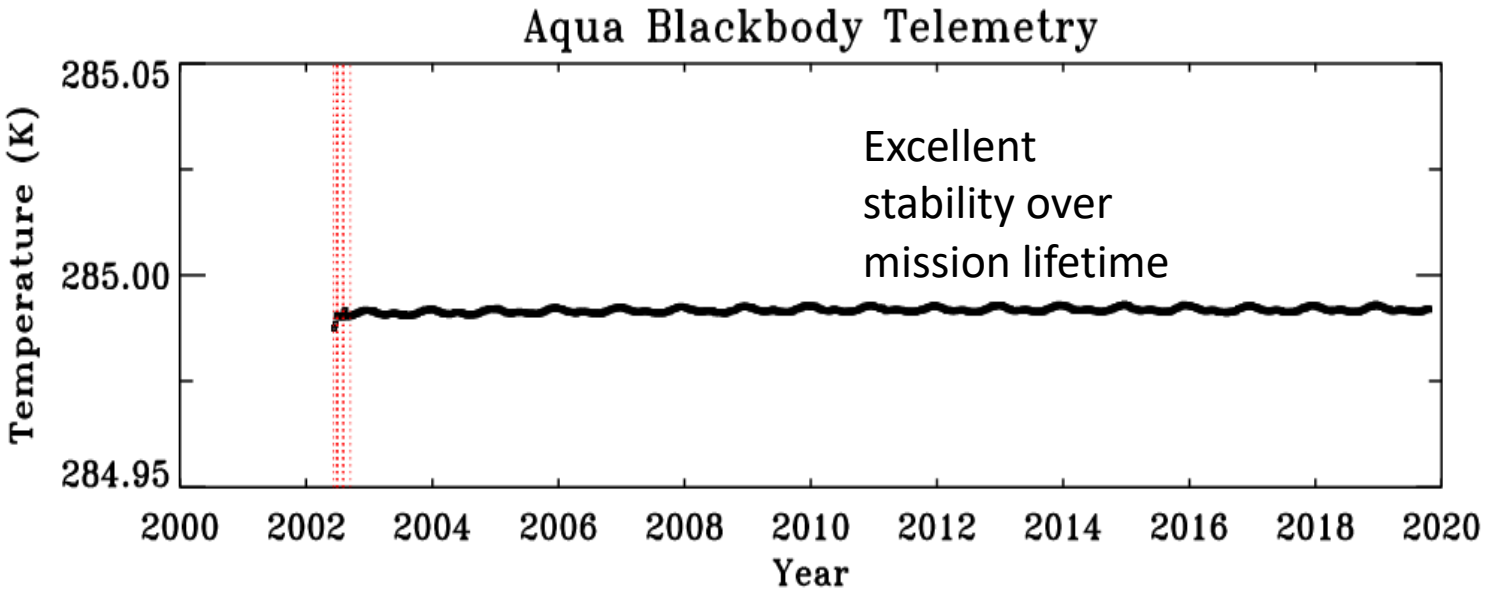
Instrument Temperature Trends



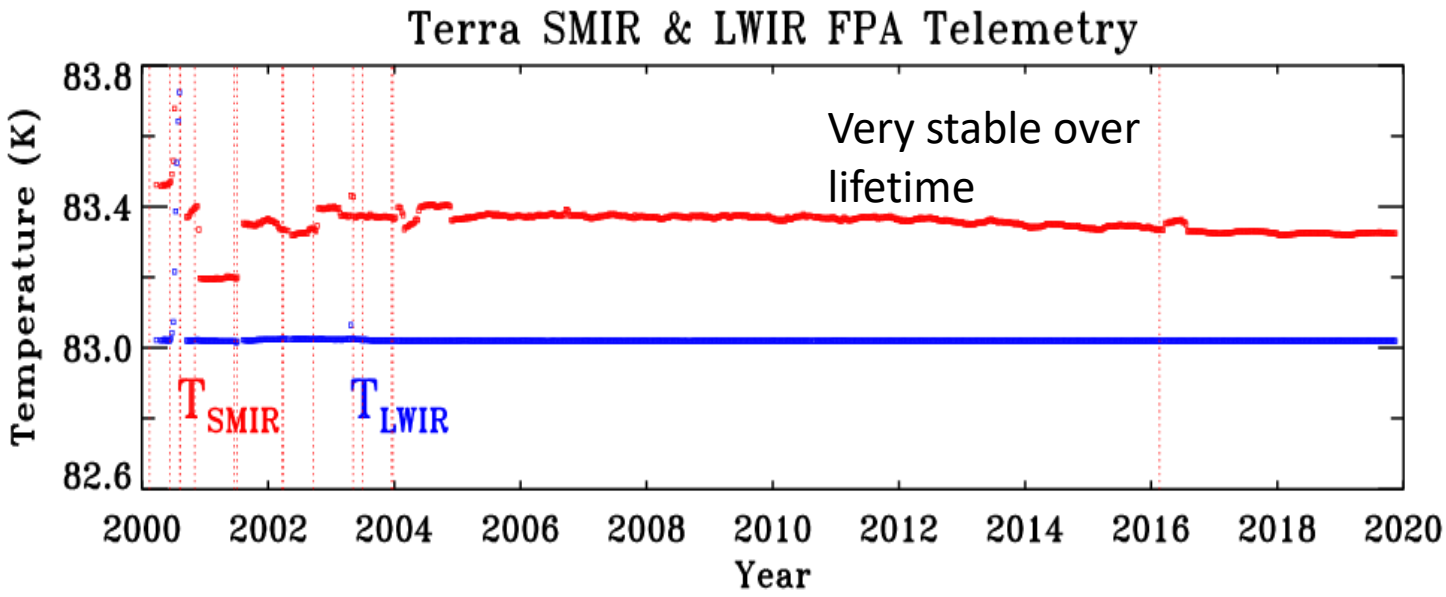


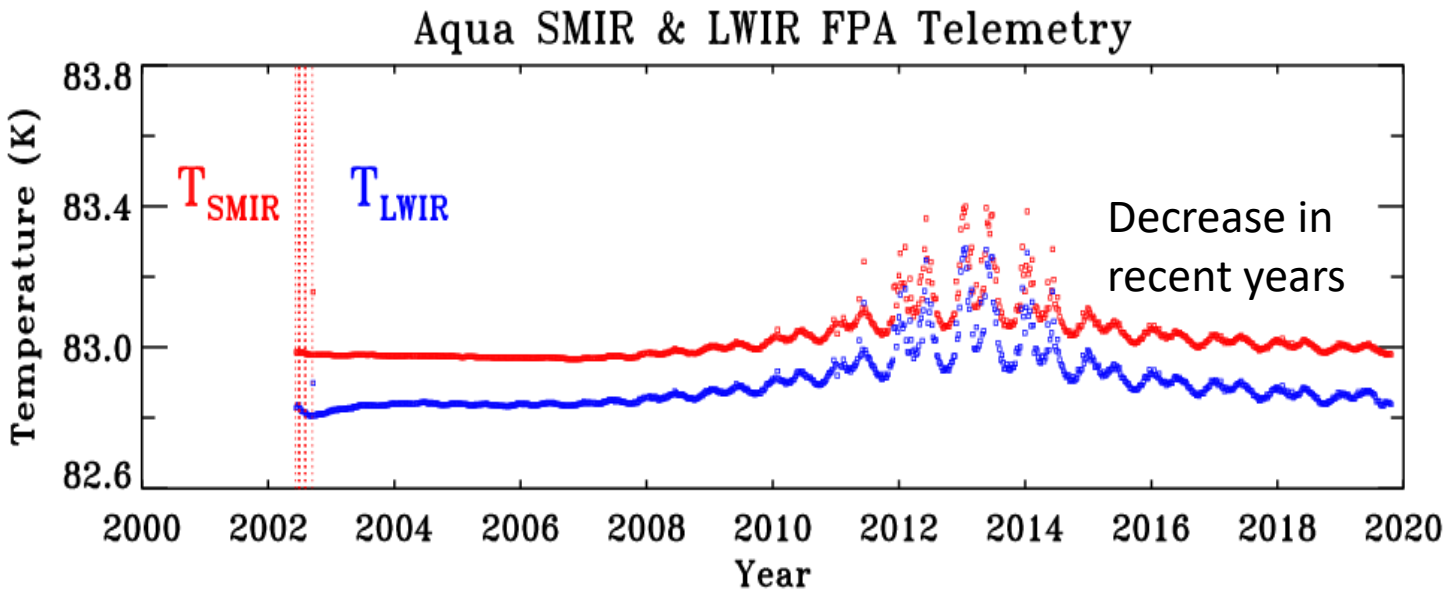
BB Temperature Trends





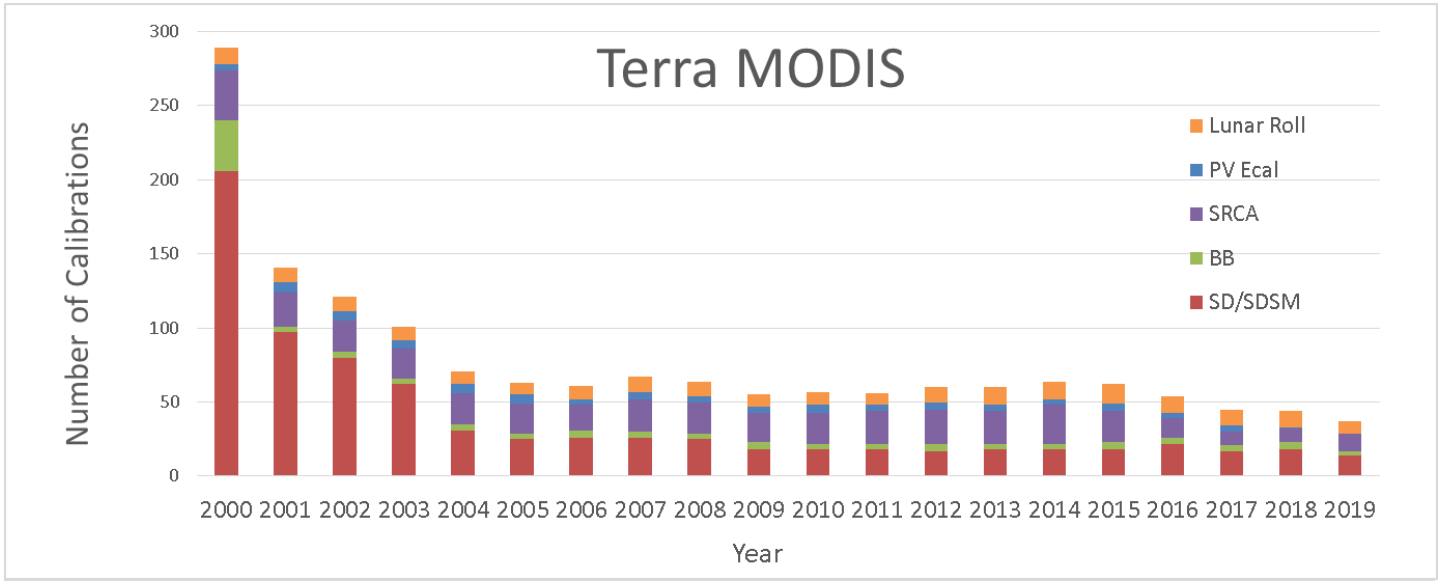
CFPA Temperature Trends



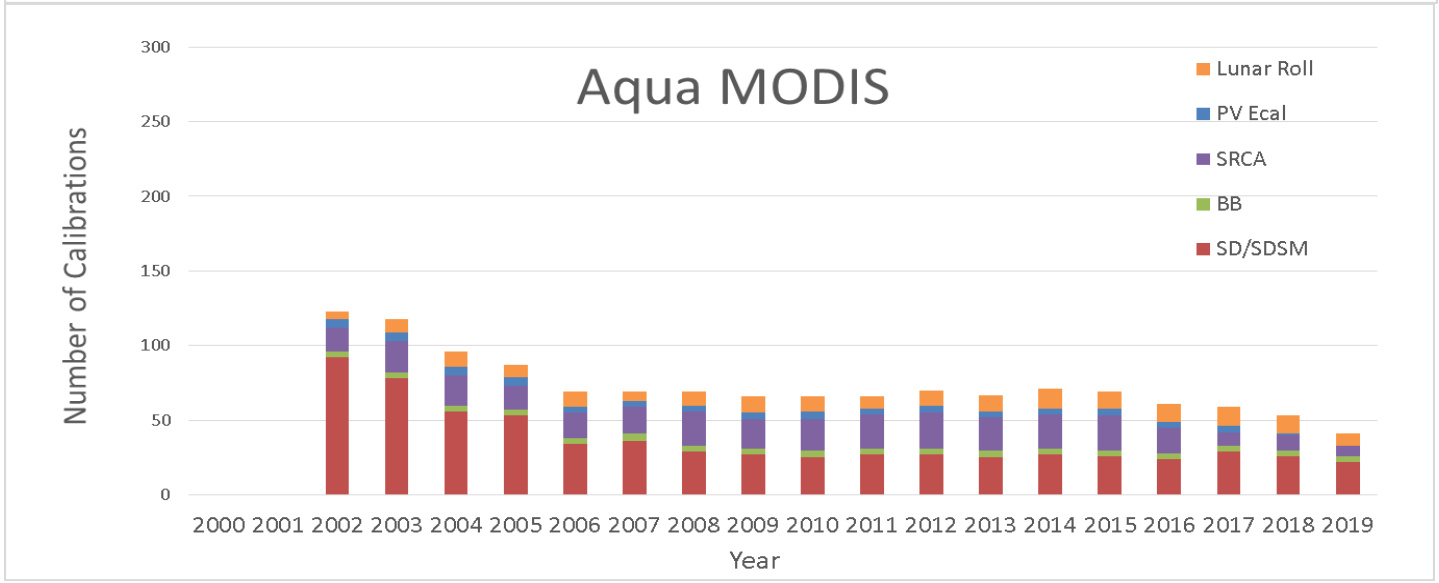


MODIS Calibration Operations

Terra



Aqua



SRCA Calibrations

- Terra – 469 SRCA Calibrations
- Aqua – 349 SRCA Calibrations
- Lamps well within lifetime usage margins

Lamp Power		10W				1W	
Lamp #		1	2	3	4	1	2
Terra	Usage (hr)	383.1	172.1	190.3	141.9	591.0	314.0
	Life (hr)	500	500	500	500	4000	4000
	percent	76.6%	Failed on 11-20-2004	Failed on 2-18-2006	28.4%	14.8%	7.9%
Aqua	Usage (hr)	373.5	188.1	205.7	135.0	531.5	303.9
	Life (hr)	500	500	500	500	5000	5000
	percent	74.7%	Failed on 4-14-2003	Failed on 6-28-2005	Failed on 6-30-2016	10.6%	6.0%

IOT Backup Slides

Terra/Aqua MODIS OBC Operations

TERRA

Activity	PL to 10/2018	10/2018 – present	Total
SD/SDSM[#]	756	18	774
BB WUCD	110	4	114
SRCA*	456	13	469
Electronic Cal	99	1	100
Lunar Roll	188	11	199

AQUA

Activity	PL to 10/2018	10/2018 - present	Total
SD/SDSM[#]	636	27	663
BB WUCD	70	5	75
SRCA*	340	9	349
Electronic Cal	77	1	78
Lunar Roll	165	11	176

[#] Open & Screened Activities counted independently
* Includes Spatial, Spectral, and Radiometric
10/2018 = last Science Team Meeting