



# MODIS Calibration Workshop

## Backup Slides

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*and*

*MODIS Characterization Support Team (MCST)*

*MODIS Calibration Workshop, College Park, MD 20706 (May 17, 2011)*



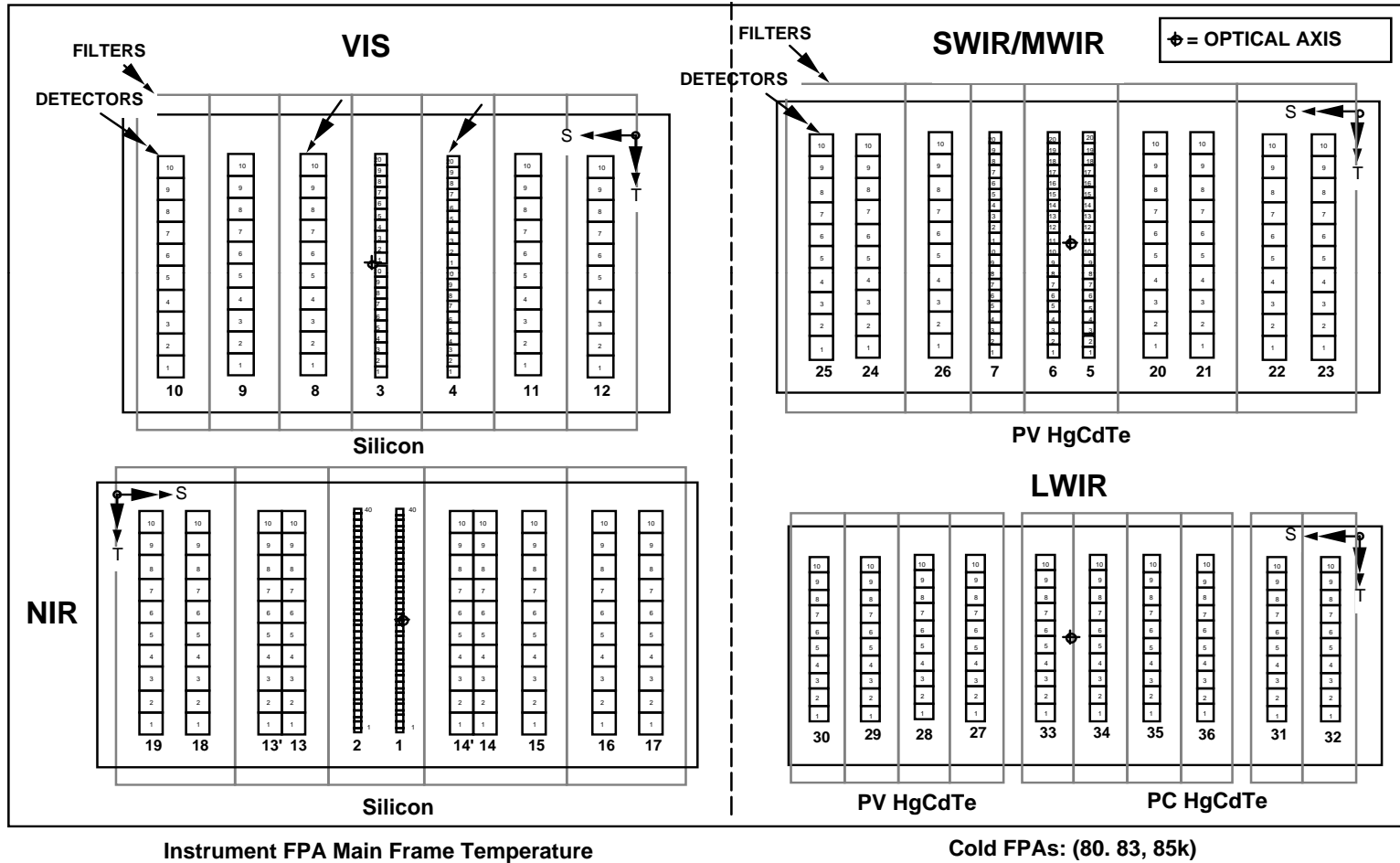
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# MODIS Focal Plane Assemblies (FPA)



**S: scan direction; T: track direction**

**B13 and B14 have 2 columns of detectors for TDI high and low gain output**



# MODIS Key Specifications



Primary Use	Band	Bandwidth <sup>1</sup>	Spectral Radiance <sup>2</sup>	Required SNR <sup>3</sup>	Primary Use	Band	Bandwidth <sup>1</sup>	Spectral Radiance <sup>2</sup>	Required NEΔT(K) <sup>4</sup>
Land/Cloud/Aerosols Boundaries	1	620 - 670	21.8	128	Surface/Cloud Temperature	20	3.660 - 3.840	0.45 (300K)	0.05
	2	841 - 876	24.7	201		21	3.929 - 3.989	2.38 (335K)	0.2
Land/Cloud/Aerosols Properties	3	459 - 479	35.3	243		22	3.929 - 3.989	0.67 (300K)	0.07
	4	545 - 565	29	228		23	4.020 - 4.080	0.79 (300K)	0.07
	5	1230 - 1250	5.4	74	Atmospheric Temperature	24	4.433 - 4.498	0.17 (250K)	0.25
	6	1628 - 1652	7.3	275		25	4.482 - 4.549	0.59 (275K)	0.25
	7	2105 - 2155	1	110	Cirrus Clouds Water Vapor	26	1.360 - 1.390	6	150 <sup>3</sup>
Ocean Color/ Phytoplankton/ Biogeochemistry	8	405 - 420	44.9	880		27	6.535 - 6.895	1.16 (240K)	0.25
	9	438 - 448	41.9	838		28	7.175 - 7.475	2.18 (250K)	0.25
	10	483 - 493	32.1	802	Cloud Properties	29	8.400 - 8.700	9.58 (300K)	0.05
	11	526 - 536	27.9	754		Ozone	30	9.580 - 9.880	3.69 (250K)
	12	546 - 556	21	750	Surface/Cloud Temperature	31	10.780 - 11.280	9.55 (300K)	0.05
	13	662 - 672	9.5	910		32	11.770 - 12.270	8.94 (300K)	0.05
	14	673 - 683	8.7	1087	Cloud Top Altitude	33	13.185 - 13.485	4.52 (260K)	0.25
	15	743 - 753	10.2	586		34	13.485 - 13.785	3.76 (250K)	0.25
16	862 - 877	6.2	516	35		13.785 - 14.085	3.11 (240K)	0.25	
Atmospheric Water Vapor	17	890 - 920	10	167		36	14.085 - 14.385	2.08 (220K)	0.35
	18	931 - 941	3.6	57	<sup>1</sup> Bands 1 to 19 are in nm; Bands 20 to 36 are in μm <sup>2</sup> Spectral Radiance values are (W/m <sup>2</sup> -μm-sr) <sup>3</sup> SNR = Signal-to-noise ratio <sup>4</sup> NEΔT = Noise-equivalent temperature difference				
	19	915 - 965	15	250					



# RSB Calibration

## Backup Slides

*MODIS Characterization Support Team (MCST)*



*MCST Workshop at MST Meeting (May 17, 2011)*





## MODIS RSB Calibration Using SD/SDSM



*EV Radiance:*

$$L_{EV} = \frac{E_{Sun} \cdot \rho_{EV} \cdot \cos(\theta_{EV})}{\pi \cdot d_{Earth\_Sun(EV)}^2}$$
$$= \frac{E_{Sun}}{\pi} m_1 \cdot dn_{EV}$$

*Solar Irradiance  $E_{SUN}$ :*

*0.4-0.8  $\mu m$  Thuillier et al., 1998;*

*0.8-1.1  $\mu m$  Neckel and Labs, 1984;*

*Above 1.1  $\mu m$  Smith and Gottlieb, 1974*

*Others:*

*Thermal leak applied for SWIR bands (B5-7, B26)*

*Leak coefficients determined from EV night time data*

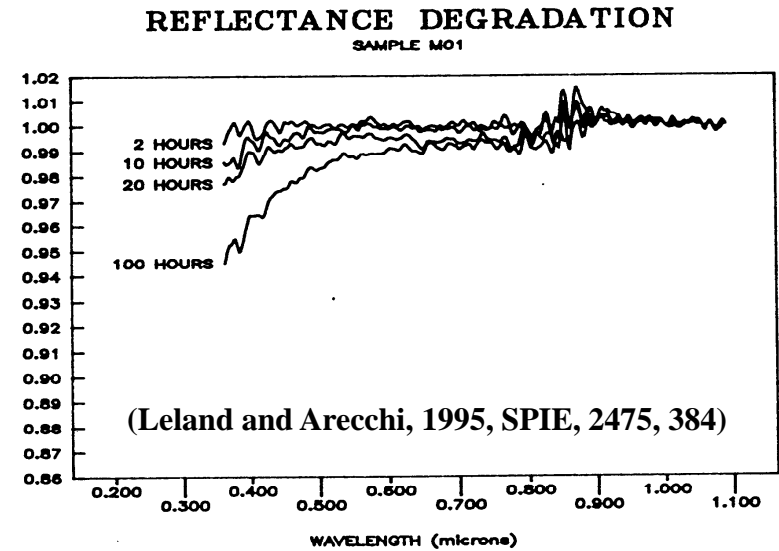
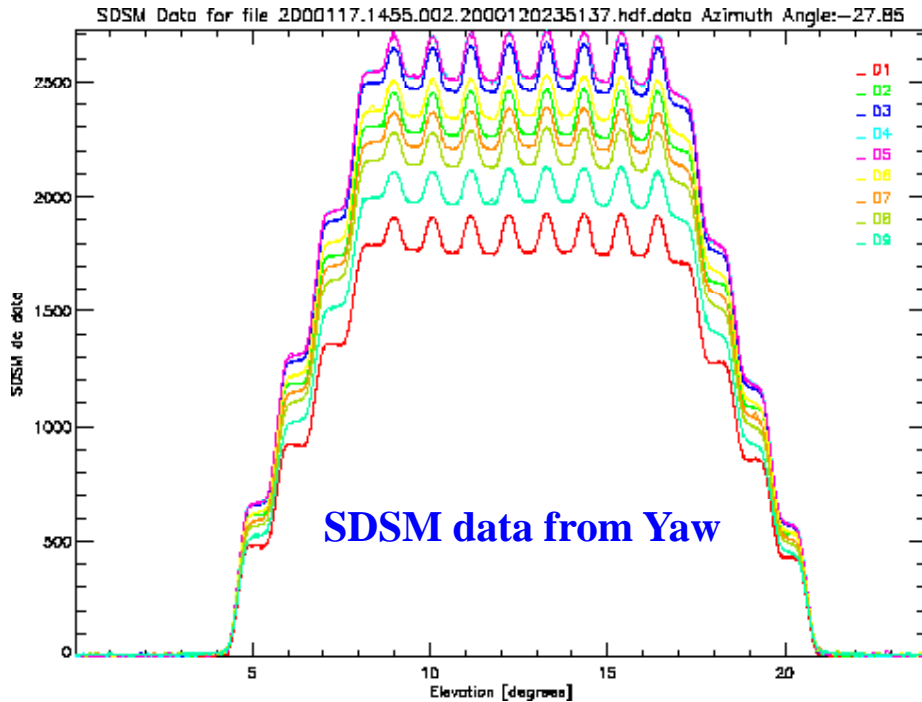
*B26 de-stripping algorithm added (from C. Moeller of Wisconsin)*



# SDSM for SD Degradation



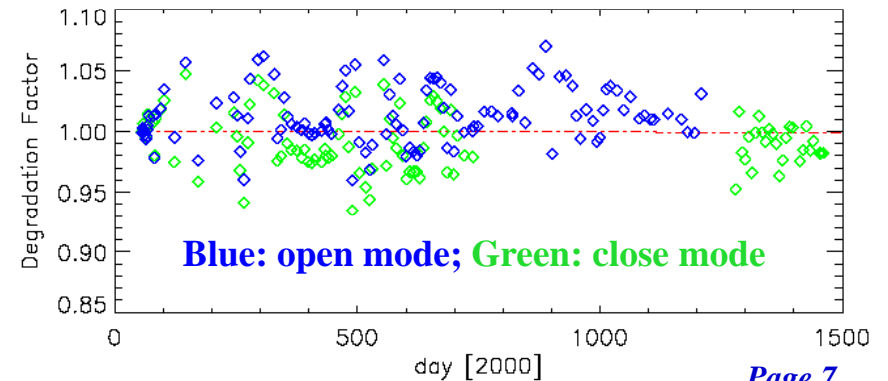
Normalize to SDSM D9 is adequate



Terra MODIS SDSM D9 show no obvious degradation from over five years' on-orbit trending (observations)

Normalize to SDSM D9 at 936nm

$$\Delta_{SD} = \frac{dc_{SD}}{dc_{Sun}} \rightarrow \left\{ \frac{dc_{SD\_view}^{D1} / dc_{Sun\_view}^{D1}}{dc_{SD\_view}^{D9} / dc_{Sun\_view}^{D9}} \right\}$$



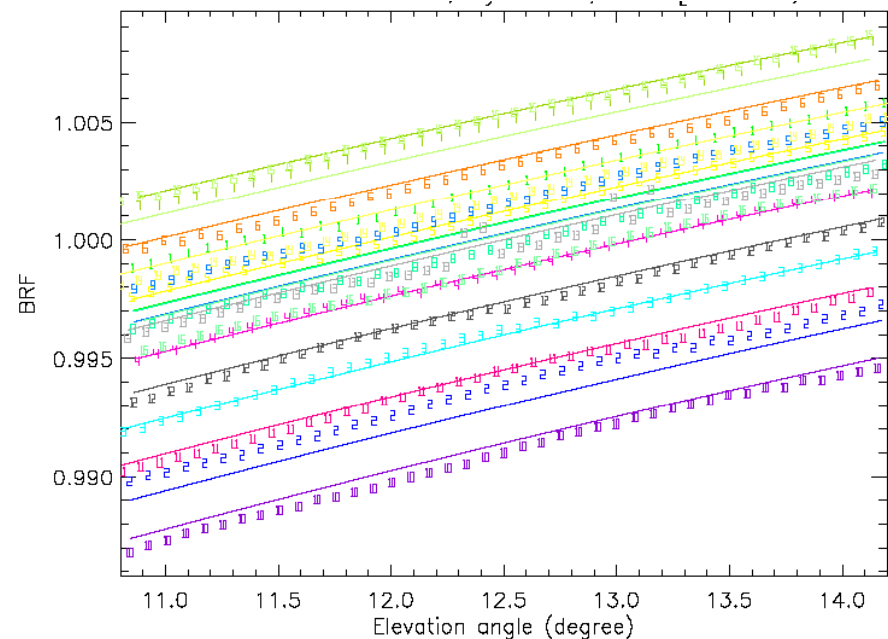


# Solar Diffuser BRF Validation (on-orbit)



- On-orbit BRF validation performed (yaw maneuvers)
- Bands 1-4 and 17-19 used to validate the BRF (bands 8-16 saturate without SD screen, SWIR bands have xtalk)
- Pre-launch BRF curves used to fit the observations
- Measurements (Terra MODIS) agree with pre-launch values to within  $\pm 0.25\%$ \* (consistency checked among different detectors within a band; \* B2 min/max difference is  $-0.22\%/0.41\%$ )
- Pre-launch BRF is used in the m1 calculation

Terra MODIS B3 BRF  
fitting (solid line); on-orbit data (symbols)

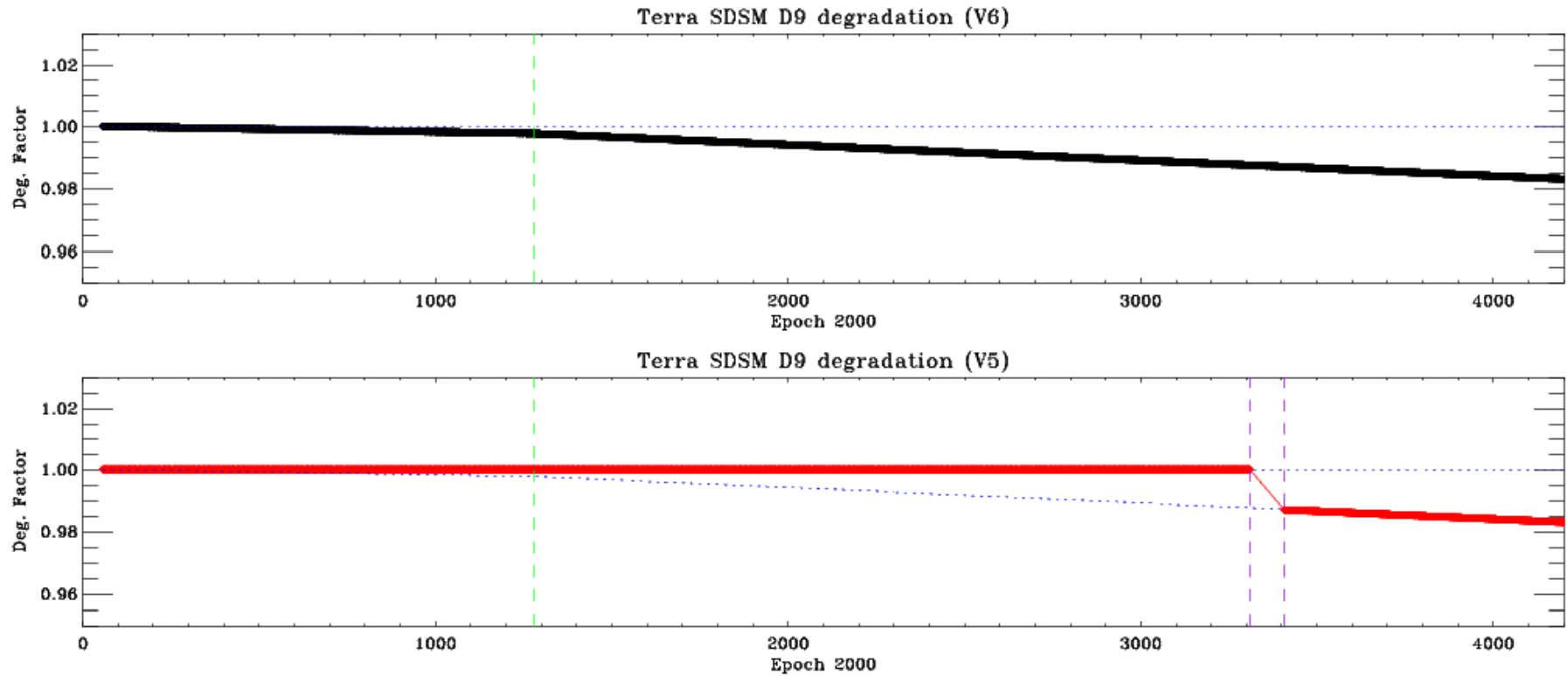


Band	Min_Diff	Max_Diff
1	-0.1309	0.2413
2	-0.2172	0.4130
3	-0.1624	0.1933
4	-0.1332	0.1747
17	-0.2045	0.2705
18	-0.1385	0.2491
19	-0.1590	0.2552



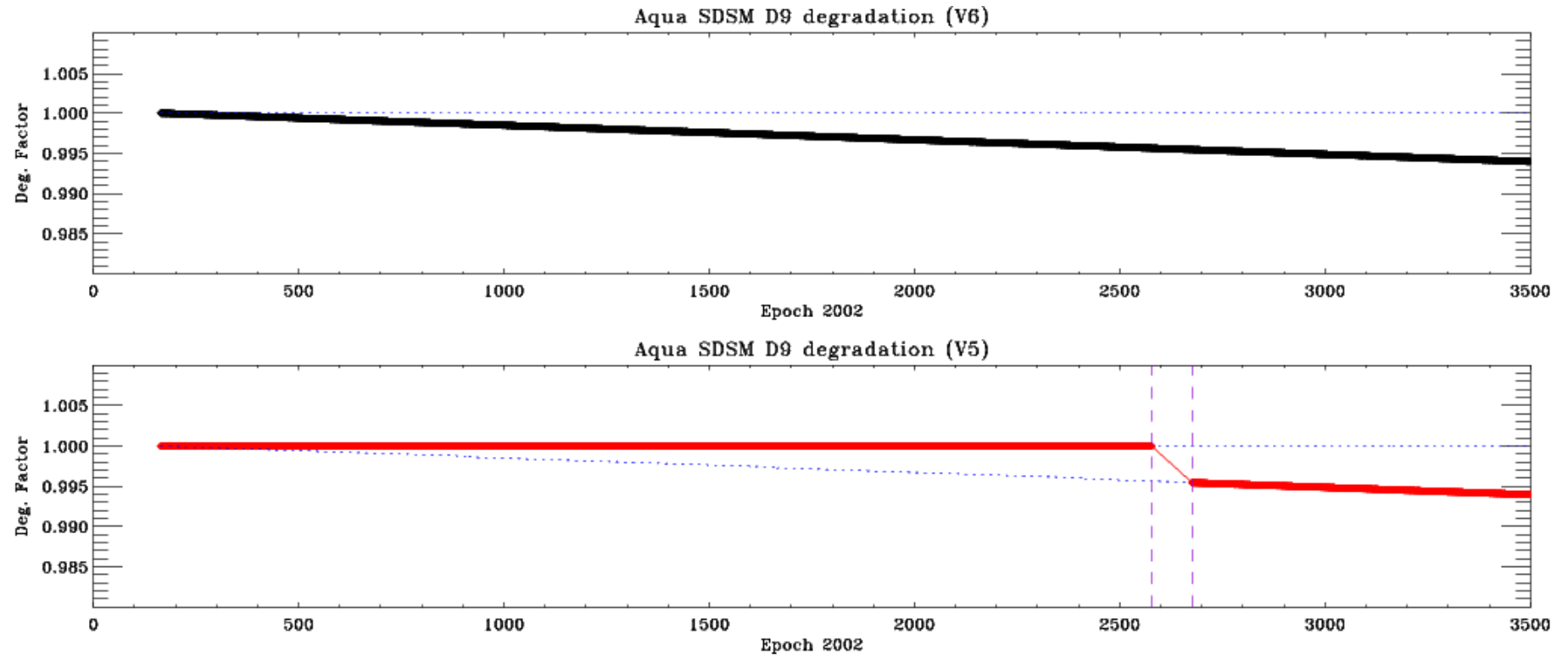


# Terra D9 Degradation





# Aqua D9 Degradation





## MODIS Polarization Effect



- TOA (Top-of-Atmosphere) reflectance

$$[\rho_{EV} \cos(\theta_{EV})]_{L1B} = \rho_{EV} \cos(\theta_{EV}) \{1 + f \cdot a_{BDM\theta} \cos[2(\mu + \delta_{BDM\theta})]\}$$

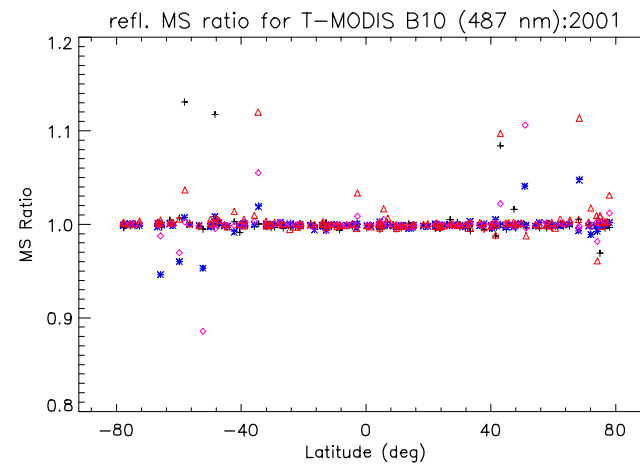
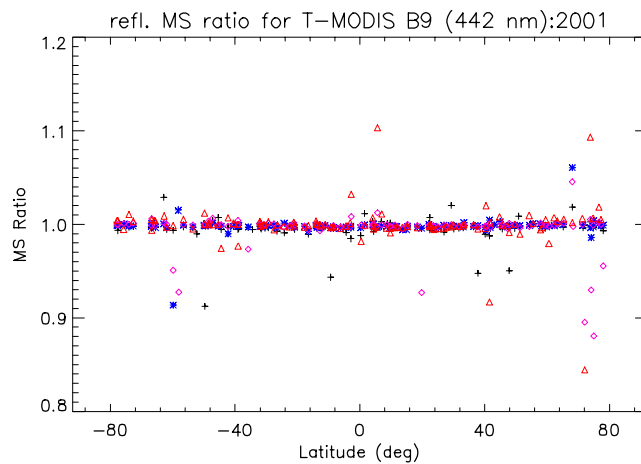
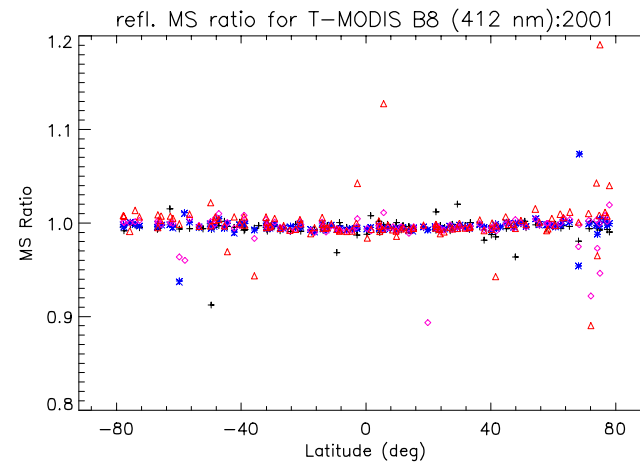
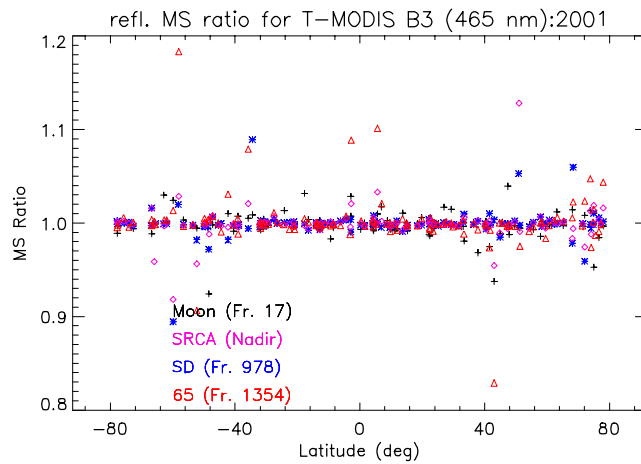
- B, D, M, and  $\theta$  are band, detector, mirror side, and angle of incidence
- $a$  and  $\delta$  are instrument's polarization factor and phase angle, which were measured prelaunch but change on orbit
- $f$  and  $\mu$  are degree of the incident light's polarization and the direction of larger axis of the incident light's polarization

- EV mirror side ratio

$$\frac{[\rho_{EV} \cos(\theta_{EV})]_{L1B,MS1}}{[\rho_{EV} \cos(\theta_{EV})]_{L1B,MS2}} = \frac{\{1 + f \cdot a_{BD1\theta} \cos[2(\mu + \delta_{BD1\theta})]\}}{\{1 + f \cdot a_{BD2\theta} \cos[2(\mu + \delta_{BD2\theta})]\}}$$

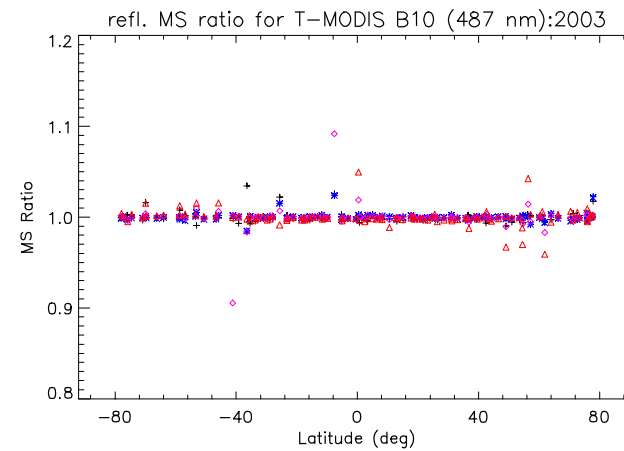
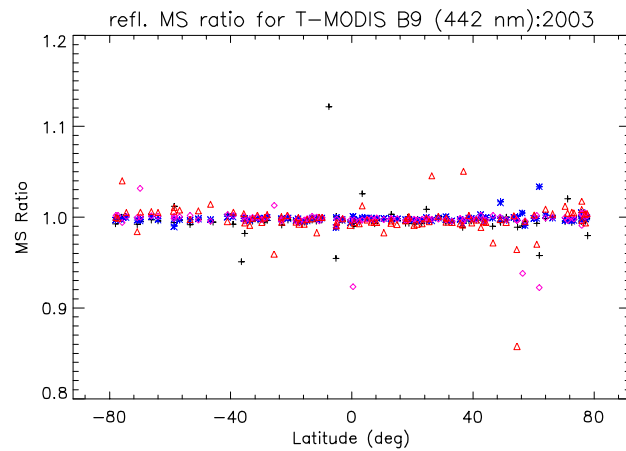
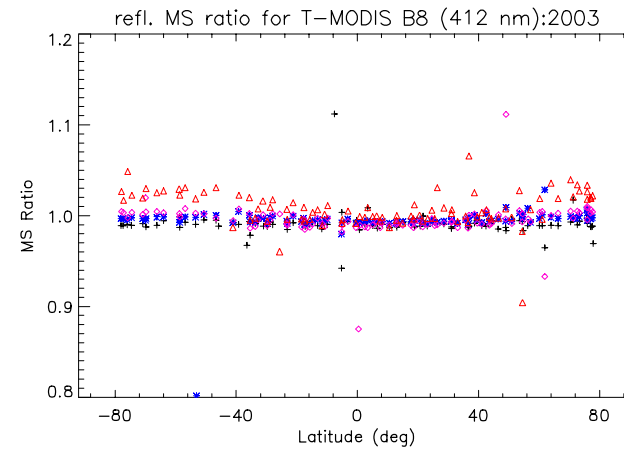
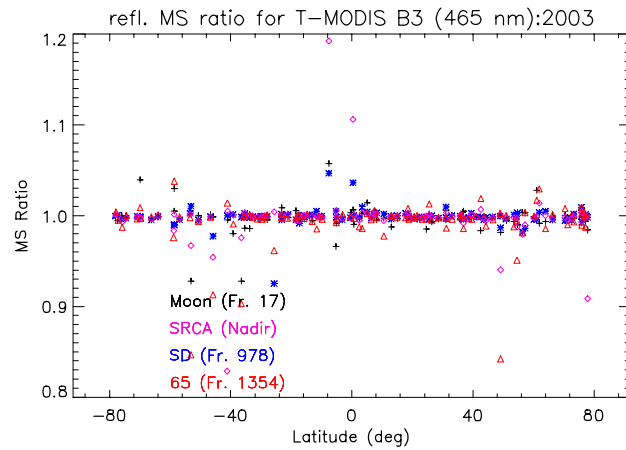


# Terra L1B MS Ratio at Different Latitudes



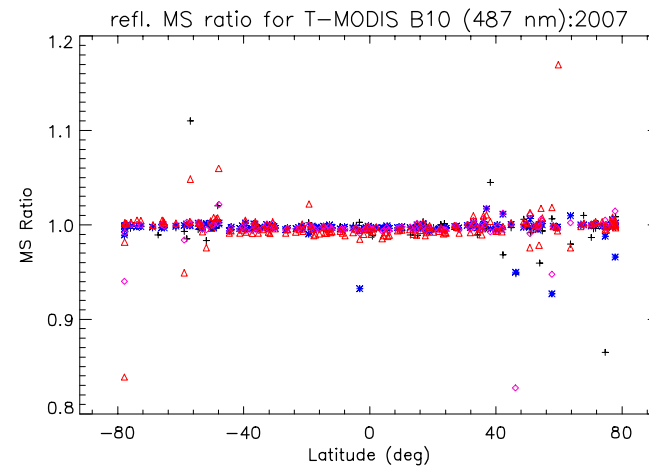
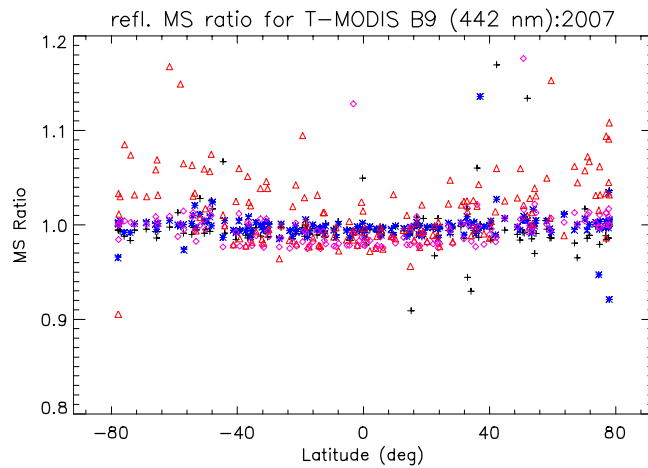
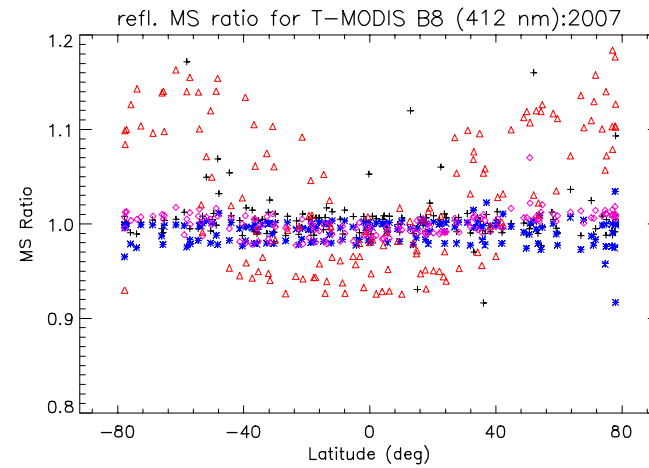
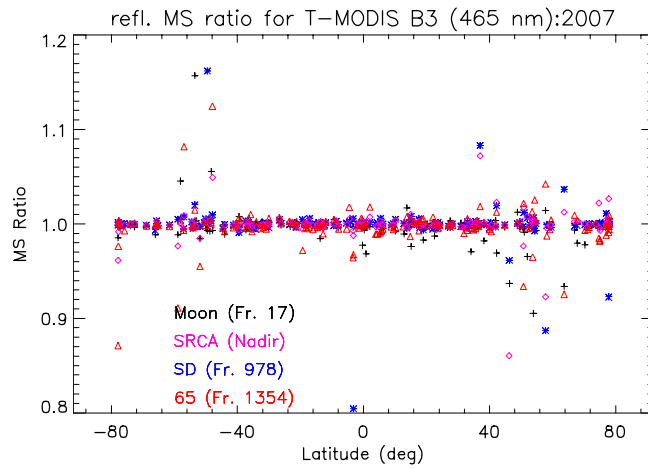


# Terra L1B MS Ratio at Different Latitudes



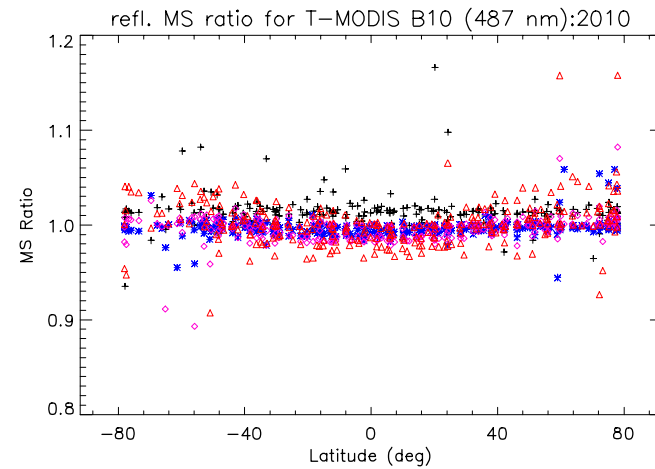
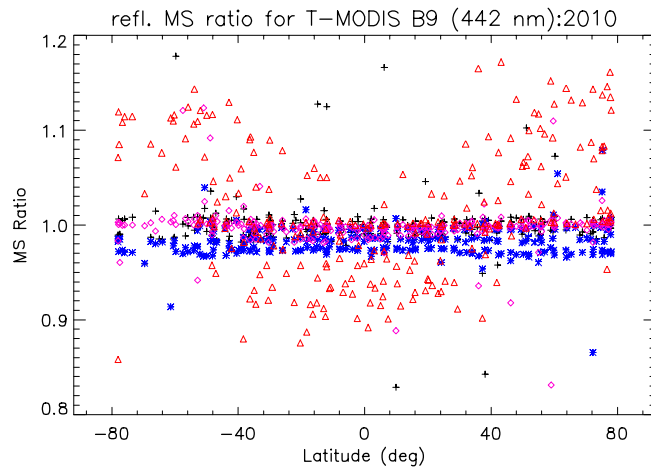
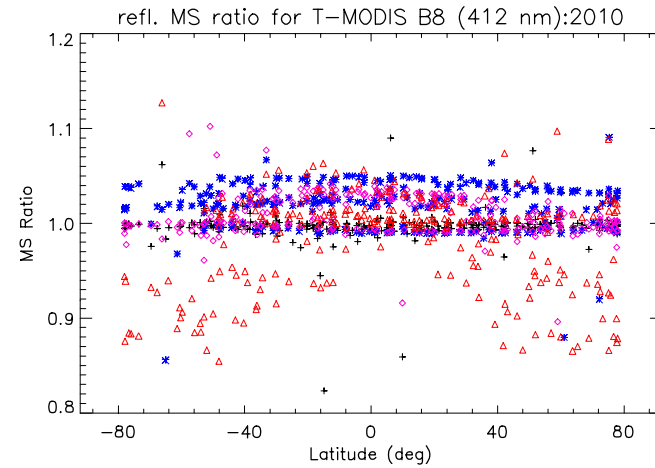
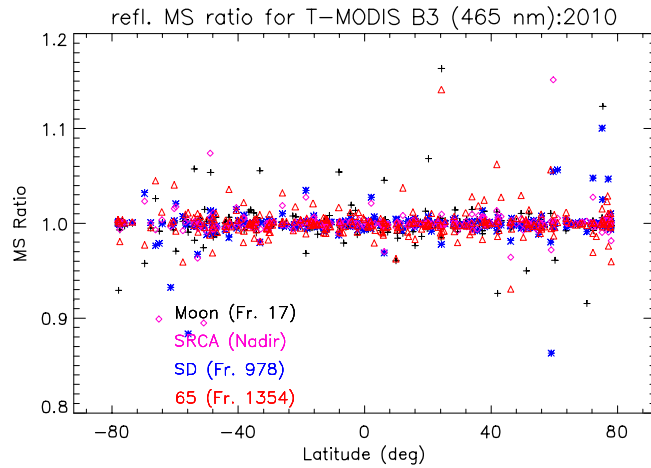


# Terra L1B MS Ratio at Different Latitudes



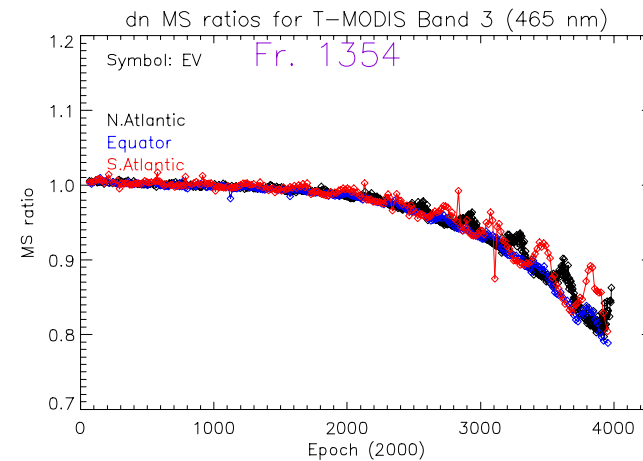
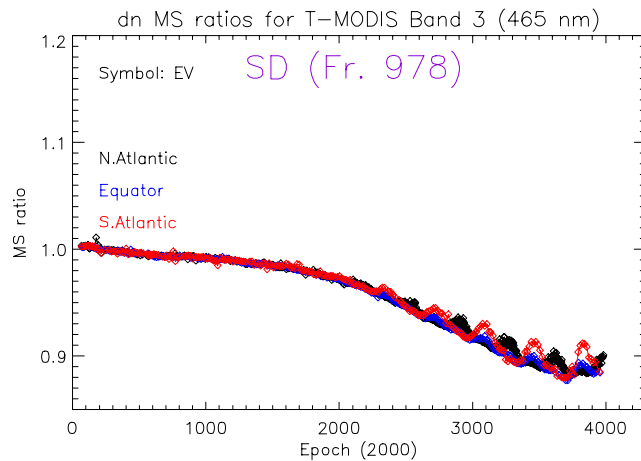
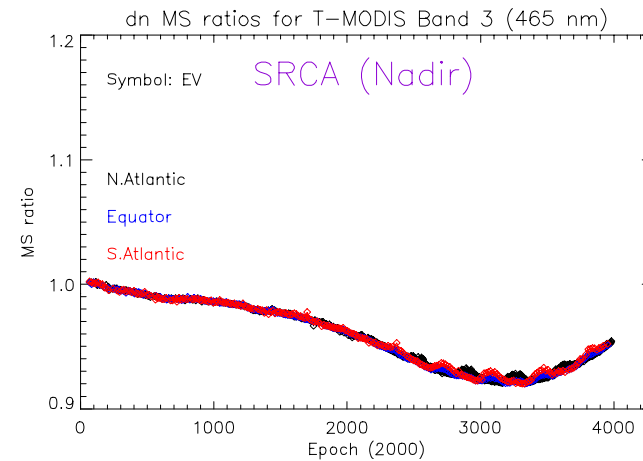
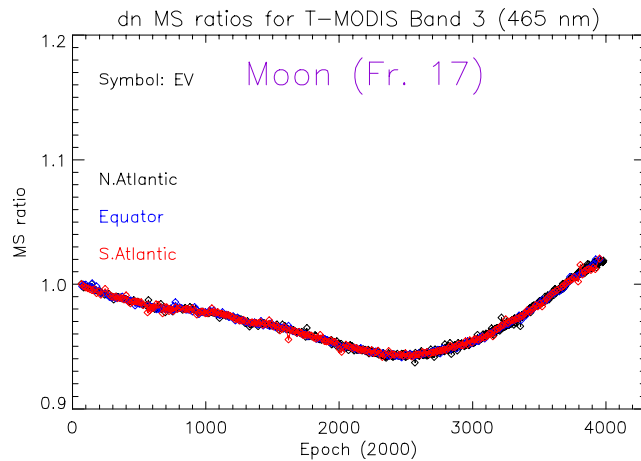


# Terra L1B MS Ratio in at Different Latitudes





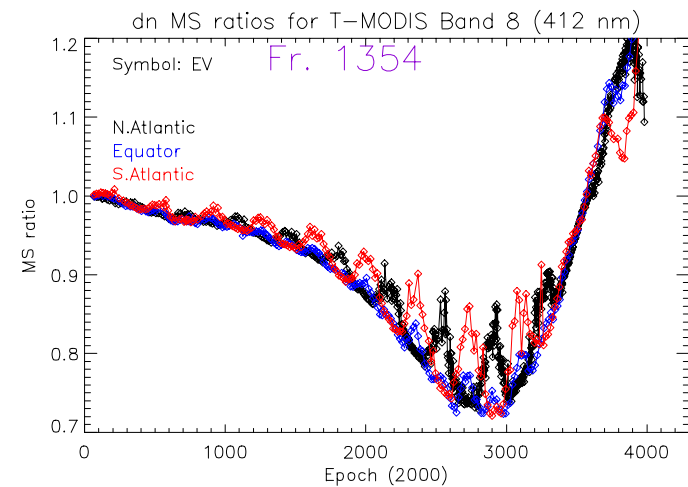
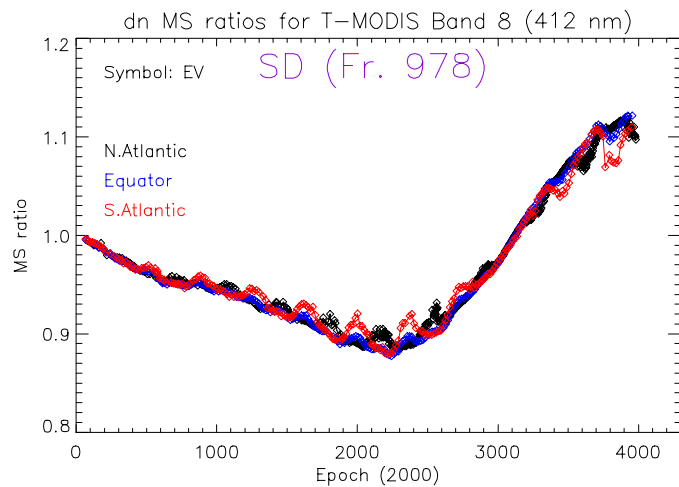
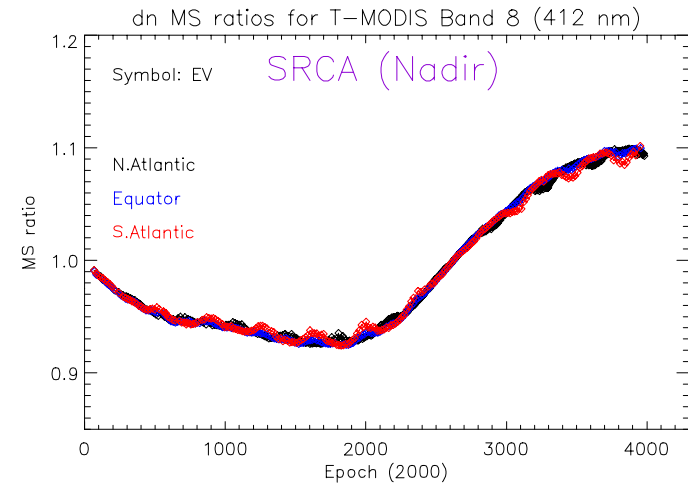
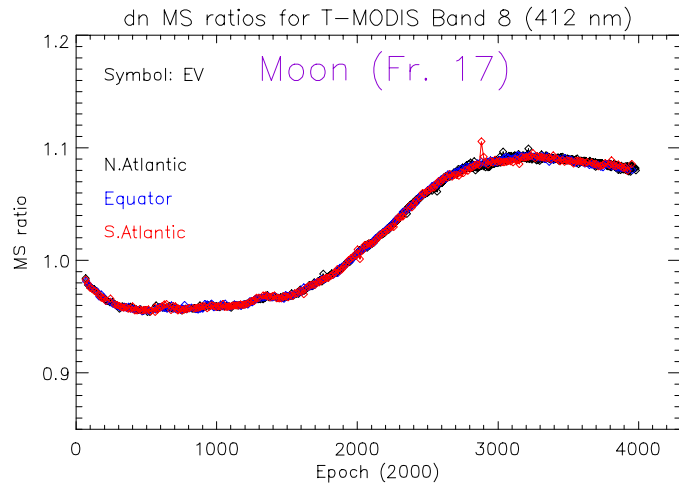
# Terra Instrument Response MS Ratio





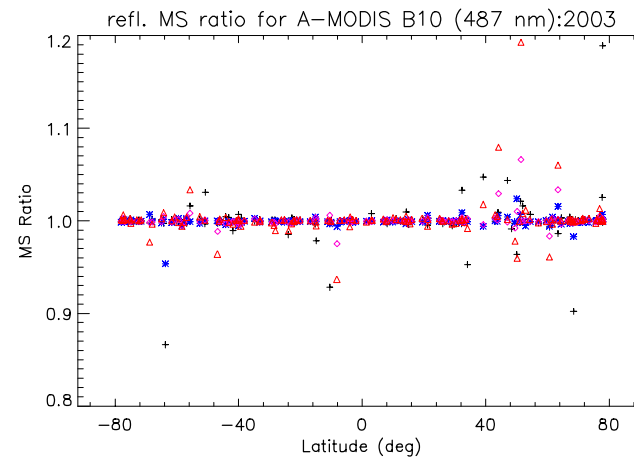
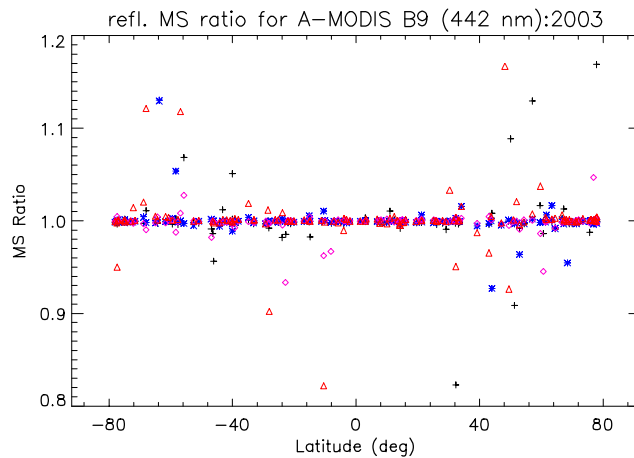
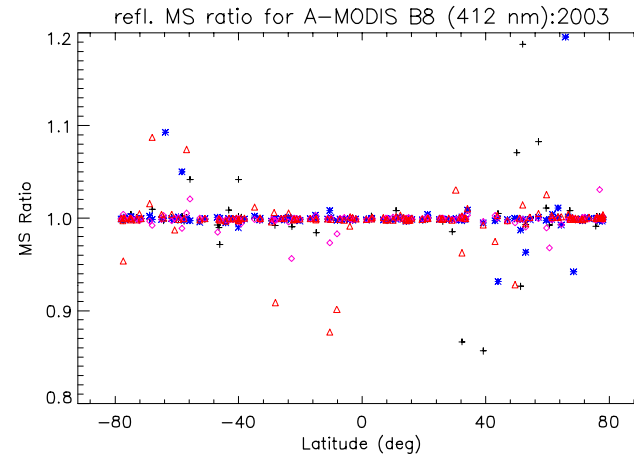
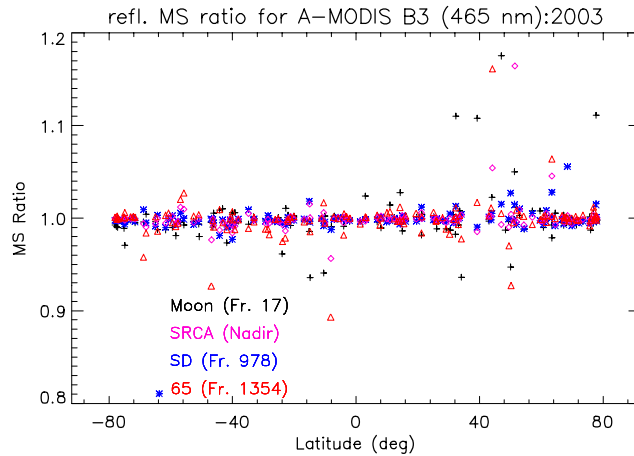


# Terra Instrument Response MS Ratio



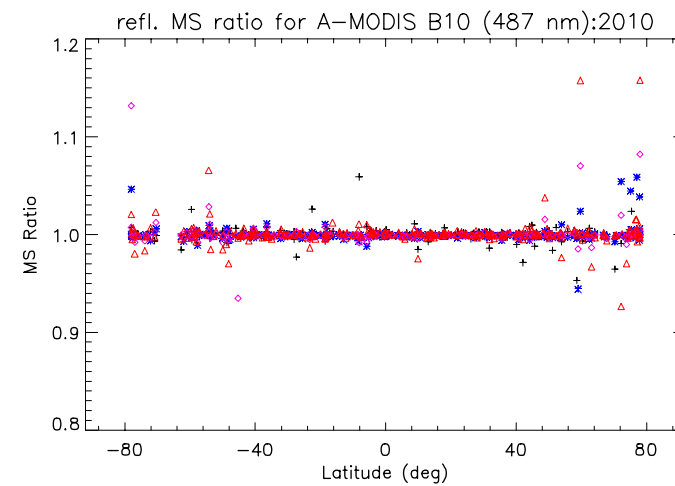
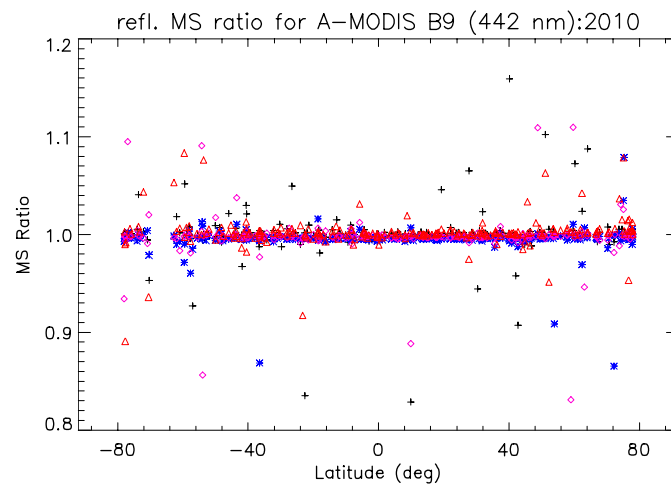
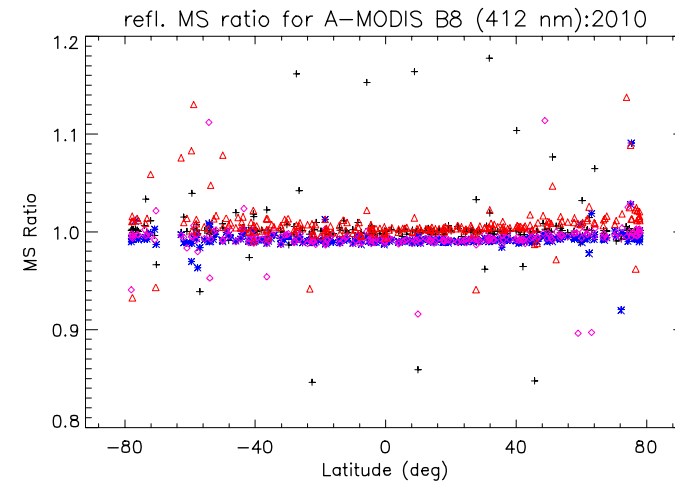
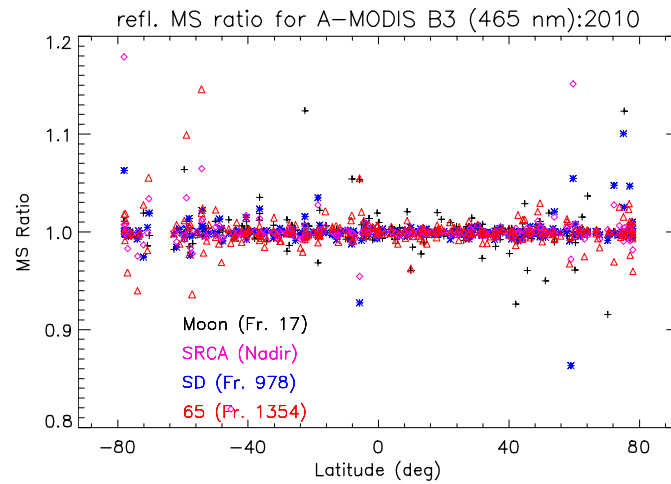


# Aqua L1B MS Ratio at Different Latitudes





# Aqua L1B MS Ratio at Different Latitudes





# TEB Calibration Backup Slides

*MODIS Characterization Support Team (MCST)*

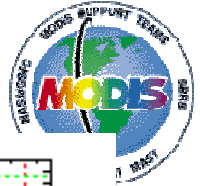


*MCST Workshop at MST Meeting (May 17, 2011)*

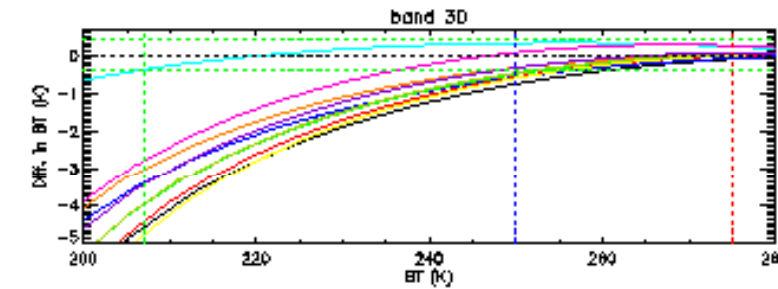
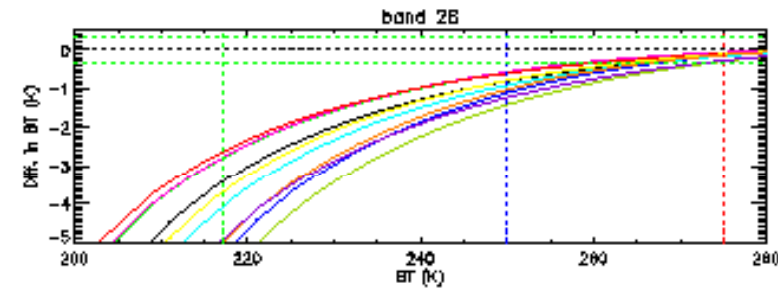
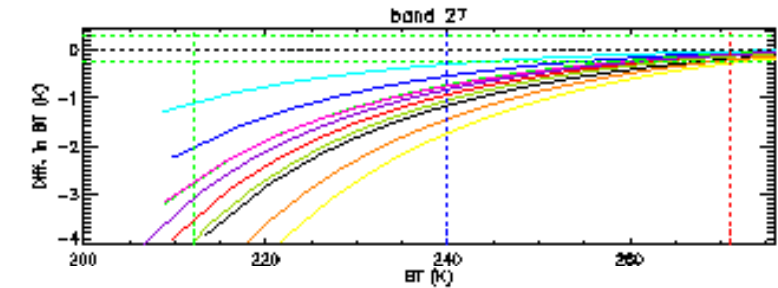
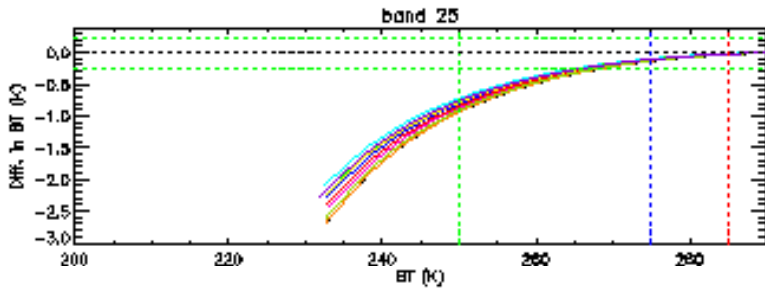
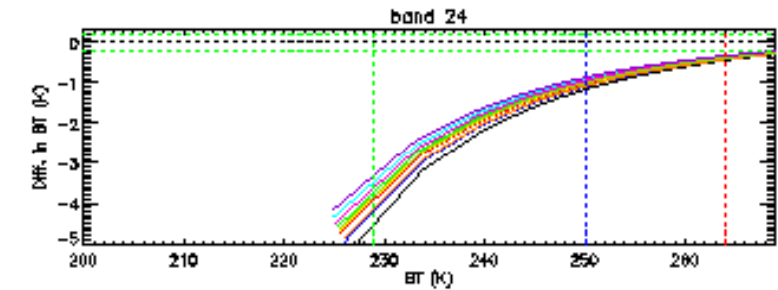
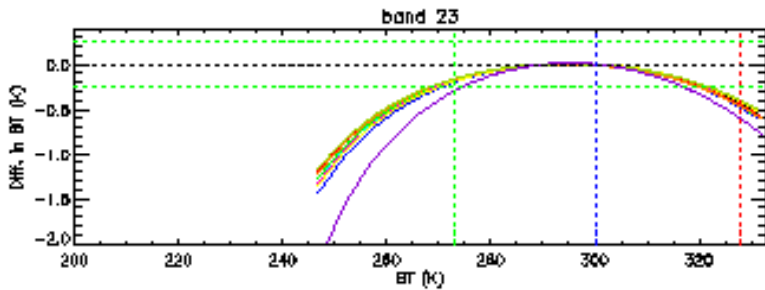
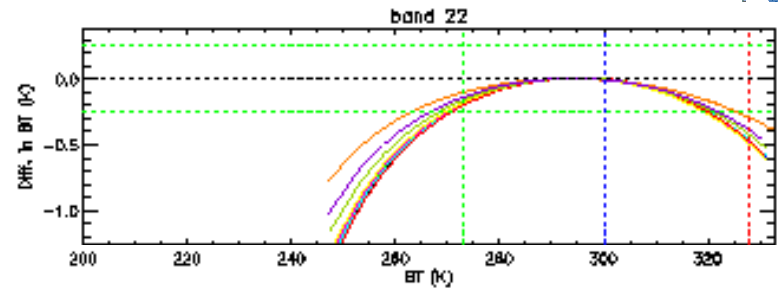
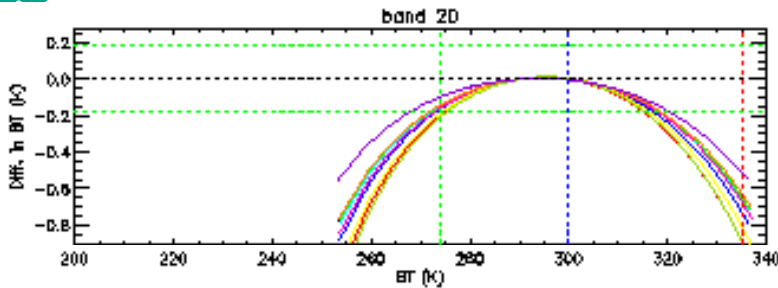




# Estimated L1B Impact due to zero a0



$$\Delta T = C6 - C5$$



Diff in BT = T(Za0) - T(LUT)

T<sub>0.3Ltyp</sub>; T<sub>Ltyp</sub>; T<sub>Lmax</sub>;

D1

D2 D3 D4 D5 D6 D7 D8 D9 D10 e 21

EV frames: 600 to 700

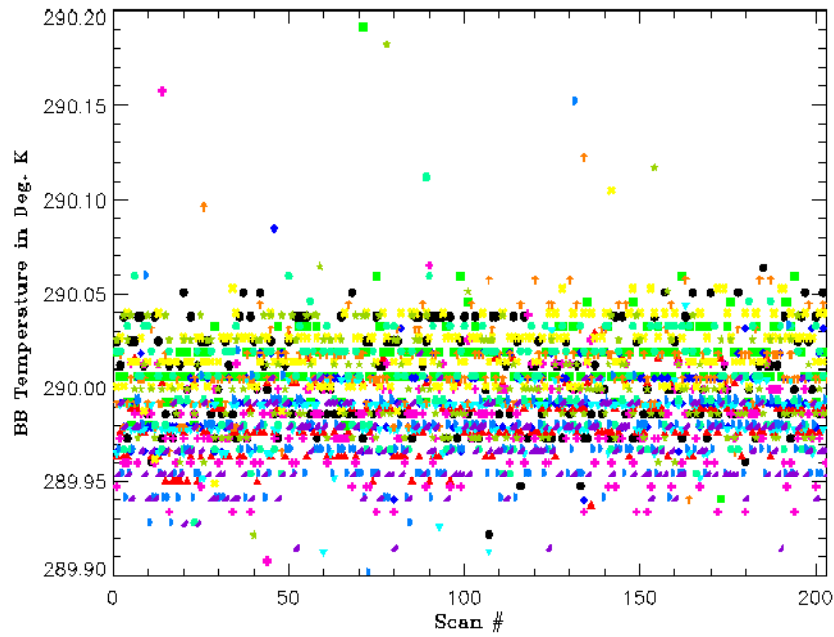


# Terra BB Short-term Stability

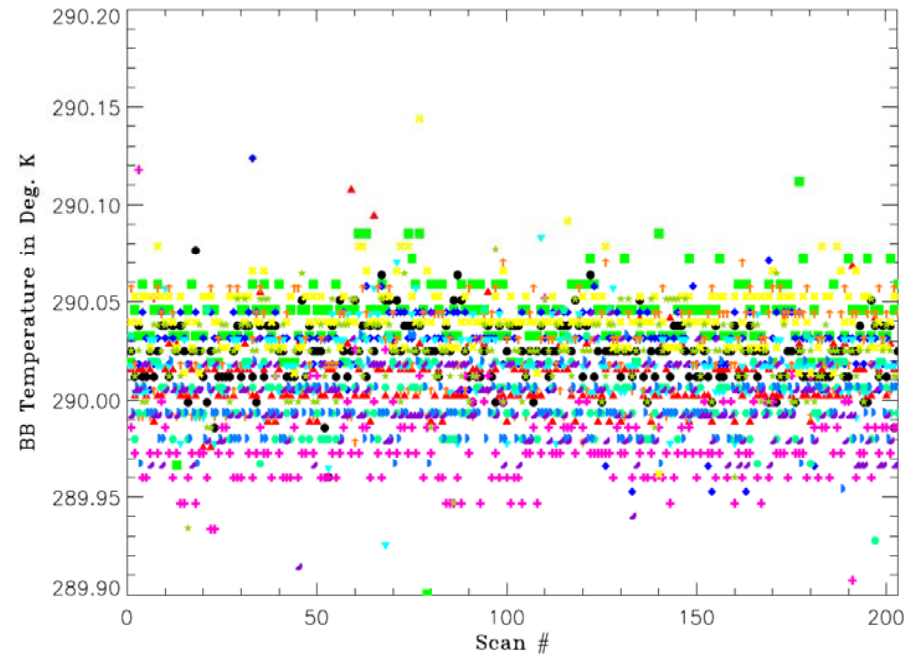


1-granule, scan-by-scan, 12 individual BB thermistors

MODIS Terra - Individual BB Thermistor Temperatures from Granule 2003.015.0000



MODIS Terra - Individual BB Thermistor Temperatures from Granule 2011.108.0900



Therm 1 Therm 2 Therm 3 Therm 4 Therm 5 Therm 6 Therm 7 Therm 8 Therm 9 Therm 10 Therm 11 Therm 12

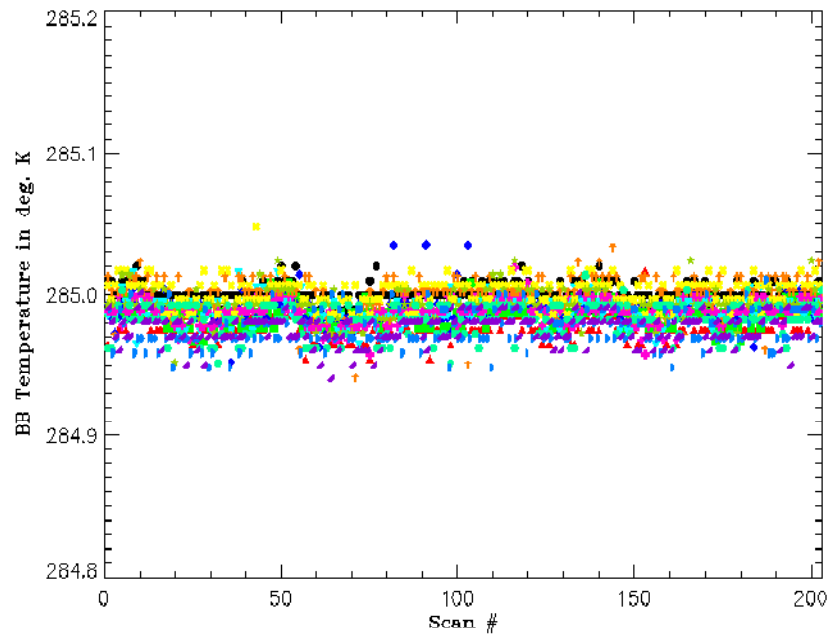


# Aqua BB Short-term Stability

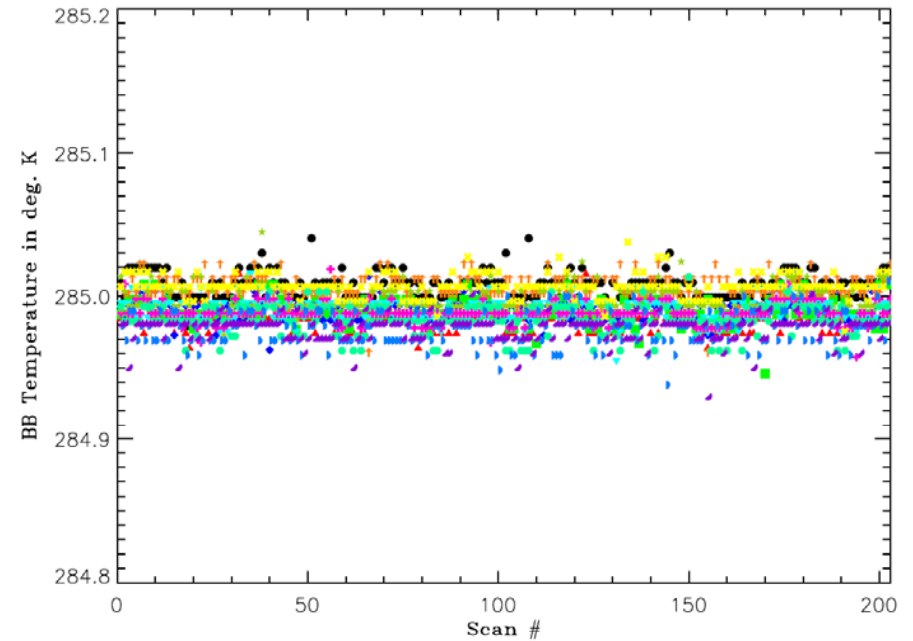


1-granule, scan-by-scan, 12 individual BB thermistors

MODIS Aqua - Individual BB Thermistor Temperatures from Granule 2002.268.0055



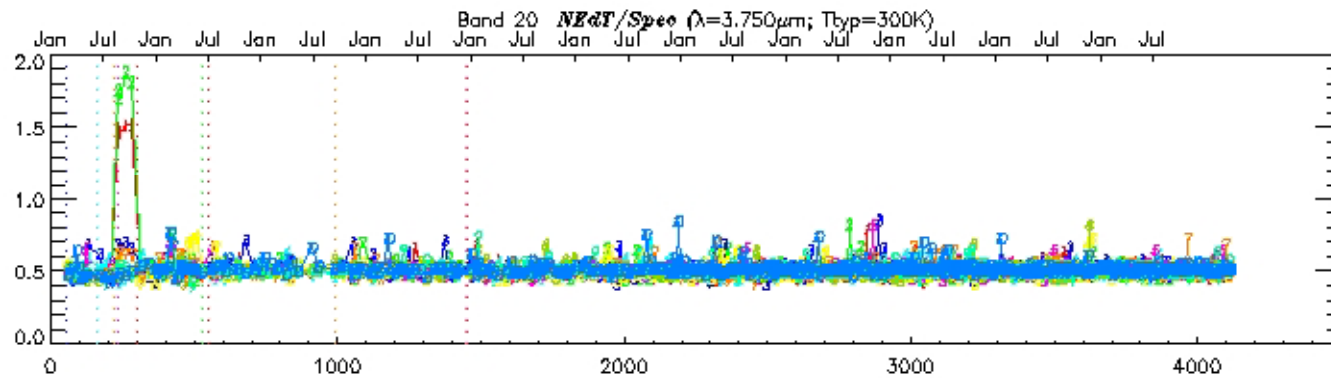
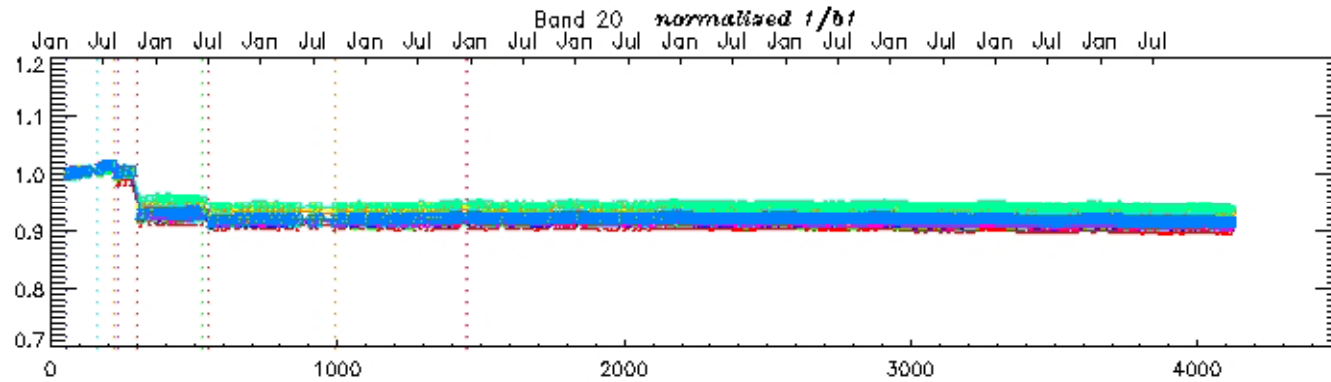
MODIS Aqua - Individual BB Thermistor Temperatures from Granule 2011.108.0900



Therm 1 Therm 2 Therm 3 Therm 4 Therm 5 Therm 6 Therm 7 Therm 8 Therm 9 Therm 10 Therm 11 Therm 12



Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)

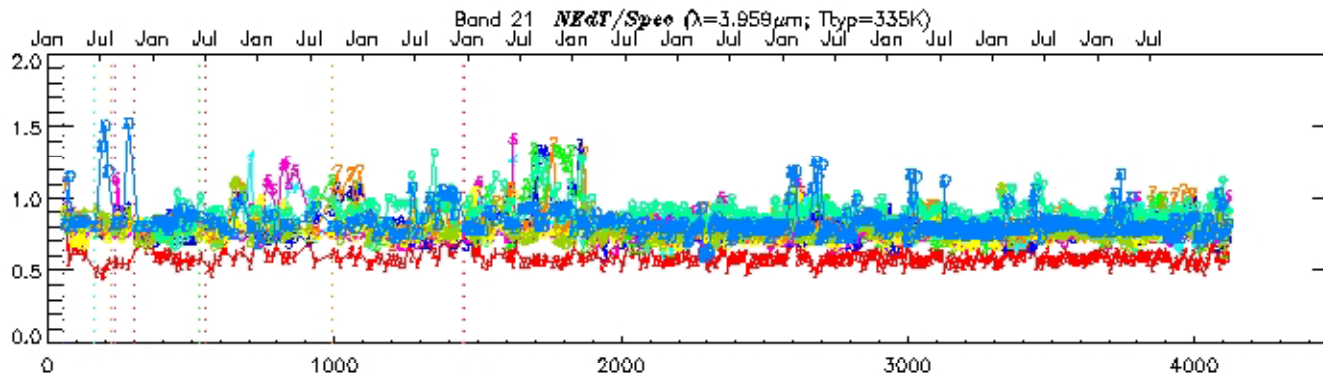
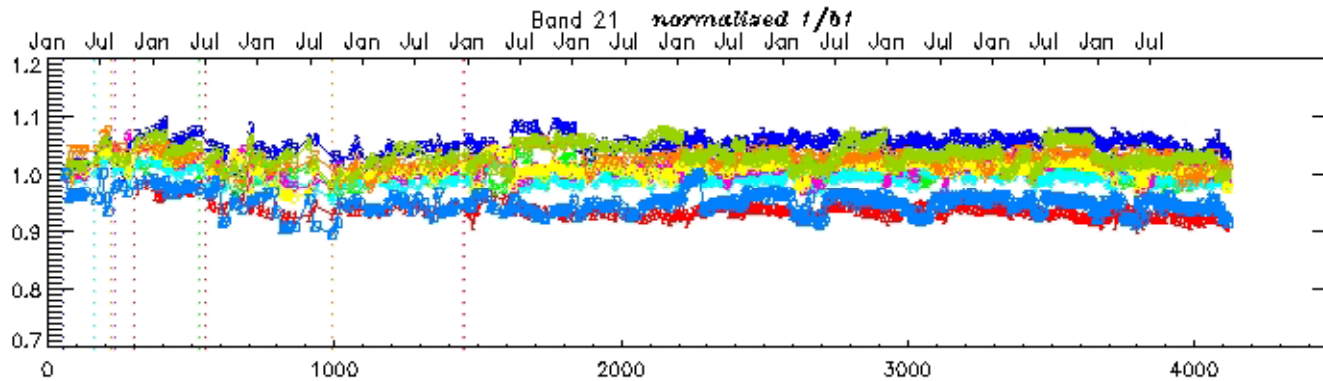


- |   |  |        |        |        |        |        |        |        |         |
|---|--|--------|--------|--------|--------|--------|--------|--------|---------|
| Ch1: -  | Ch2: -                                     | Ch3: - | Ch4: - | Ch5: - | Ch6: - | Ch7: - | Ch8: - | Ch9: - | Ch10: - |
| Day 3000055 - Nadir Door Open                   | Day 3001188 - PS3 anomaly                  |        |        |        |        |        |        |        |         |
| Day 3000180 - CFPA Lost Control                 | Day 3002280 - Formatter switched to B-Side |        |        |        |        |        |        |        |         |
| Day 3000218 - Formatter Anomaly                 | Day 3003350 - Safe Mode                    |        |        |        |        |        |        |        |         |
| Day 3000232 - Back in Science Mode              | Day 3003358 - Back in Science Mode         |        |        |        |        |        |        |        |         |
| Day 3000304, 3001183 - switch to B side, A side |  |        |        |        |        |        |        |        |         |





Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order;  $T_{bb}@290K$ )



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 3000055 - Nadir Door Open

Day 3000180 - CFPA Lost Control

Day 3000218 - Formatter Anomaly

Day 3000232 - Back in Science Mode

Day 3000304, 3001183 - switch to B side, A side

Day 3001188 - PS3 anomaly

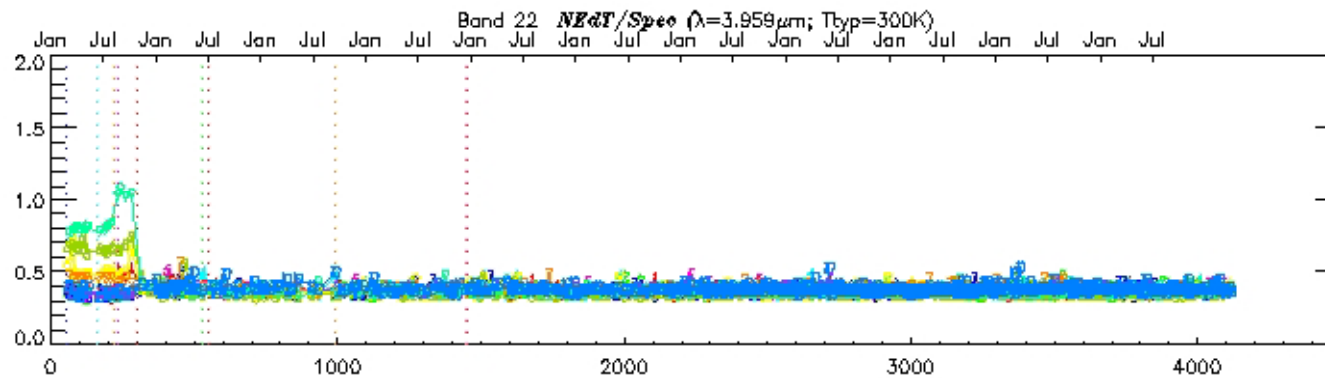
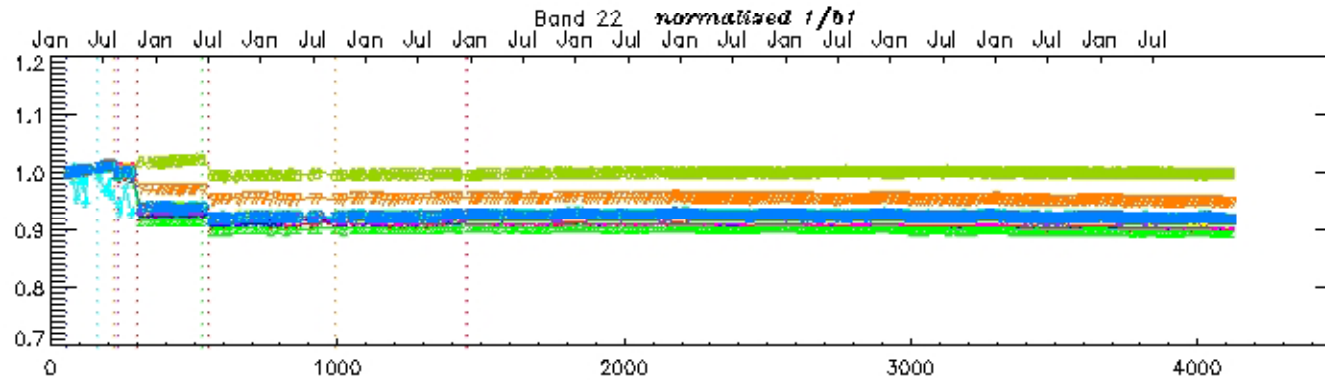
Day 3002280 - Formatter switched to B-Side

Day 3003350 - Safe Mode

Day 3003358 - Back in Science Mode



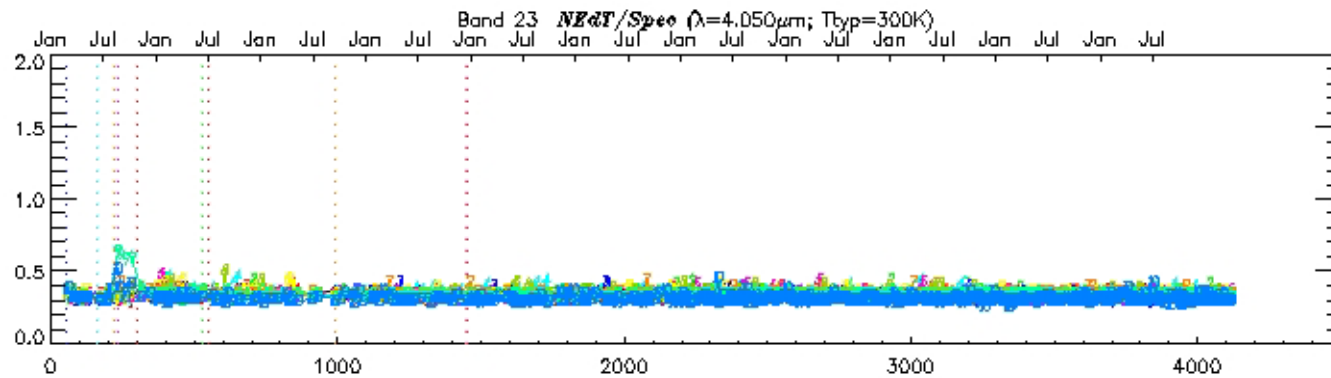
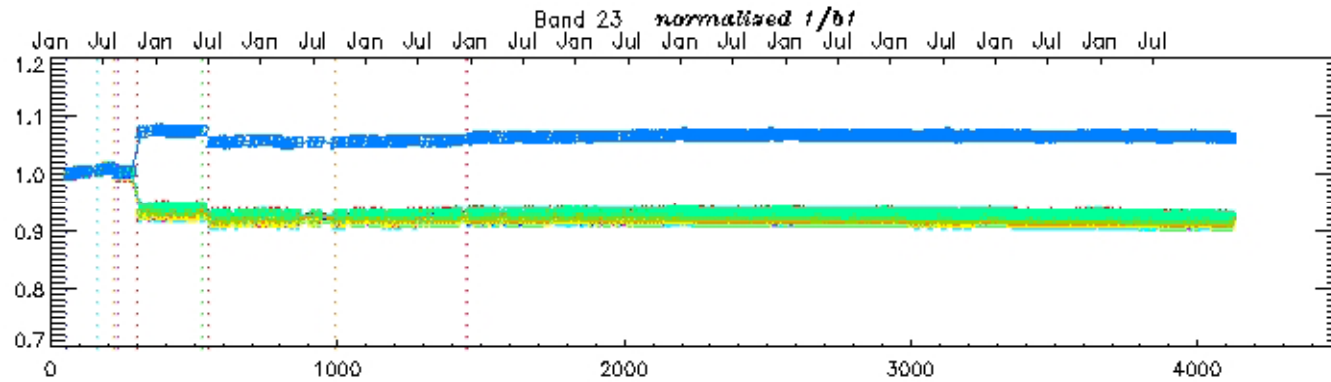
Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



- |   |  |        |        |        |        |        |        |        |         |
|---|--|--------|--------|--------|--------|--------|--------|--------|---------|
| Ch1: -  | Ch2: -                                     | Ch3: - | Ch4: - | Ch5: - | Ch6: - | Ch7: - | Ch8: - | Ch9: - | Ch10: - |
| Day 2000055 - Nadir Door Open                   | Day 2001188 - PS3 anomaly                  |        |        |        |        |        |        |        |         |
| Day 2000180 - CFPA Lost Control                 | Day 2002280 - Formatter switched to B-Side |        |        |        |        |        |        |        |         |
| Day 2000218 - Formatter Anomaly                 | Day 2003350 - Safe Mode                    |        |        |        |        |        |        |        |         |
| Day 2000232 - Back in Science Mode              | Day 2003358 - Back in Science Mode         |        |        |        |        |        |        |        |         |
| Day 2000304, 2001183 - switch to B side, A side |  |        |        |        |        |        |        |        |         |



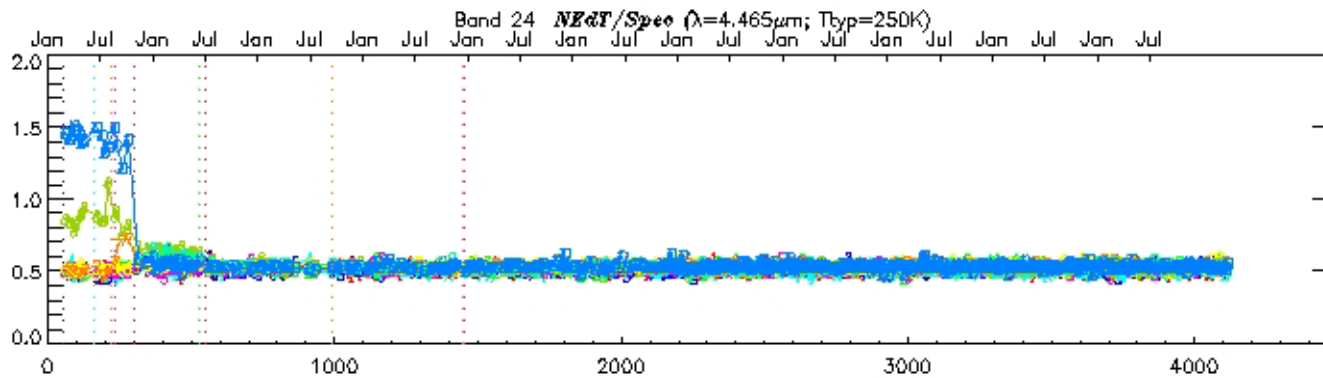
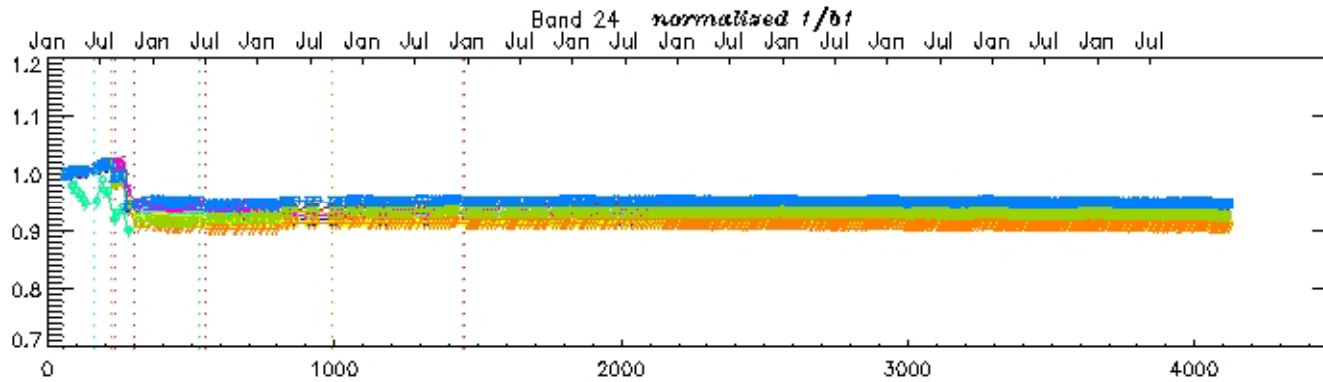
Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order;  $T_{bb}@290K$ )



- Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -
- Day 3000055 - Nadir Door Open
  - Day 3000180 - CFPA Lost Control
  - Day 3000218 - Formatter Anomaly
  - Day 3000232 - Back in Science Mode
  - Day 3000304, 3001183 - switch to B side, A side
  - Day 3001188 - PS3 anomaly
  - Day 3002280 - Formatter switched to B-Side
  - Day 3003350 - Safe Mode
  - Day 3003358 - Back in Science Mode



Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 3000055 - Nadir Door Open

Day 3000180 - CFPA Lost Control

Day 3000218 - Formatter Anomaly

Day 3000232 - Back in Science Mode

Day 3000304, 3001183 - switch to B side, A side

Day 3001188 - PS3 anomaly

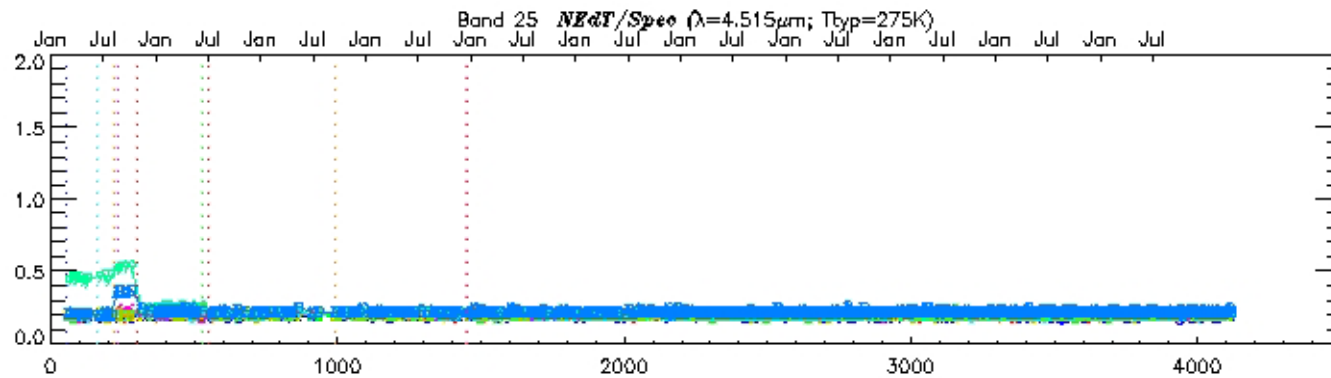
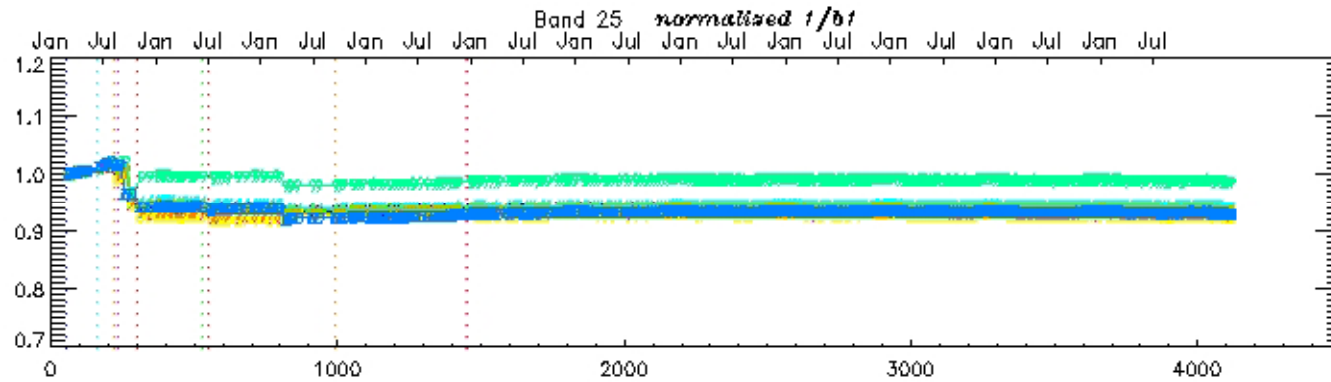
Day 3002280 - Formatter switched to B-Side

Day 3003350 - Safe Mode

Day 3003358 - Back in Science Mode



Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 3000055 - Nadir Door Open

Day 3000180 - CFPA Lost Control

Day 3000218 - Formatter Anomaly

Day 3000232 - Back in Science Mode

Day 3000304, 3001183 - switch to B side, A side

Day 3001188 - PS3 anomaly

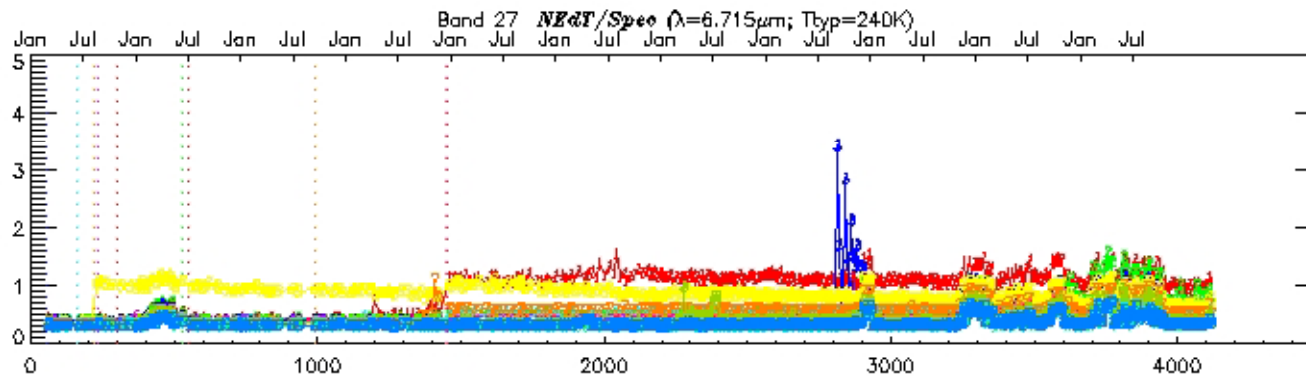
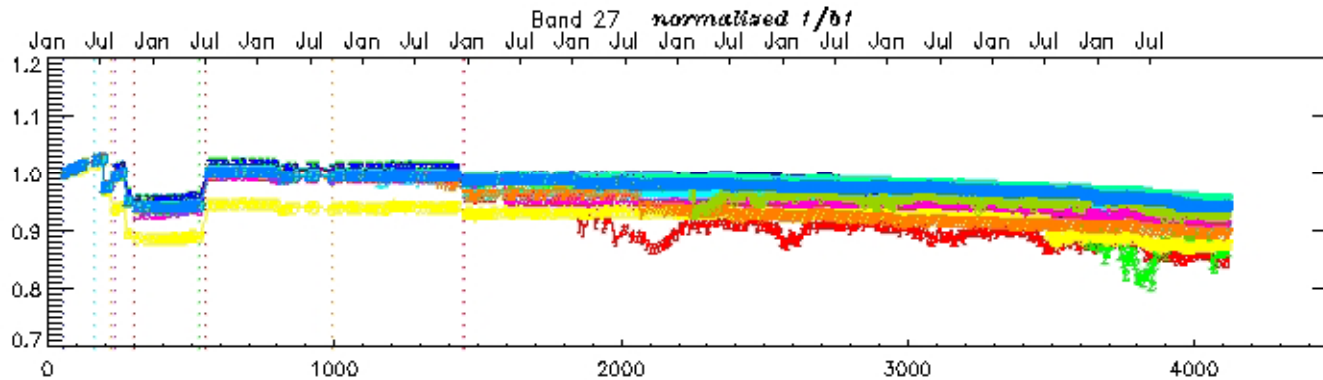
Day 3002280 - Formatter switched to B-Side

Day 3003350 - Safe Mode

Day 3003358 - Back in Science Mode



Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 2000055 - Nadir Door Open

Day 2000180 - CFPA Lost Control

Day 2000218 - Formatter Anomaly

Day 2000232 - Back in Science Mode

Day 2000304, 2001183 - switch to B side, A side

Day 2001188 - PS3 anomaly

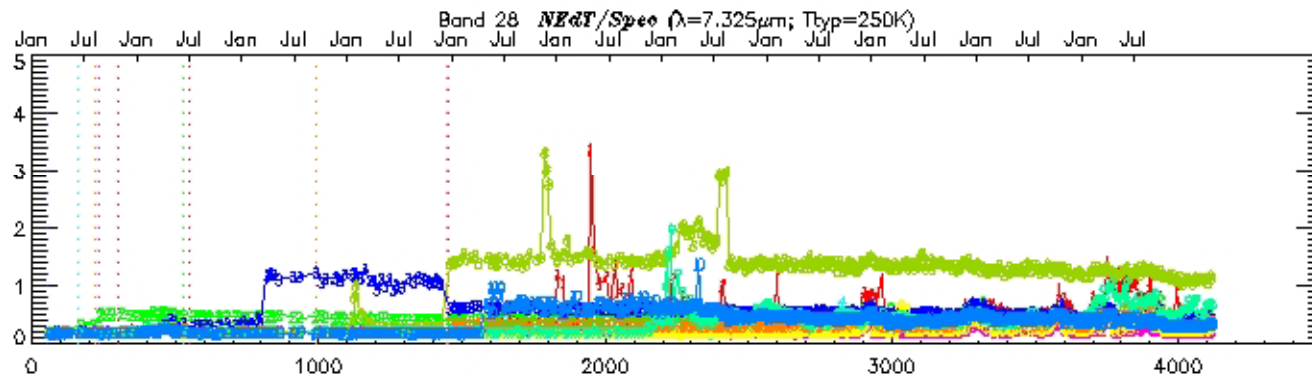
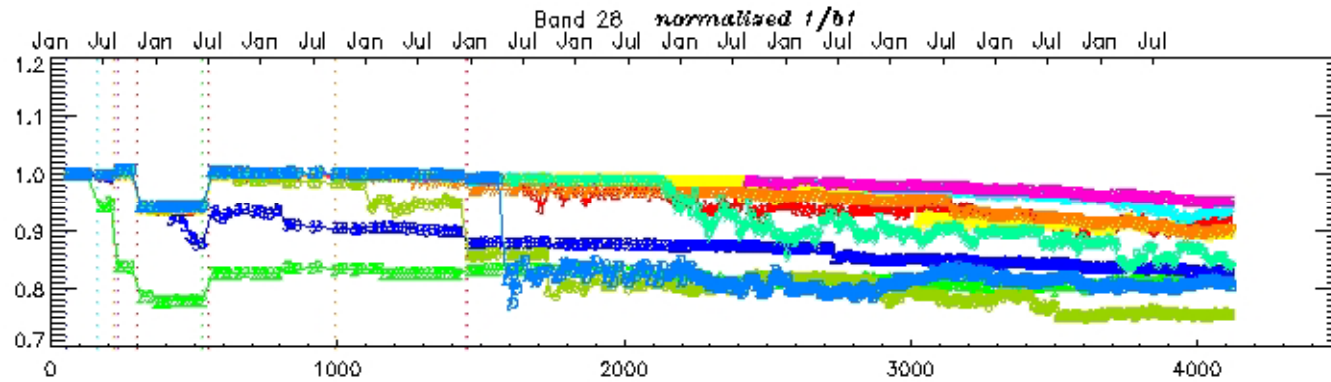
Day 2002280 - Formatter switched to B-Side

Day 2003350 - Safe Mode

Day 2003358 - Back in Science Mode



Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 3000055 - Nadir Door Open

Day 3000180 - CFPA Lost Control

Day 3000218 - Formatter Anomaly

Day 3000232 - Back in Science Mode

Day 3000304, 3001183 - switch to B side, A side

Day 3001188 - PS3 anomaly

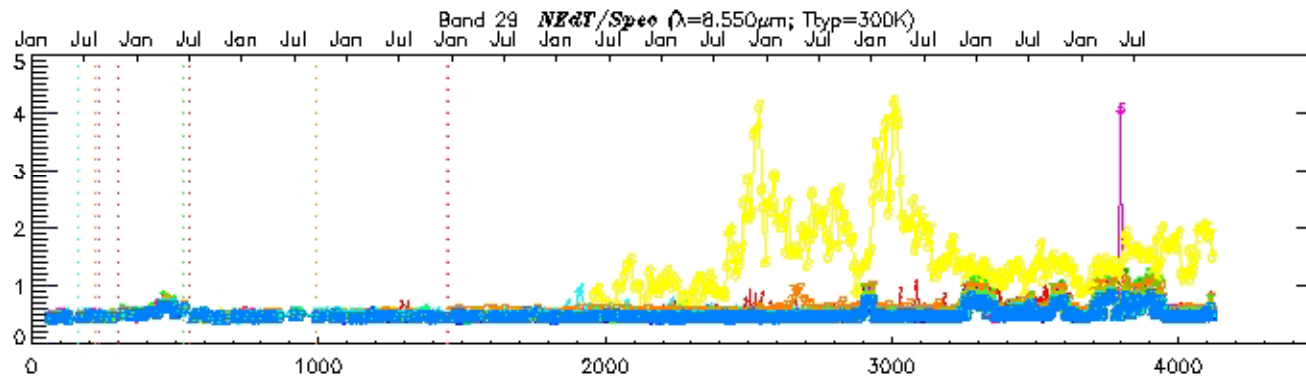
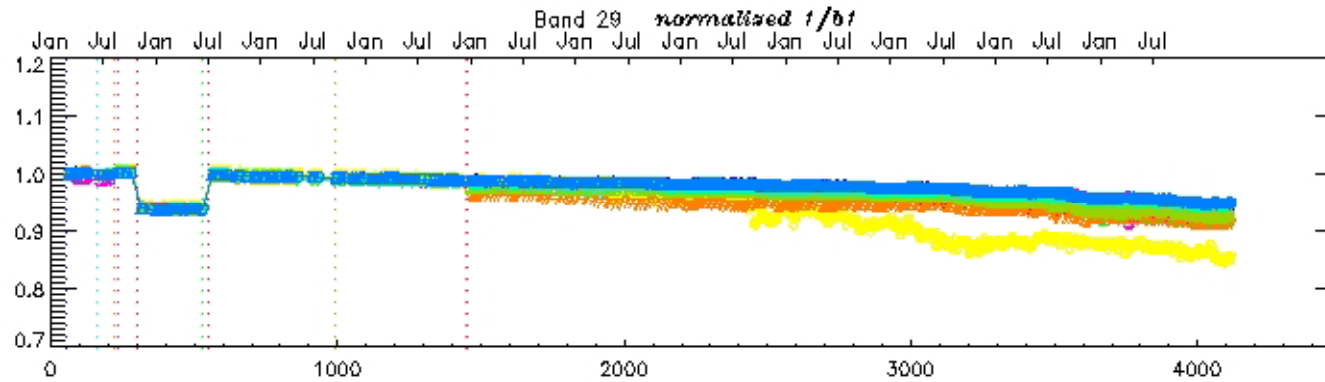
Day 3002280 - Formatter switched to B-Side

Day 3003350 - Safe Mode

Day 3003358 - Back in Science Mode



Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order;  $T_{bb}@290K$ )

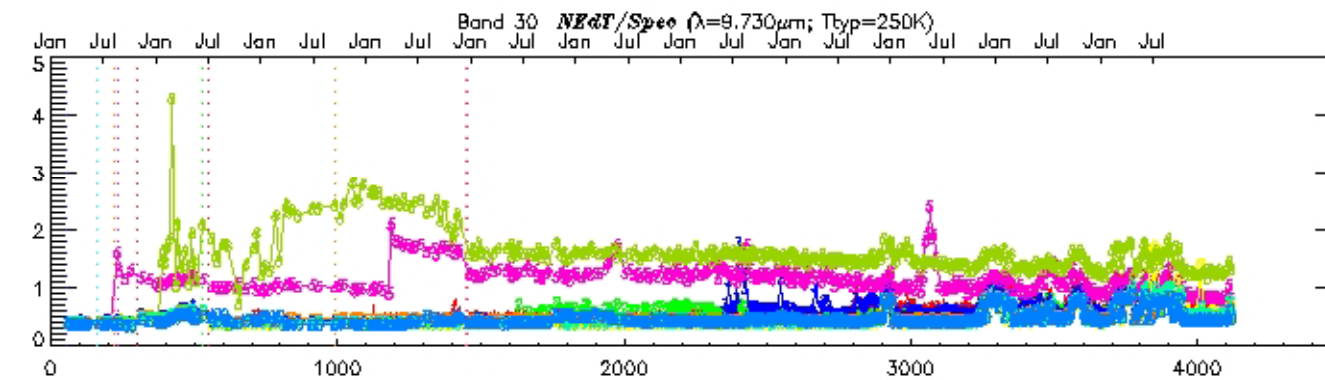
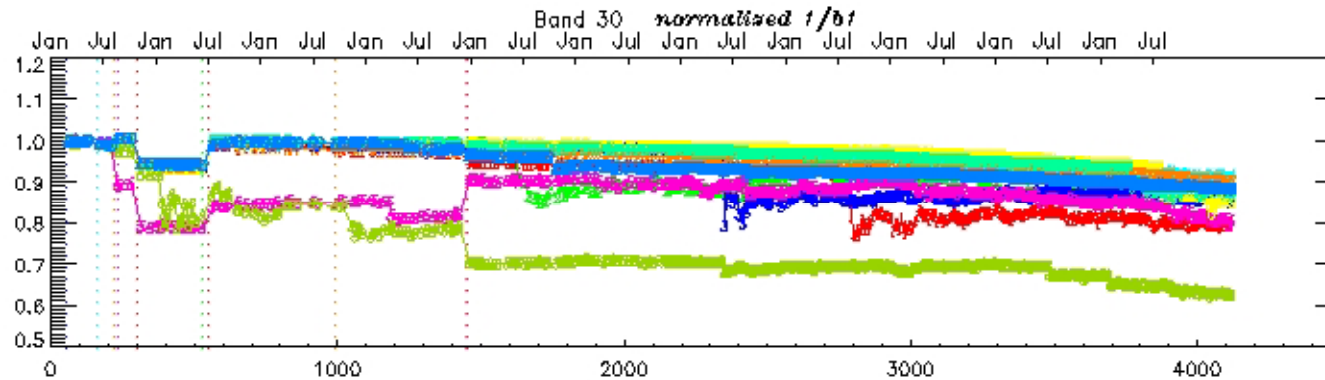


- Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -
- Day 3000055 - Nadir Door Open
  - Day 3000180 - CFPA Lost Control
  - Day 3000218 - Formatter Anomaly
  - Day 3000232 - Back in Science Mode
  - Day 3000304, 3001183 - switch to B side, A side
  - Day 3001188 - PS3 anomaly
  - Day 3002280 - Formatter switched to B-Side
  - Day 3003350 - Safe Mode
  - Day 3003358 - Back in Science Mode





Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 3000055 - Nadir Door Open

Day 3000180 - CFPA Lost Control

Day 3000218 - Formatter Anomaly

Day 3000232 - Back in Science Mode

Day 3000304, 3001183 - switch to B side, A side

Day 3001188 - PS3 anomaly

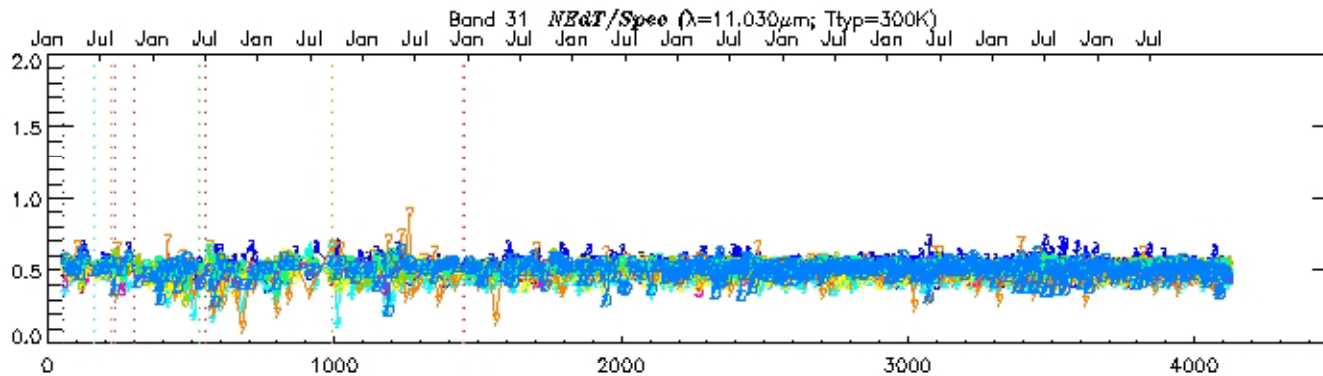
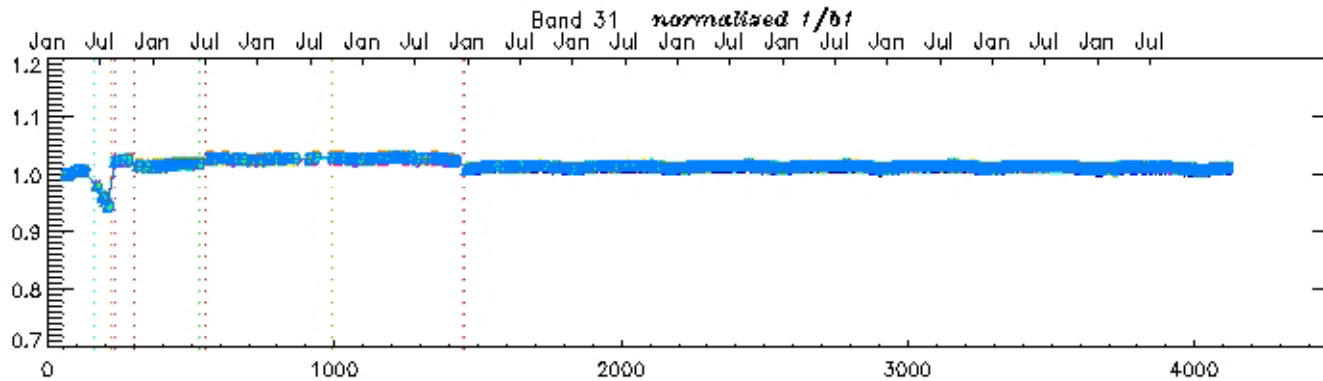
Day 3002280 - Formatter switched to B-Side

Day 3003350 - Safe Mode

Day 3003358 - Back in Science Mode



Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 3000055 - Nadir Door Open

Day 3000180 - CFPA Lost Control

Day 3000218 - Formatter Anomaly

Day 3000232 - Back in Science Mode

Day 3000304, 3001183 - switch to B side, A side

Day 3001188 - PS3 anomaly

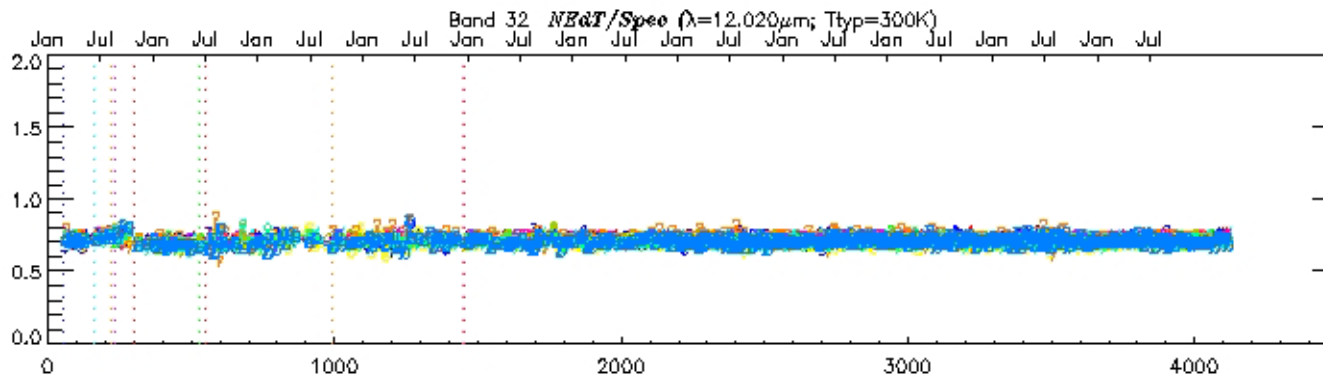
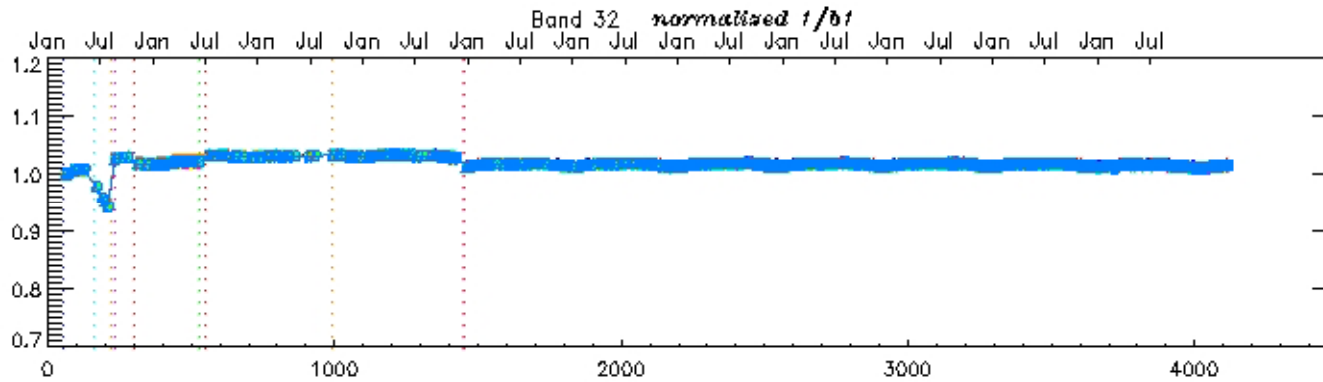
Day 3002280 - Formatter switched to B-Side

Day 3003350 - Safe Mode

Day 3003358 - Back in Science Mode



Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 3000055 - Nadir Door Open

Day 3000180 - CFPA Lost Control

Day 3000218 - Formatter Anomaly

Day 3000232 - Back in Science Mode

Day 3000304, 3001183 - switch to B side, A side

Day 3001188 - PS3 anomaly

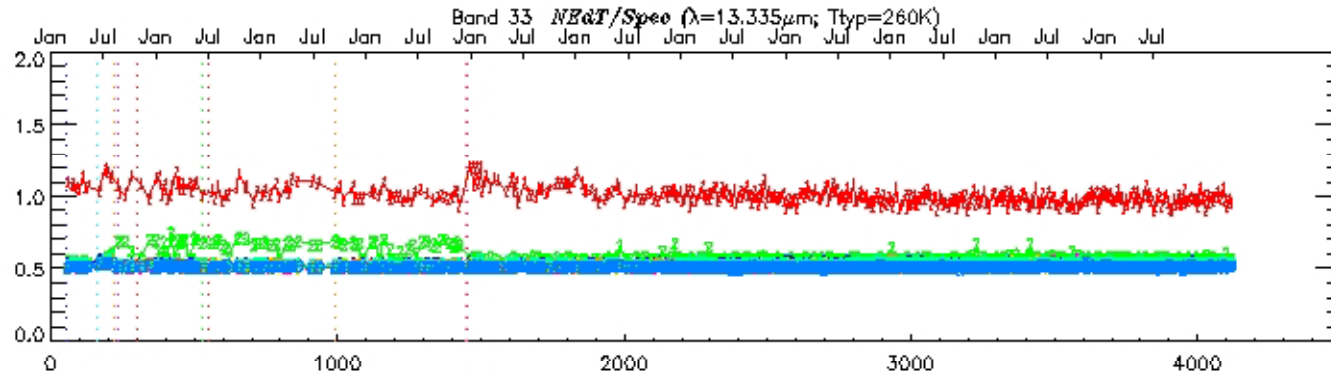
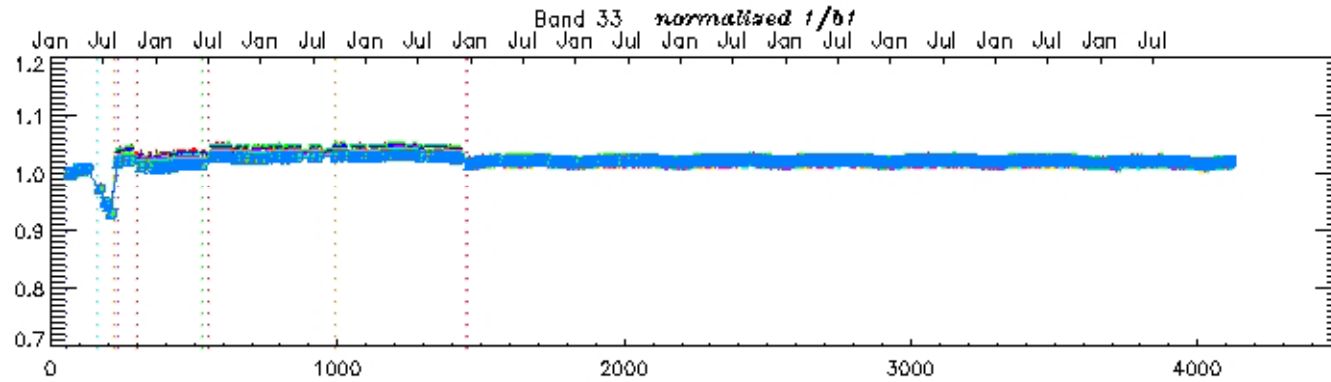
Day 3002280 - Formatter switched to B-Side

Day 3003350 - Safe Mode

Day 3003358 - Back in Science Mode



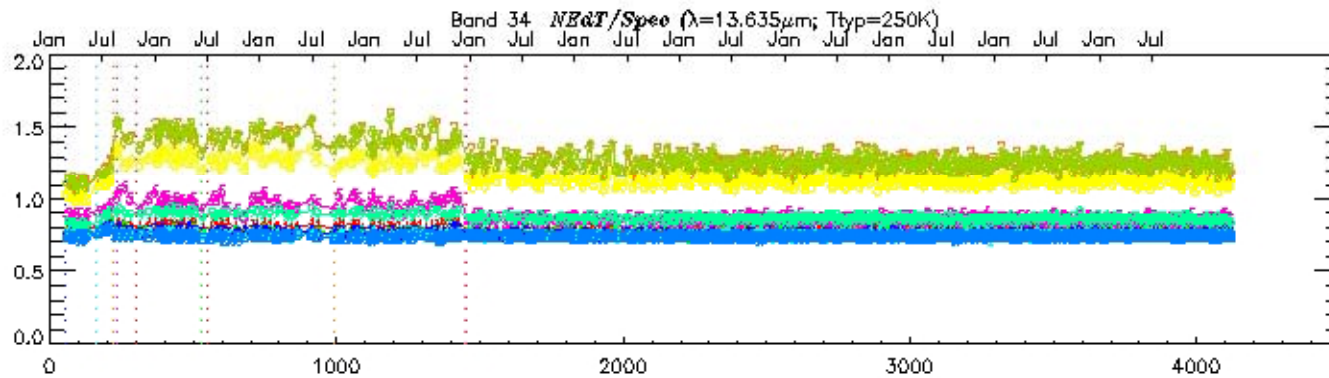
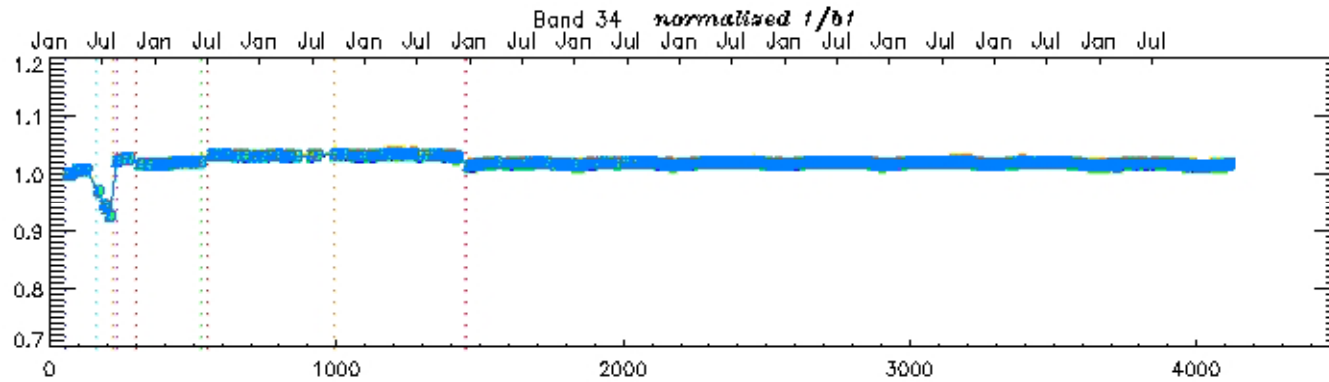
Terra MODIS TEB 1/b1 & NEDT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



- |   |  |        |        |        |        |        |        |        |         |
|---|--|--------|--------|--------|--------|--------|--------|--------|---------|
| Ch1: -  | Ch2: -                                     | Ch3: - | Ch4: - | Ch5: - | Ch6: - | Ch7: - | Ch8: - | Ch9: - | Ch10: - |
| Day 2000055 - Nadir Door Open                   | Day 2001188 - PS3 anomaly                  |        |        |        |        |        |        |        |         |
| Day 2000180 - CFPA Lost Control                 | Day 2002280 - Formatter switched to B-Side |        |        |        |        |        |        |        |         |
| Day 2000218 - Formatter Anomaly                 | Day 2003350 - Safe Mode                    |        |        |        |        |        |        |        |         |
| Day 2000232 - Back in Science Mode              | Day 2003358 - Back in Science Mode         |        |        |        |        |        |        |        |         |
| Day 2000304, 2001183 - switch to B side, A side |  |        |        |        |        |        |        |        |         |



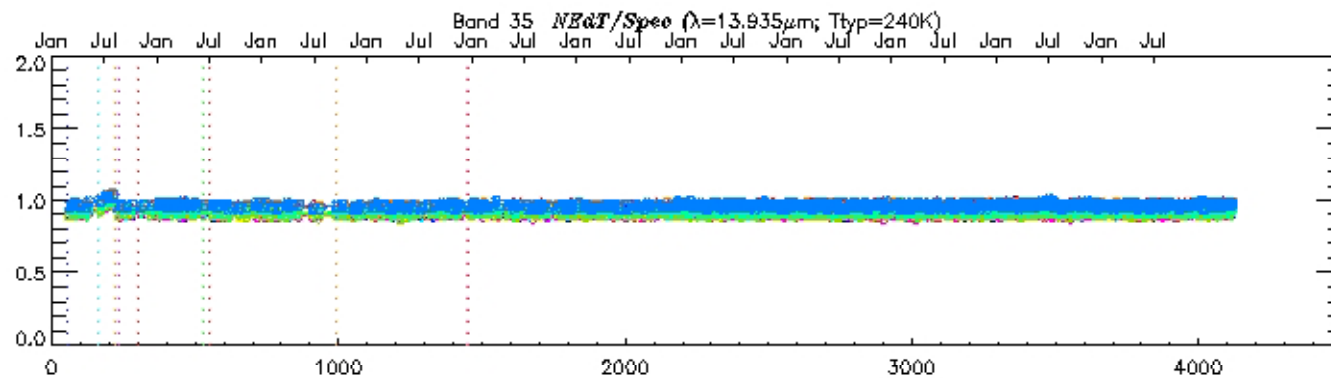
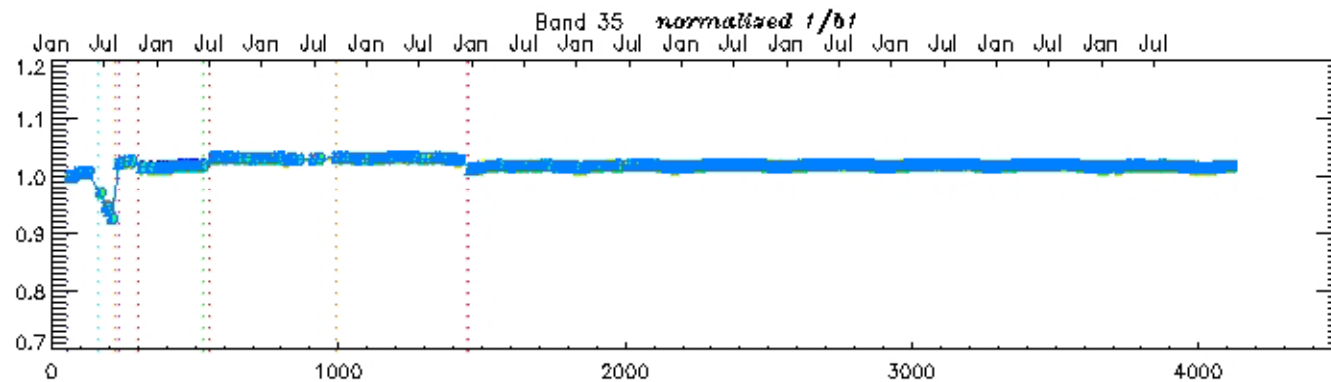
Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@290K)



- |   |  |        |        |        |        |        |        |        |         |
|---|--|--------|--------|--------|--------|--------|--------|--------|---------|
| Ch1: -  | Ch2: -                                     | Ch3: - | Ch4: - | Ch5: - | Ch6: - | Ch7: - | Ch8: - | Ch9: - | Ch10: - |
| Day 3000055 - Nadir Door Open                   | Day 3001188 - PS3 anomaly                  |        |        |        |        |        |        |        |         |
| Day 3000180 - CFPA Lost Control                 | Day 3002280 - Formatter switched to B-Side |        |        |        |        |        |        |        |         |
| Day 3000218 - Formatter Anomaly                 | Day 3003350 - Safe Mode                    |        |        |        |        |        |        |        |         |
| Day 3000232 - Back in Science Mode              | Day 3003358 - Back in Science Mode         |        |        |        |        |        |        |        |         |
| Day 3000304, 3001183 - switch to B side, A side |  |        |        |        |        |        |        |        |         |



Terra MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order;  $T_{BB}@290K$ )



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 3000055 - Nadir Door Open

Day 3000180 - CFPA Lost Control

Day 3000218 - Formatter Anomaly

Day 3000232 - Back in Science Mode

Day 3000304, 3001183 - switch to B side, A side

Day 3001188 - PS3 anomaly

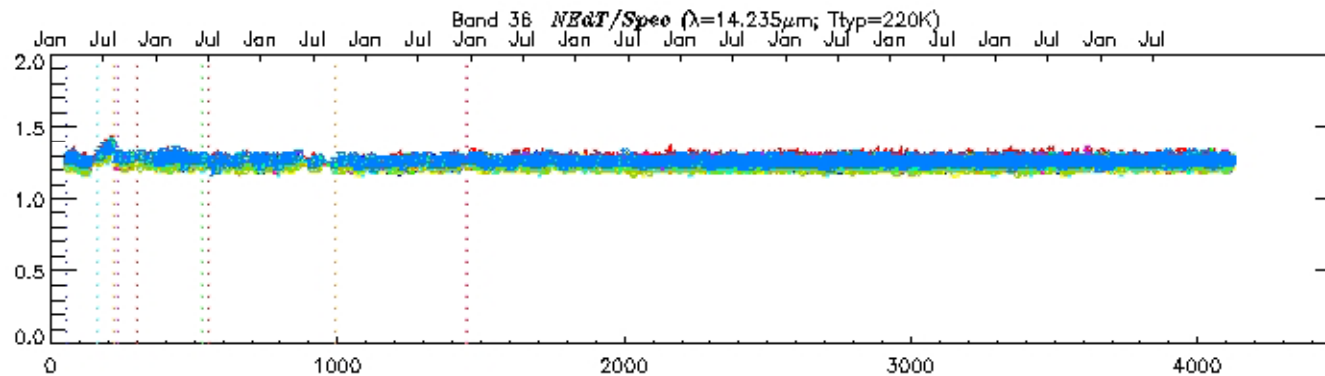
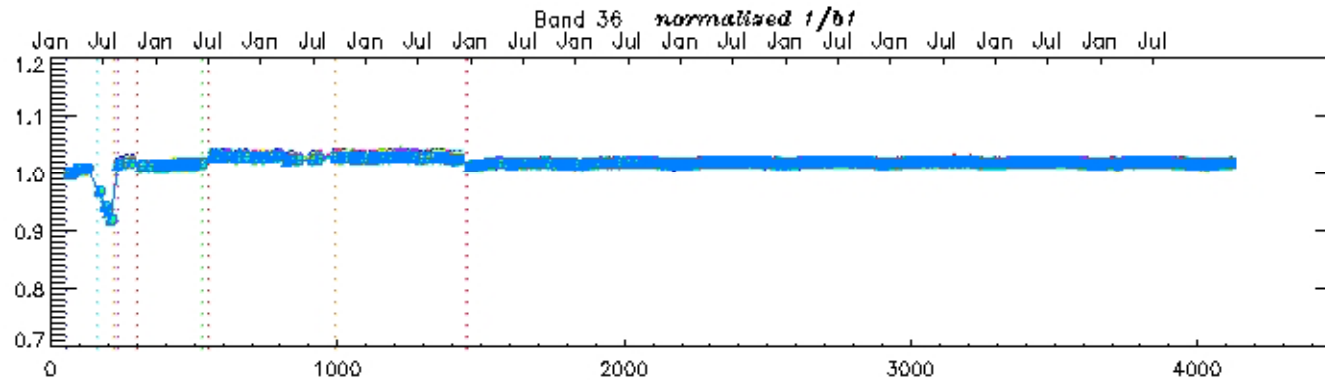
Day 3002280 - Formatter switched to B-Side

Day 3003350 - Safe Mode

Day 3003358 - Back in Science Mode



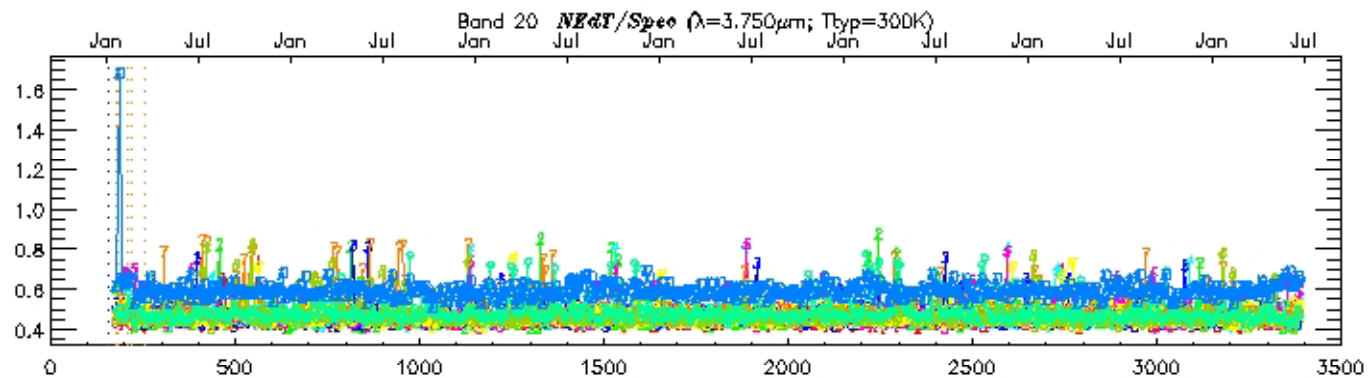
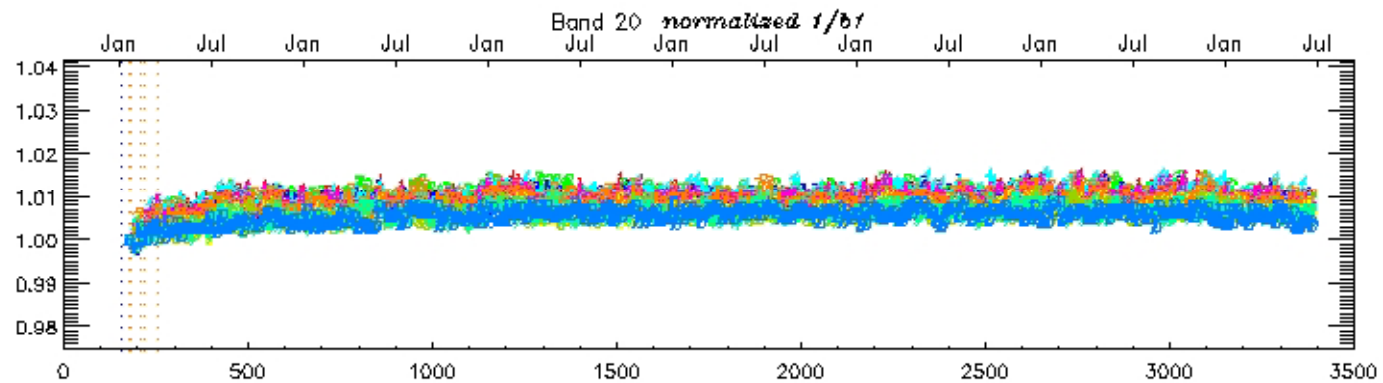
Terra MODIS TEB 1/b1 & NEDT/Spec Trending (Product Order;  $T_{BB}@290K$ )



- Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -
- Day 2000055 - Nadir Door Open
  - Day 2000180 - CFPA Lost Control
  - Day 2000218 - Formatter Anomaly
  - Day 2000232 - Back in Science Mode
  - Day 2000304, 2001183 - switch to B side, A side
  - Day 2001188 - PS3 anomaly
  - Day 2002280 - Formatter switched to B-Side
  - Day 2003350 - Safe Mode
  - Day 2003358 - Back in Science Mode



### Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>BB</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

Day 178, 183 - Safe Mode, Science Mode

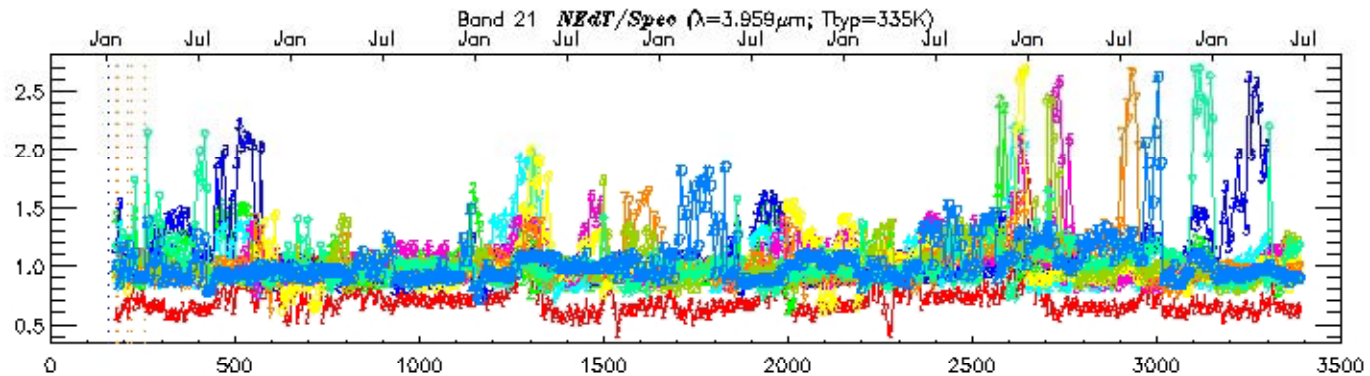
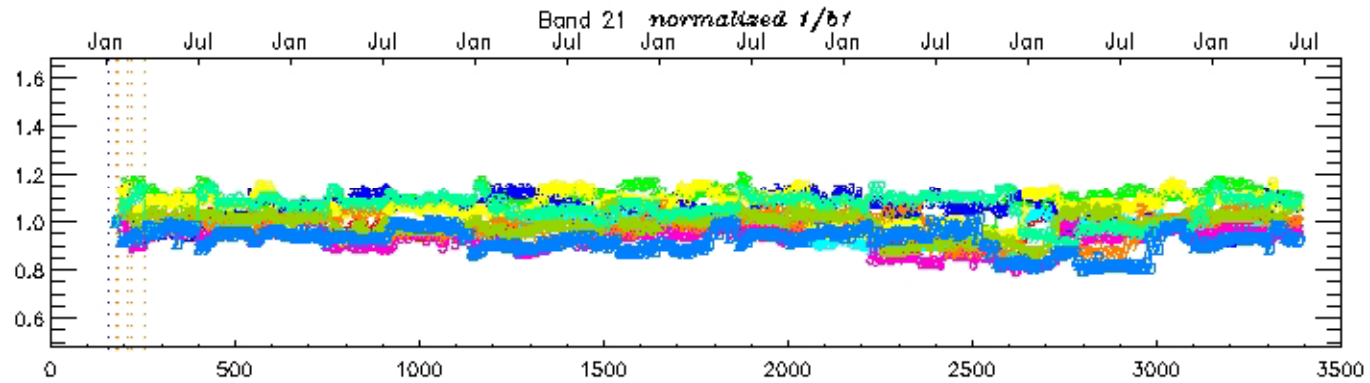
Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode





Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>nb</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

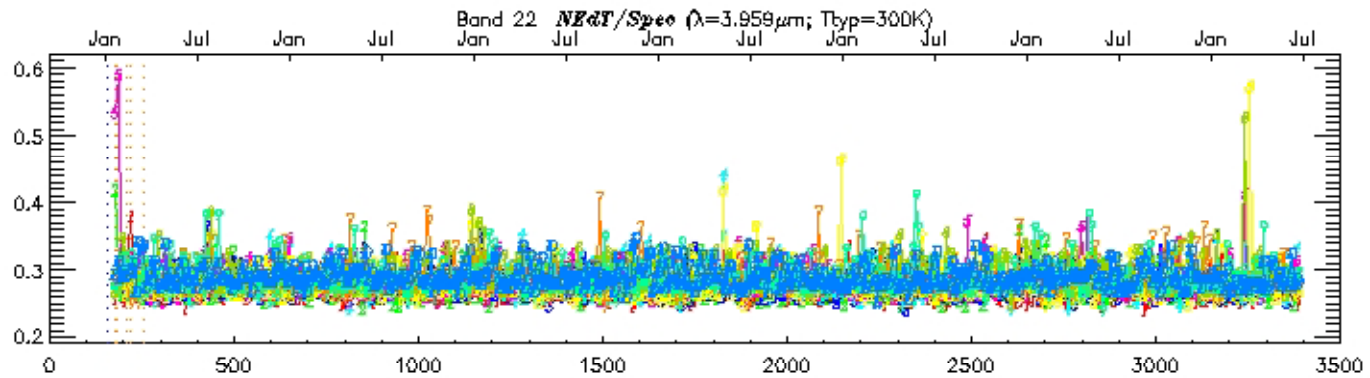
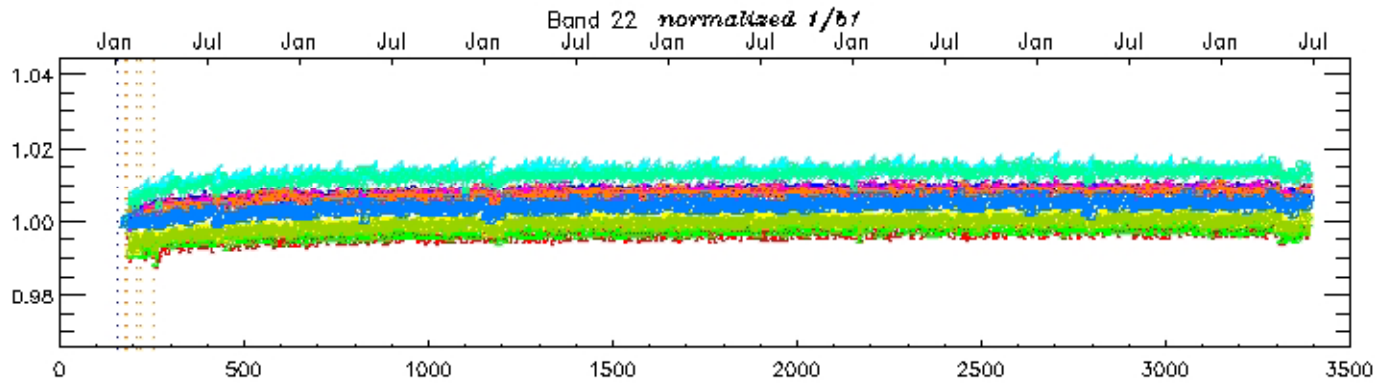
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order:  $T_{bb}@285K$ )



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

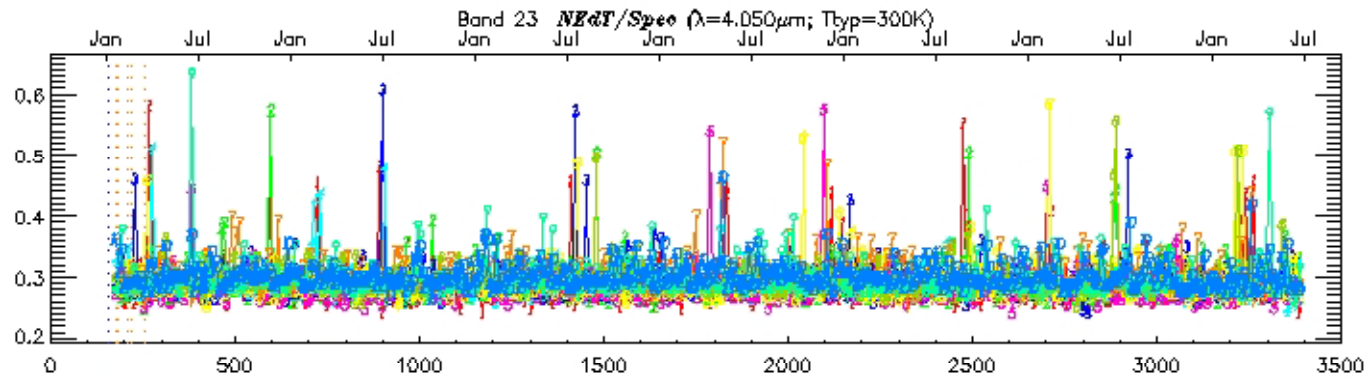
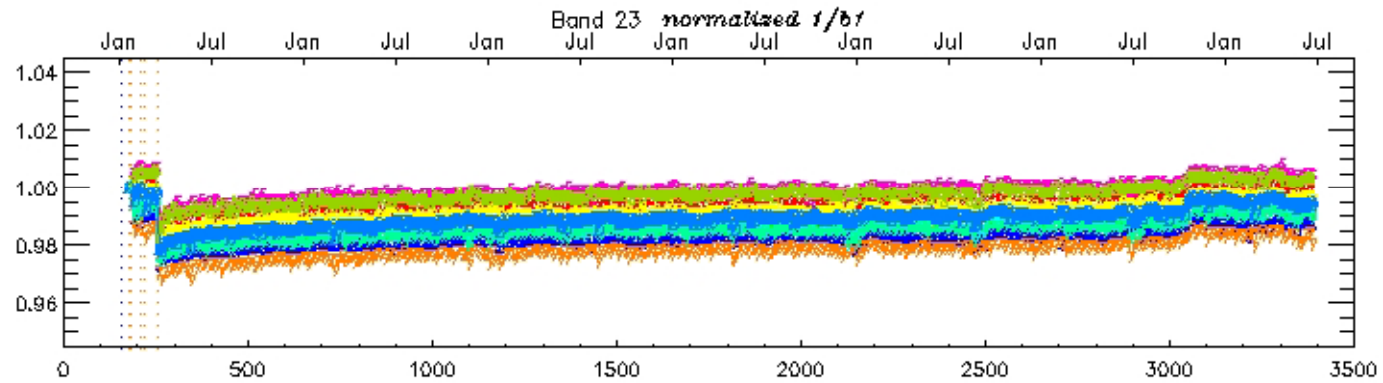
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>nb</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

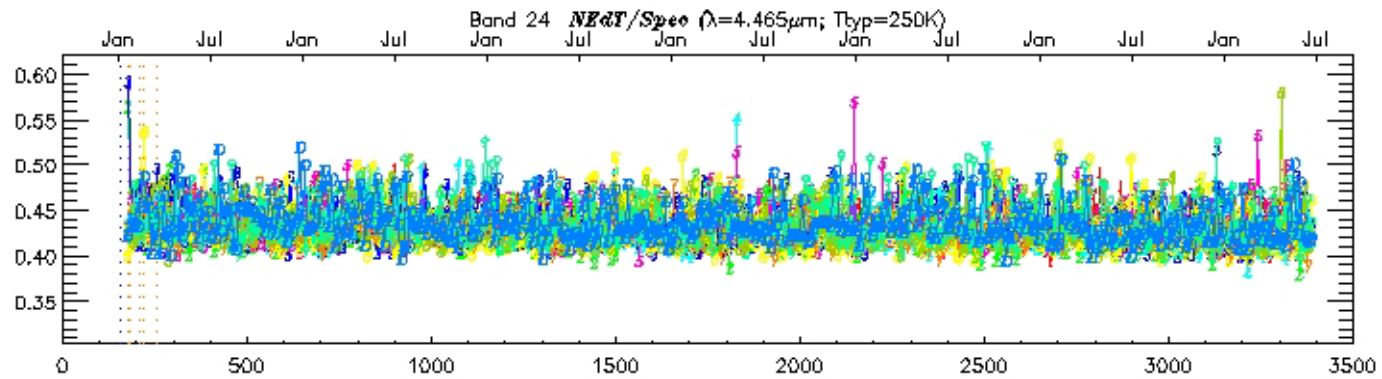
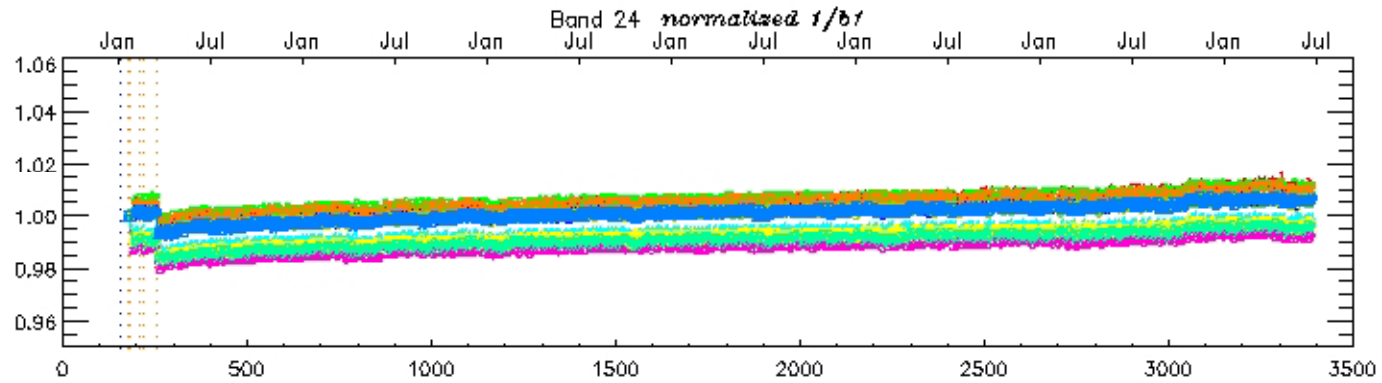
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order;  $T_{nb}@285K$ )



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

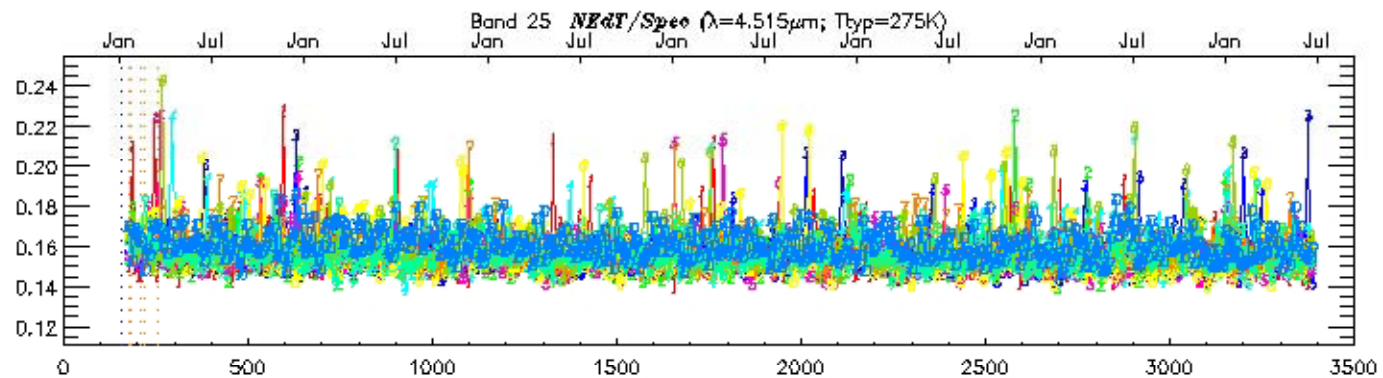
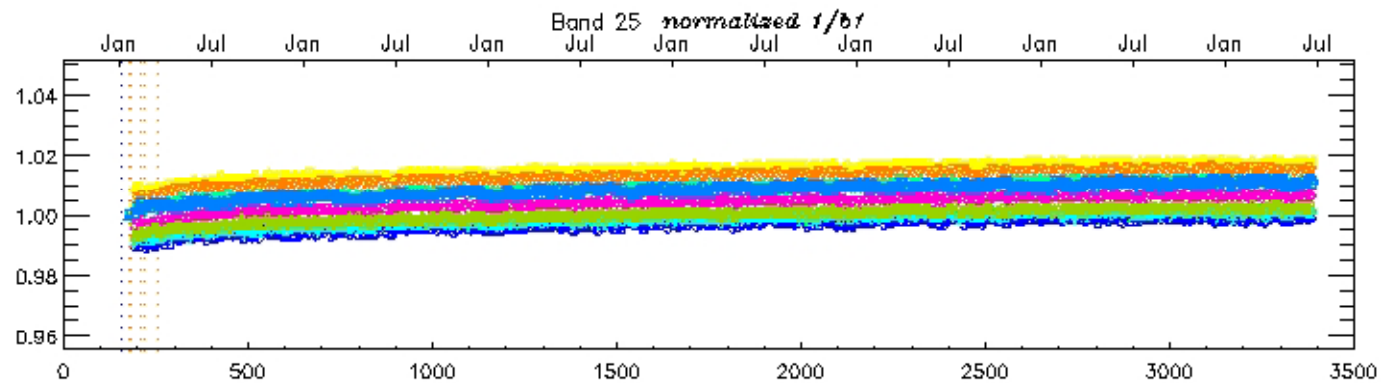
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



### Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; T<sub>BB</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

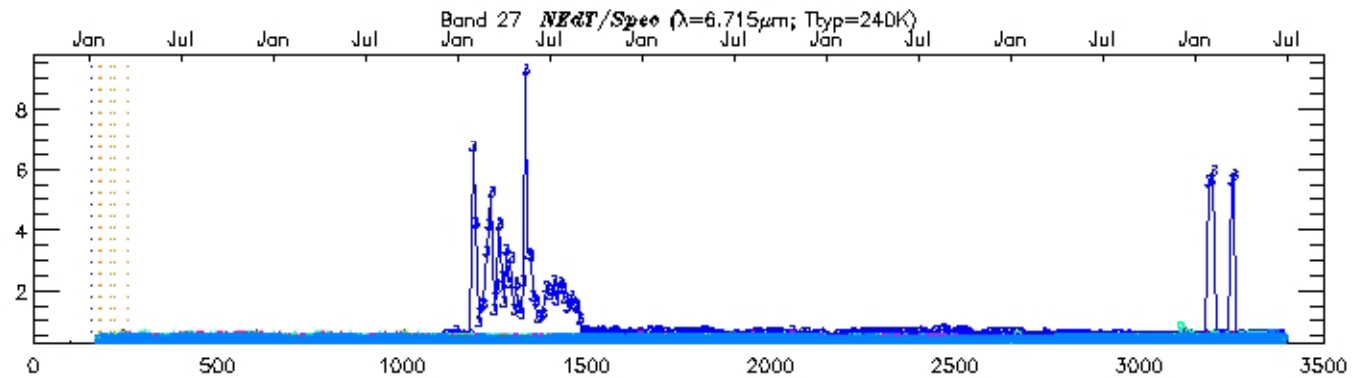
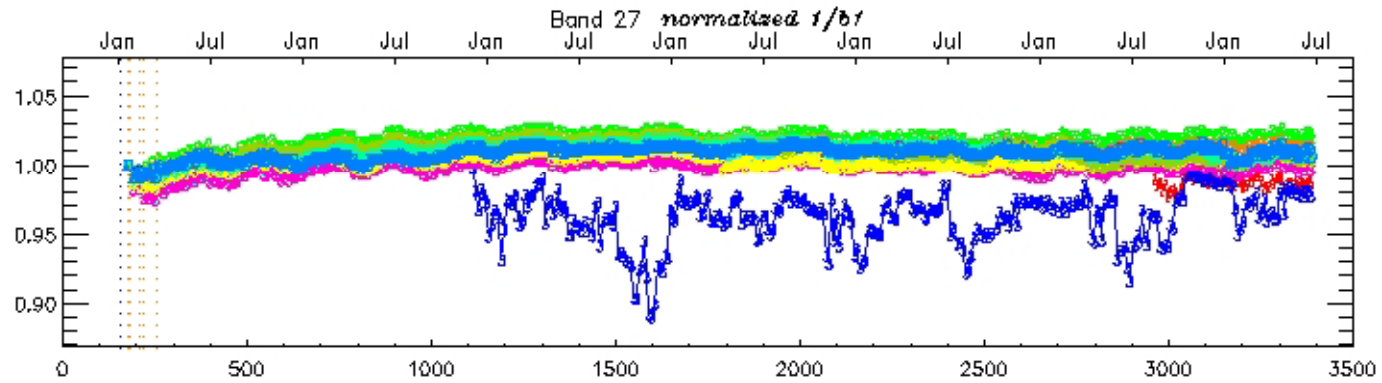
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>BB</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

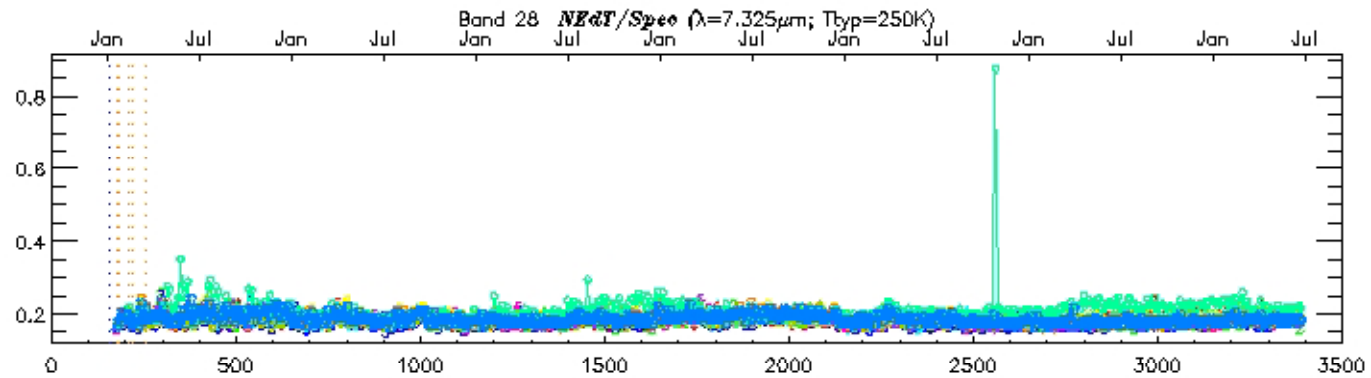
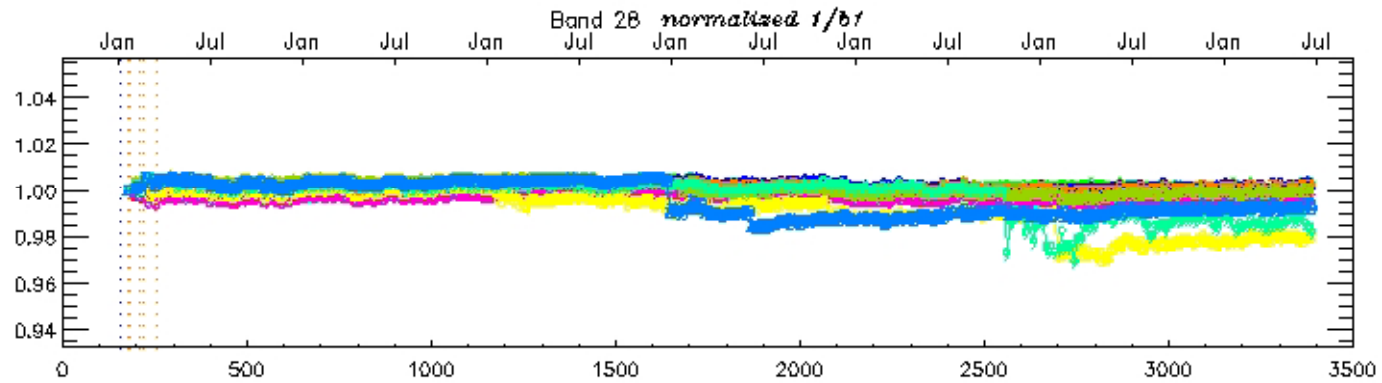
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>BB</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

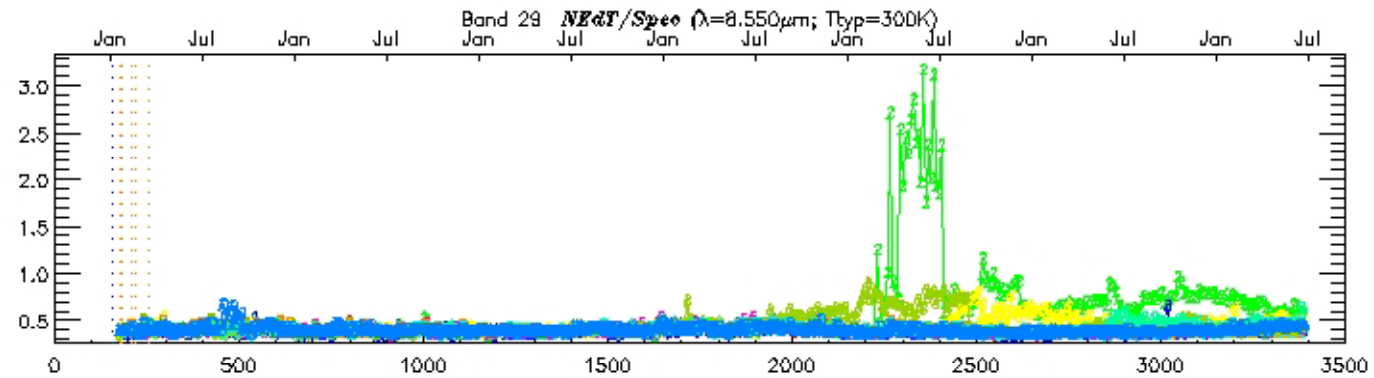
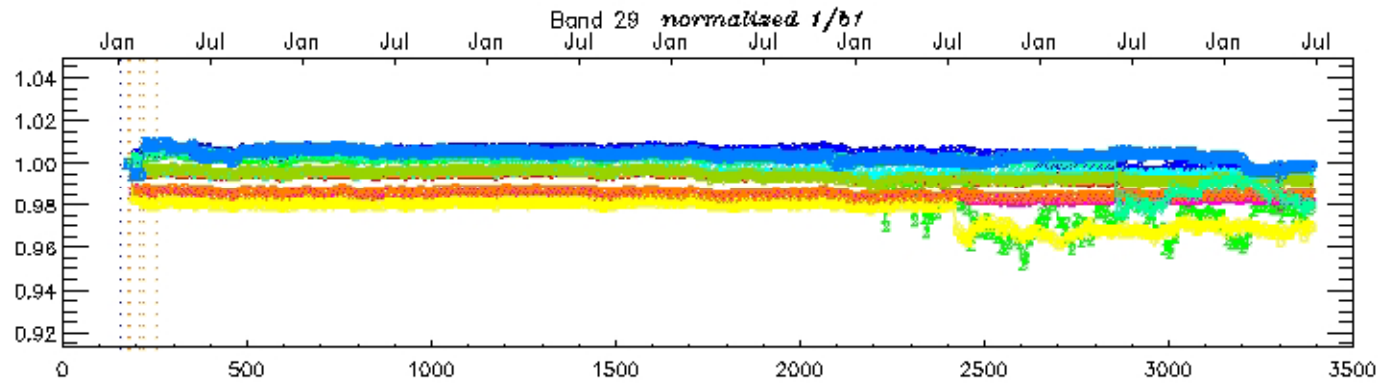
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>BB</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

Day 178, 183 - Safe Mode, Science Mode

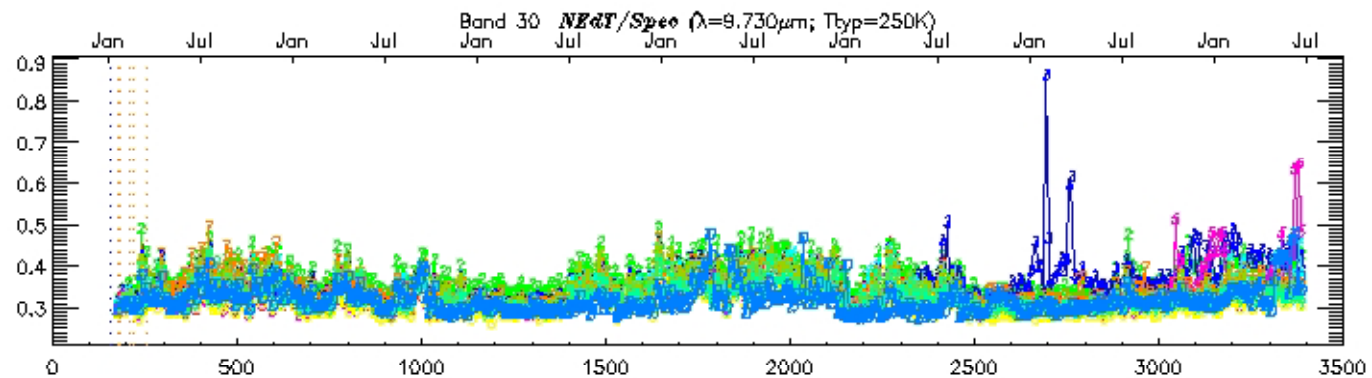
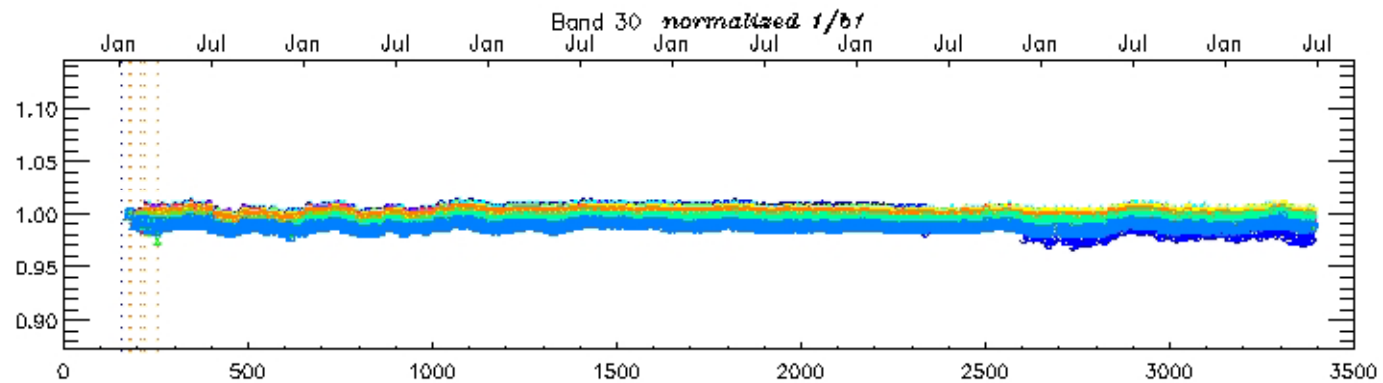
Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode





### Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>BB</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

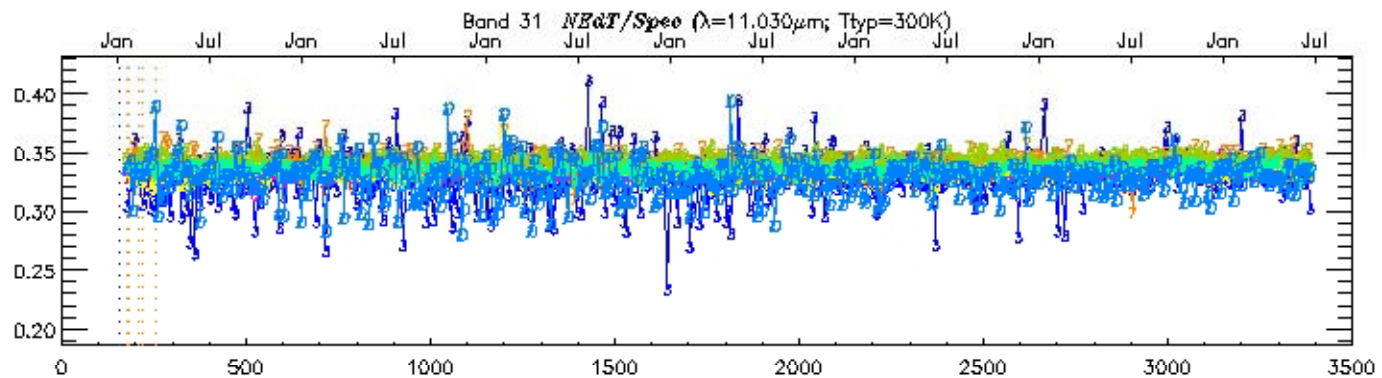
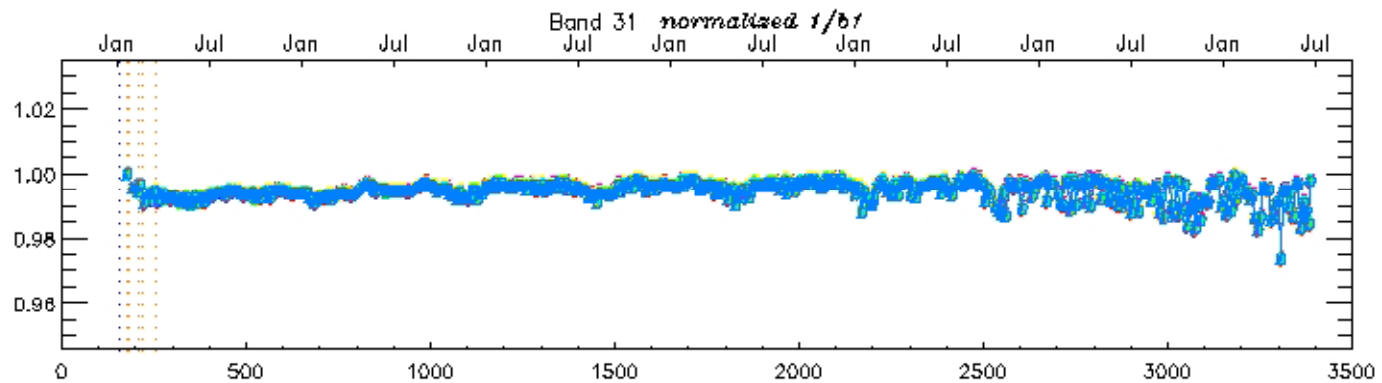
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order;  $T_{bb}@285K$ )



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

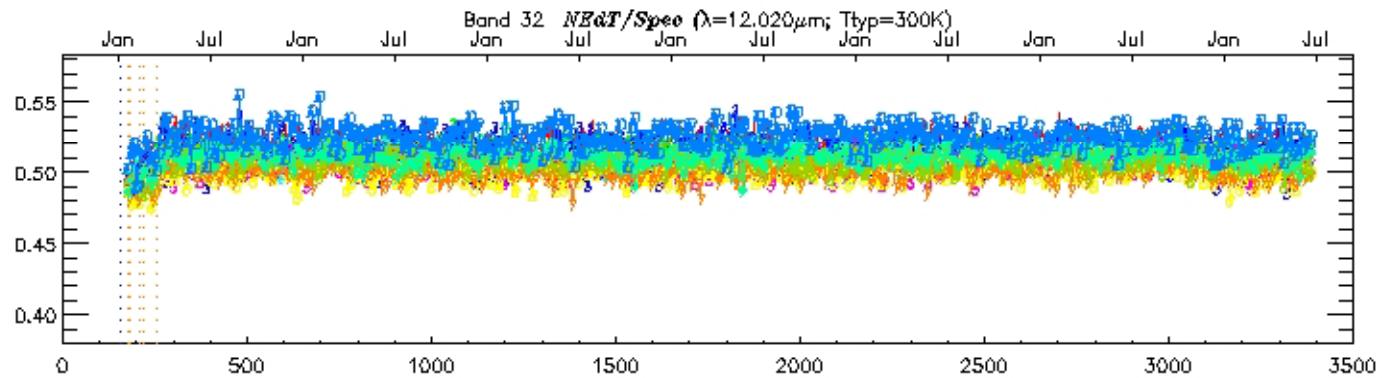
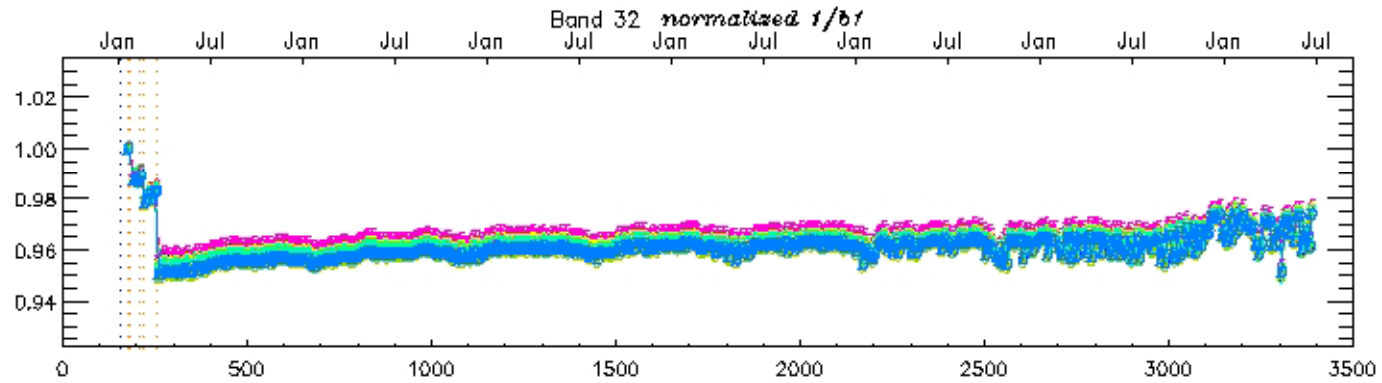
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>nb</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

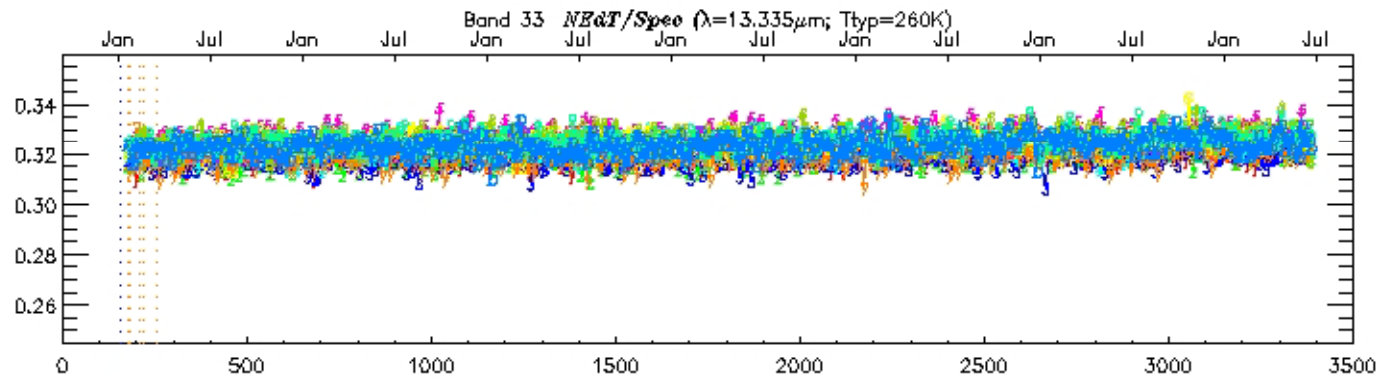
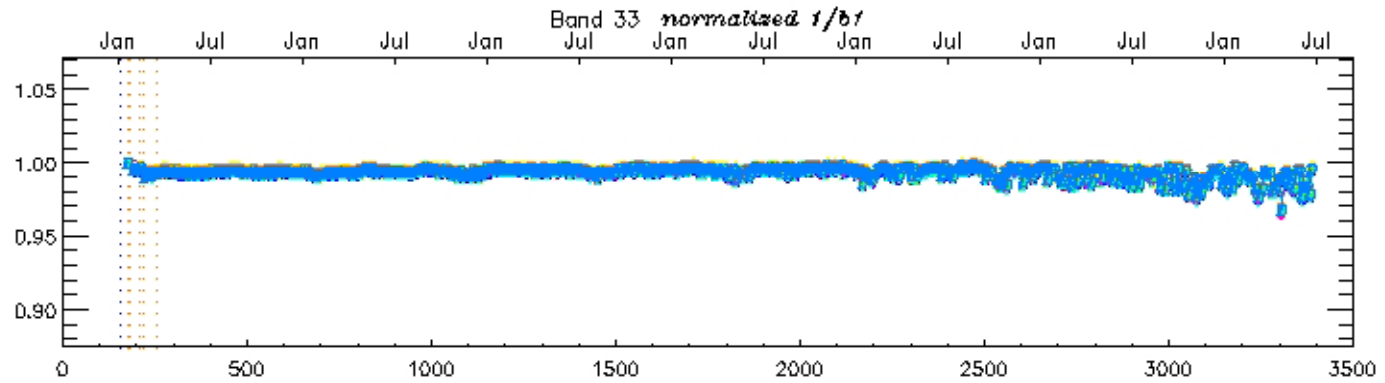
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



### Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order; $T_{bb}@285K$ )



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

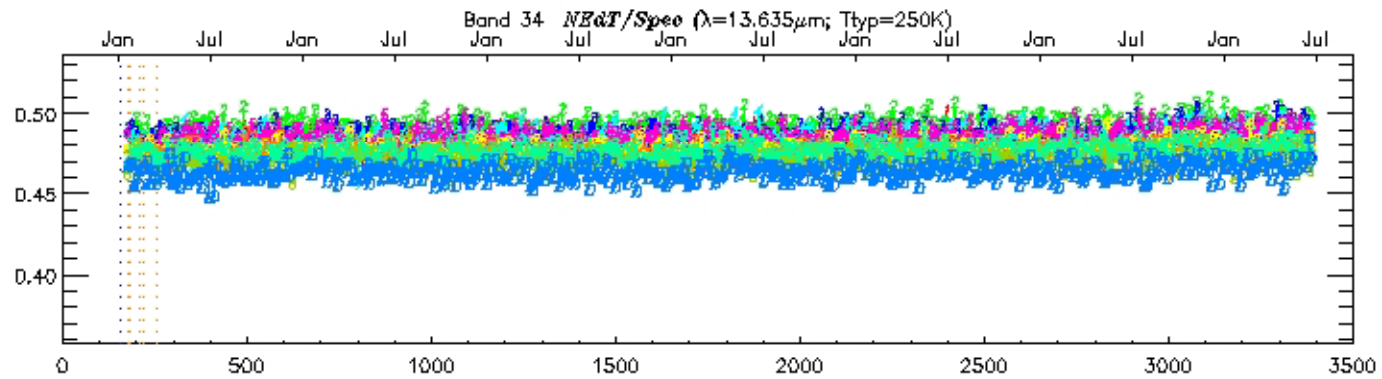
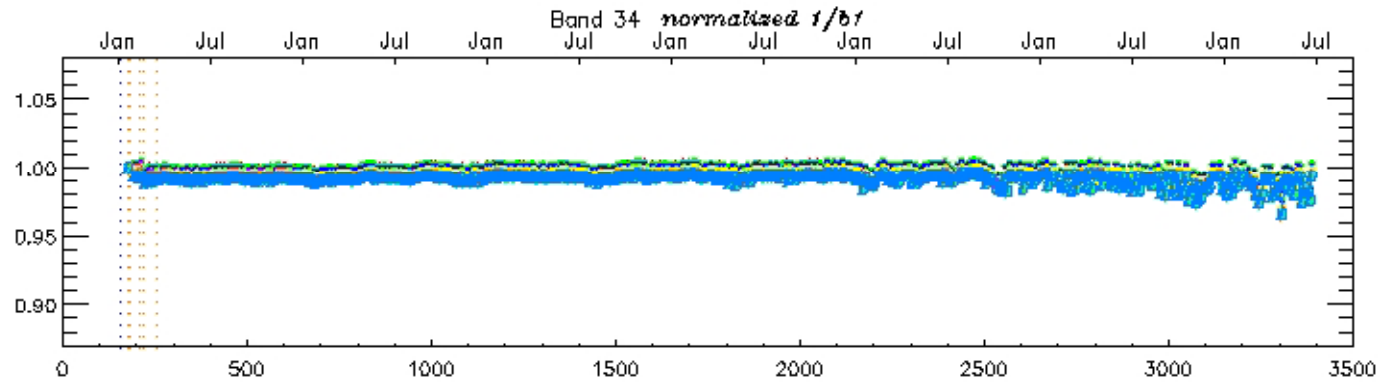
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order:  $T_{bb}@285K$ )



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

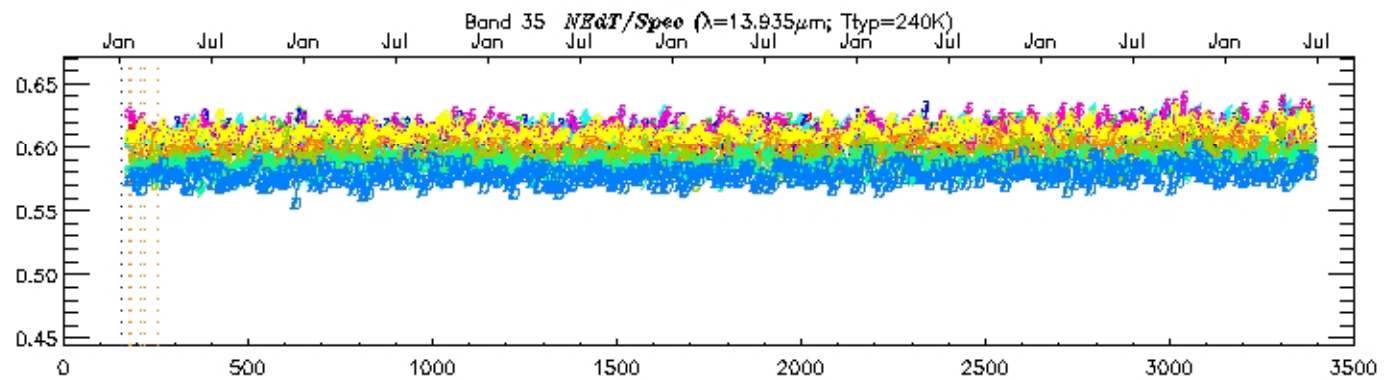
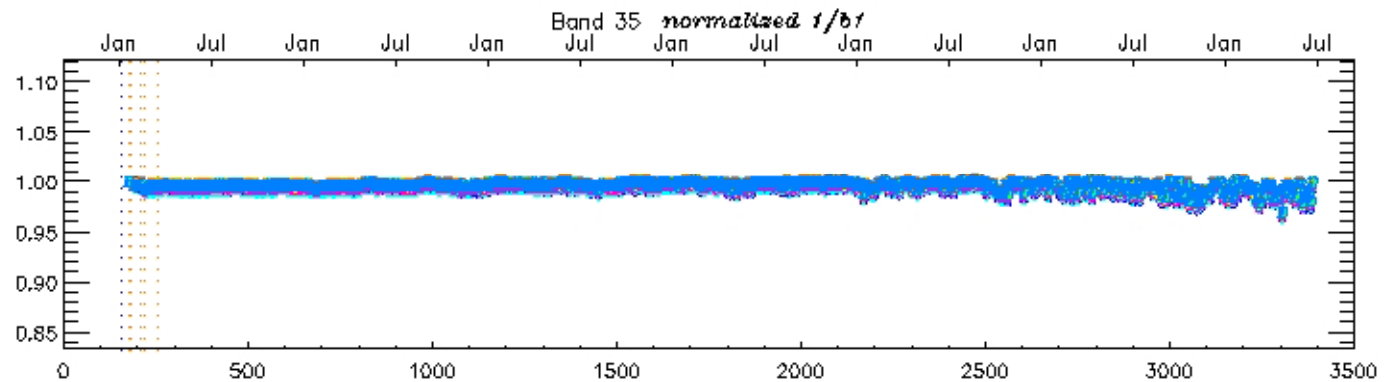
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



### Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>nb</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

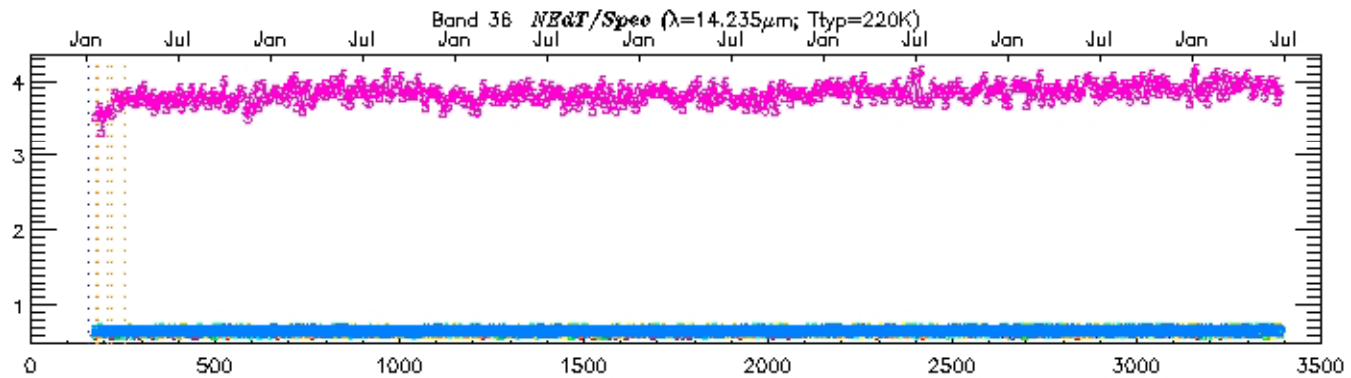
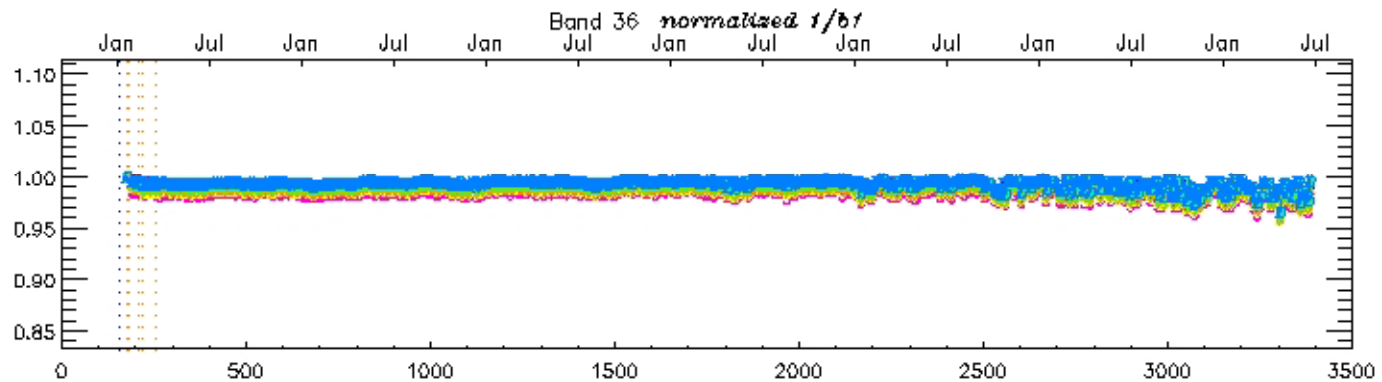
Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

Day 265, 265 - Safe Mode, Science Mode



Aqua MODIS TEB 1/b1 & NEdT/Spec Trending (Product Order: T<sub>nb</sub>@285K)



Ch1: - Ch2: - Ch3: - Ch4: - Ch5: - Ch6: - Ch7: - Ch8: - Ch9: - Ch10: -

Day 168 - Science Mode begin

Day 175 - Nadir Door Open

Day 178, 183 - Safe Mode, Science Mode

Day 210, 218 - Safe Mode, Science Mode

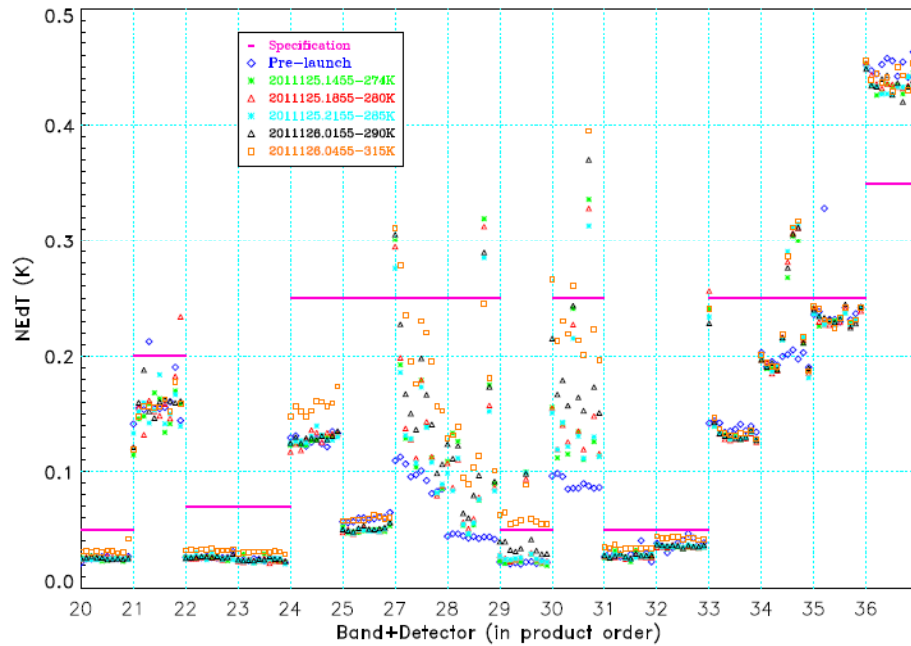
Day 265, 265 - Safe Mode, Science Mode



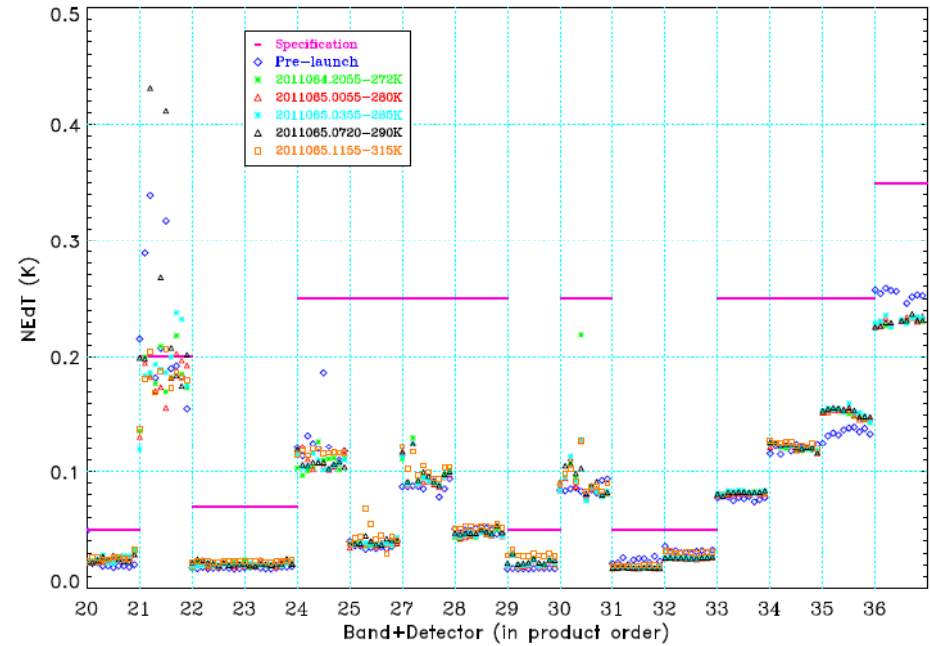
# NEdT trending during BB WUCD



TERRA MODIS TEB On-Orbit NEdT at  $L_{typ}$  during BB Warm-up (V5)



AQUA MODIS TEB On-Orbit NEdT at  $L_{typ}$  during BB Warm-up







# Terra MODIS Noisy Detector History



## Detectors in Product Order

Day/Year	Band	27					28					29		30					33	34					36					
		Spec NEdT[K]					0.25					0.25					0.05		0.25					0.25	0.25					0.35
		Detector #	1	2	3	6	8	1	3	8	9	10	4	6	1	2	3	5	8	1	5	6	7	8	1-10					
Pre-launch	-	0.10	0.11	0.08	0.10	0.08	0.05	0.05	0.04	0.05	0.04	0.02	0.02	0.09	0.08	0.09	0.09	0.09	0.14	0.20	0.20	0.21	0.20	0.45						
055/2000	Nadir door open	0.09	0.10	0.10	0.09	0.03	0.05	0.06	0.06	0.05	0.05	0.02	0.02	0.09	0.10	0.06	0.11	0.11	0.28	0.23	0.26	0.27	0.29	0.43						
232/2000	Back from FPA recycle	0.10	0.10	0.10	0.24	0.03	0.05	0.05	0.05	0.05	0.05	0.02	0.03	0.09	0.11	0.07	0.31	0.11	0.27	0.24	0.33	0.37	0.38	0.42						
030/2001	-	0.10	0.13	0.11	0.27	0.03	0.05	0.06	0.05	0.05	0.05	0.02	0.02	0.13	0.12	0.07	0.29	0.30	0.25	0.24	0.33	0.37	0.37	0.43						
087/2002	Back from safe mode	0.11	0.10	0.10	0.24	0.03	0.06	0.32	0.05	0.05	0.04	0.02	0.02	0.10	0.10	0.06	0.26	0.64	0.25	0.24	0.29	0.32	0.33	0.43						
022/2003	-	0.10	0.10	0.10	0.23	0.03	0.05	0.30	0.27	0.04	0.04	0.02	0.02	0.11	0.10	0.06	0.25	0.65	0.27	0.25	0.33	0.37	0.37	0.43						
086/2003	After DSM <sup>1</sup>	0.11	0.10	0.10	0.23	0.03	0.05	0.29	0.08	0.05	0.05	0.03	0.02	0.12	0.10	0.06	0.47	0.65	0.26	0.24	0.33	0.36	0.36	0.44						
118/2004	-	0.26	0.11	0.10	0.26	0.03	0.05	0.16	0.36	0.05	0.16	0.02	0.03	0.12	0.10	0.06	0.33	0.41	0.27	0.21	0.29	0.32	0.32	0.43						
158/2004	-	0.28	0.12	0.09	0.25	0.03	0.05	0.16	0.37	0.05	0.21	0.03	0.03	0.12	0.10	0.07	0.31	0.40	0.27	0.22	0.28	0.31	0.31	0.43						
162/2004	-	0.26	0.12	0.10	0.27	0.03	0.05	0.16	0.37	0.05	0.20	0.02	0.03	0.13	0.14	0.06	0.32	0.42	0.27	0.22	0.30	0.34	0.34	0.43						
175/2004	-	0.28	0.12	0.10	0.26	0.03	0.12	0.17	0.35	0.05	0.17	0.03	0.02	0.12	0.17	0.06	0.30	0.41	0.27	0.21	0.28	0.32	0.32	0.43						
034/2005	-	0.28	0.11	0.10	0.22	0.03	0.10	0.16	0.45	0.05	0.16	0.04	0.02	0.12	0.17	0.06	0.31	0.39	0.26	0.21	0.28	0.31	0.31	0.43						
130/2005	-	0.31	0.11	0.10	0.22	0.03	0.40	0.15	0.40	0.05	0.14	0.03	0.06	0.12	0.17	0.07	0.40	0.40	0.26	0.21	0.31	0.34	0.34	0.43						
309/2005	-	0.30	0.12	0.10	0.21	0.03	0.09	0.14	0.35	0.30	0.18	0.03	0.04	0.12	0.18	0.06	0.31	0.40	0.24	0.21	0.27	0.30	0.30	0.43						
053/2006	-	0.30	0.11	0.10	0.21	0.27	0.13	0.15	0.40	0.19	0.16	0.03	0.04	0.12	0.16	0.11	0.33	0.39	0.28	0.21	0.28	0.31	0.31	0.43						
155/2006	-	0.26	0.11	0.10	0.21	0.11	0.10	0.14	0.46	0.10	0.15	0.03	0.05	0.11	0.14	0.26	0.31	0.41	0.24	0.21	0.28	0.31	0.31	0.44						
241/2006	-	0.26	0.11	0.10	0.22	0.10	0.10	0.14	0.36	0.10	0.11	0.03	0.11	0.12	0.15	0.16	0.29	0.39	0.25	0.22	0.28	0.32	0.32	0.43						
193/2007	-	0.28	0.11	0.19	0.20	0.11	0.07	0.14	0.35	0.10	0.11	0.03	0.10	0.12	0.13	0.14	0.27	0.36	0.25	0.21	0.27	0.30	0.30	0.43						
327/2008	-	0.35	0.26	0.26	0.26	0.18	0.16	0.15	0.32	0.13	0.12	0.04	0.06	0.27	0.23	0.25	0.30	0.38	0.25	0.21	0.27	0.30	0.30	0.43						
003/2010	-	0.26	0.13	0.25	0.17	0.08	0.09	0.11	0.30	0.09	0.10	0.02	0.05	0.16	0.13	0.12	0.21	0.30	0.23	0.21	0.29	0.31	0.32	0.43						

<sup>1</sup>Spacecraft Deep Space Maneuver

						In Spec			Near the Spec					Out of Spec										inoperable	



## Aqua MODIS Noisy Detector History

### Detectors in Product Order

Day/Year	Band	20	21			27	29		B36
	Spec NEdT [K]	0.05	0.20			0.25	0.05		0.35
	Detector #	10	3	9	others	3	2	8	5
Pre-launch	-	0.05	0.16	0.28	near 0.2	0.10	0.02	0.02	1.34
175/2002	Nadir door open	0.03	0.23	0.23	near 0.2	0.09	0.02	0.02	1.28
183/2002	Back from safe mode	0.03	0.20	0.25	near 0.2	0.09	0.02	0.02	1.31
218/2002	Back from safe mode	0.03	0.19	0.26	near 0.2	0.09	0.02	0.02	1.32
255/2002	Back from safe mode	0.03	0.23	0.20	near 0.2	0.09	0.02	0.02	1.36
102/2003	-	0.03	0.43	0.19	near 0.2	0.09	0.02	0.02	1.31
201/2003	-	0.03	0.18	0.18	near 0.2	0.09	0.02	0.02	1.29
010/2005	-	0.03	0.17	0.19	near 0.2	0.23	0.02	0.02	1.35
359/2007	-	0.03	0.18	0.21	near 0.2	0.13	0.02	0.05	1.34
038/2008	-	0.03	0.19	0.19	near 0.2	0.14	0.05	0.05	1.34



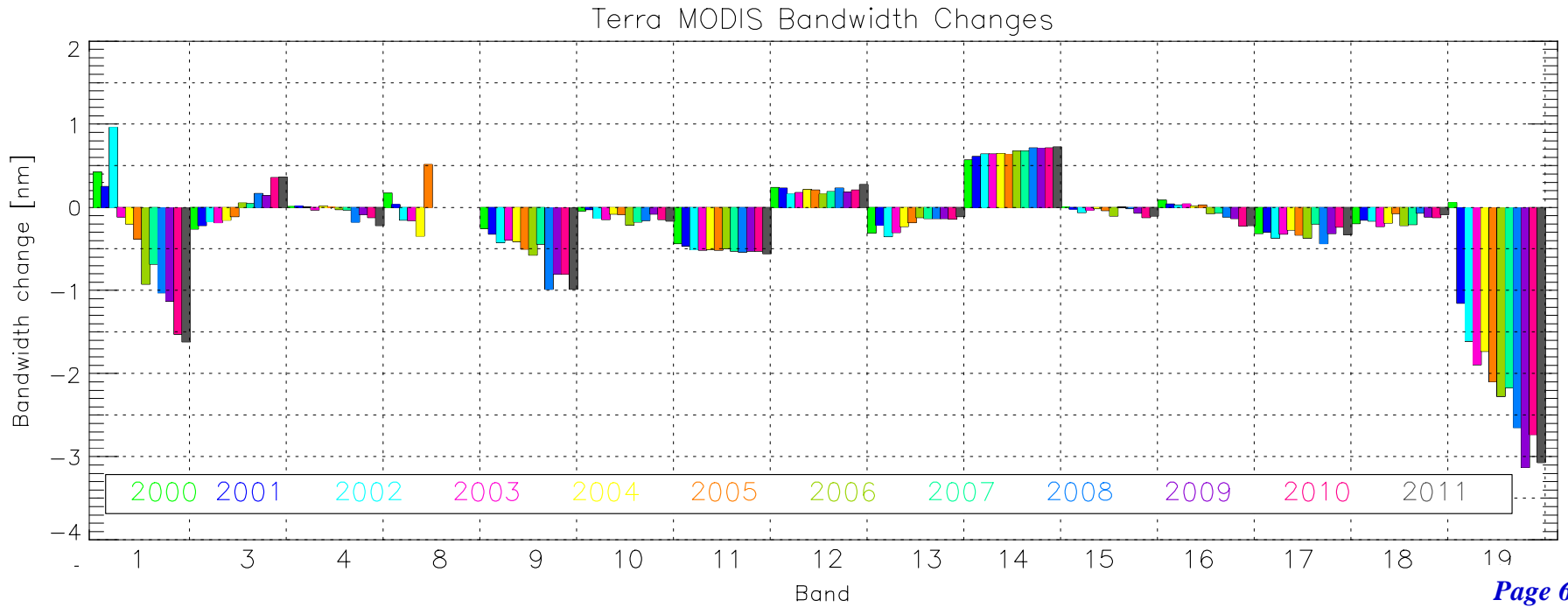
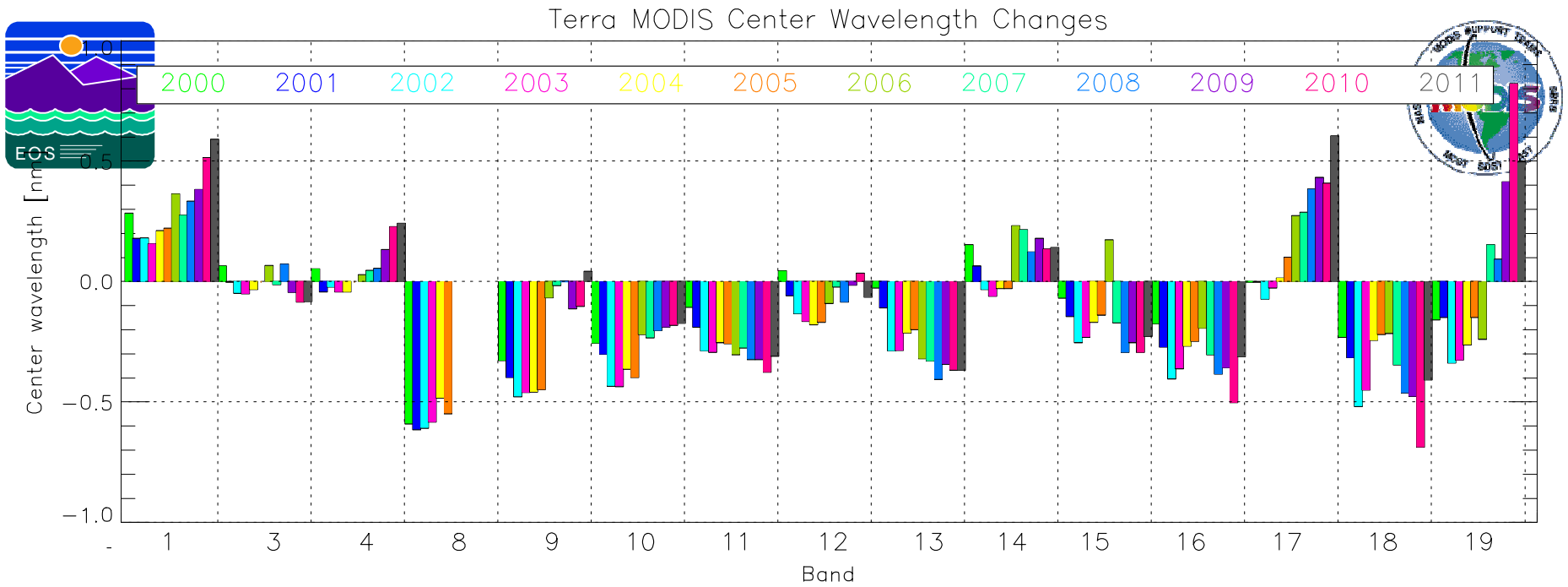
# Spectral/Spatial Backup Slides

*MODIS Characterization Support Team (MCST)*

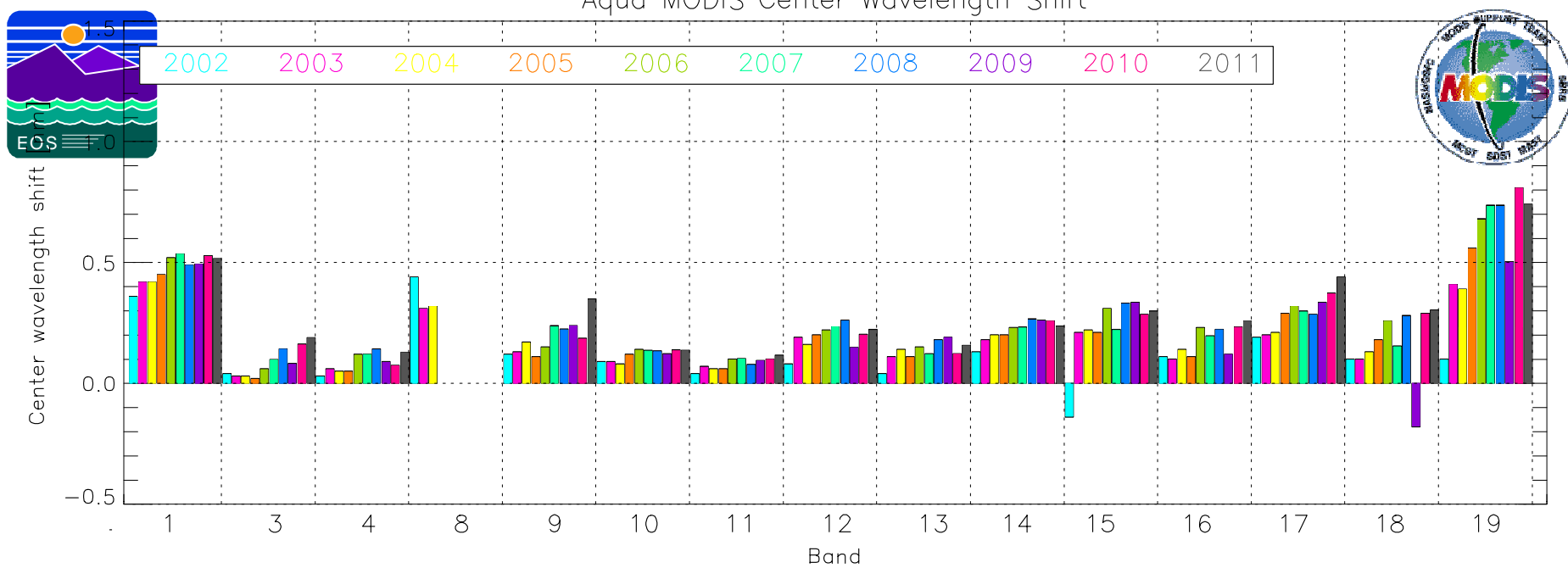


*MCST Workshop at MST Meeting (May 17, 2011)*

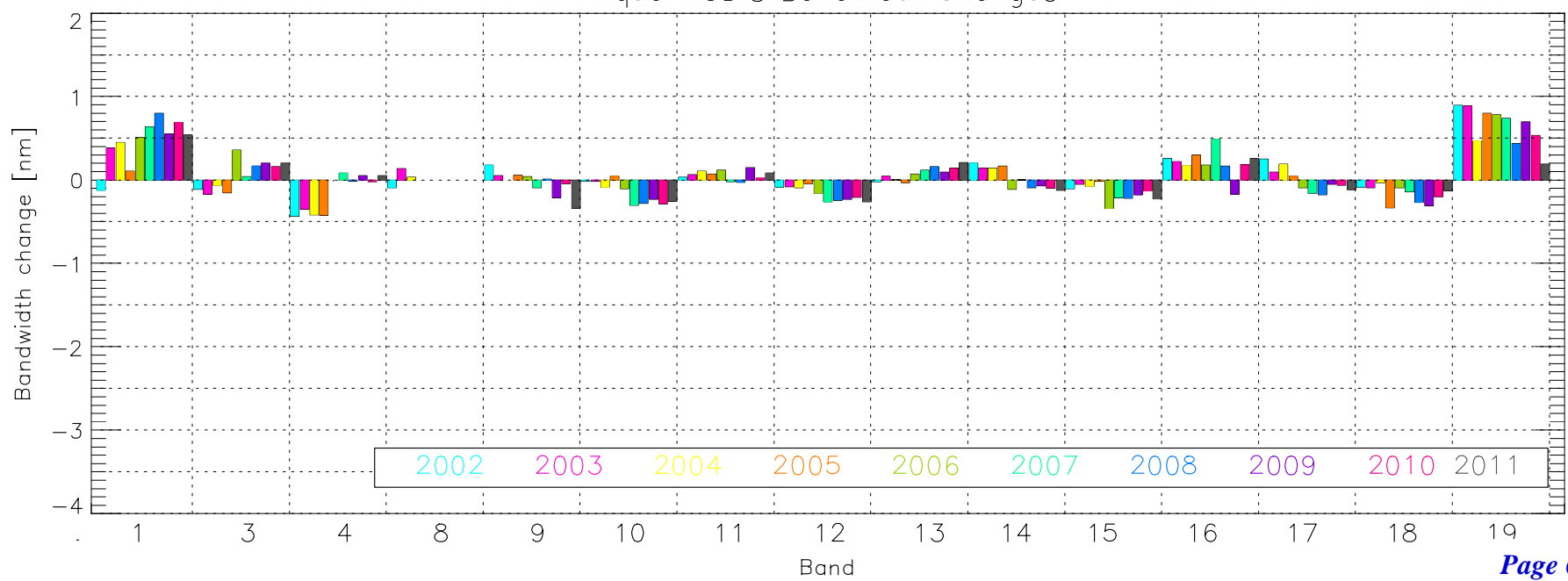




### Aqua MODIS Center Wavelength Shift

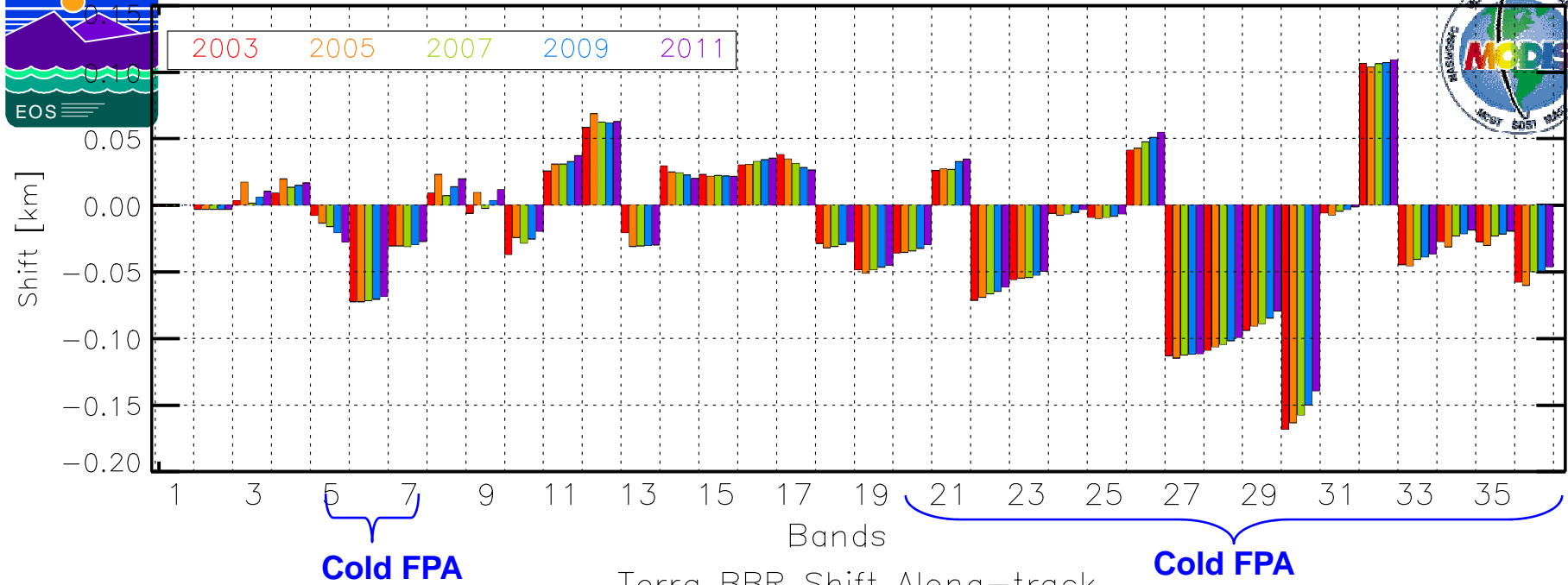
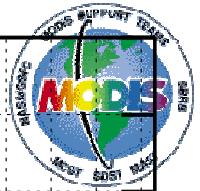


### Aqua MODIS Bandwidth Changes

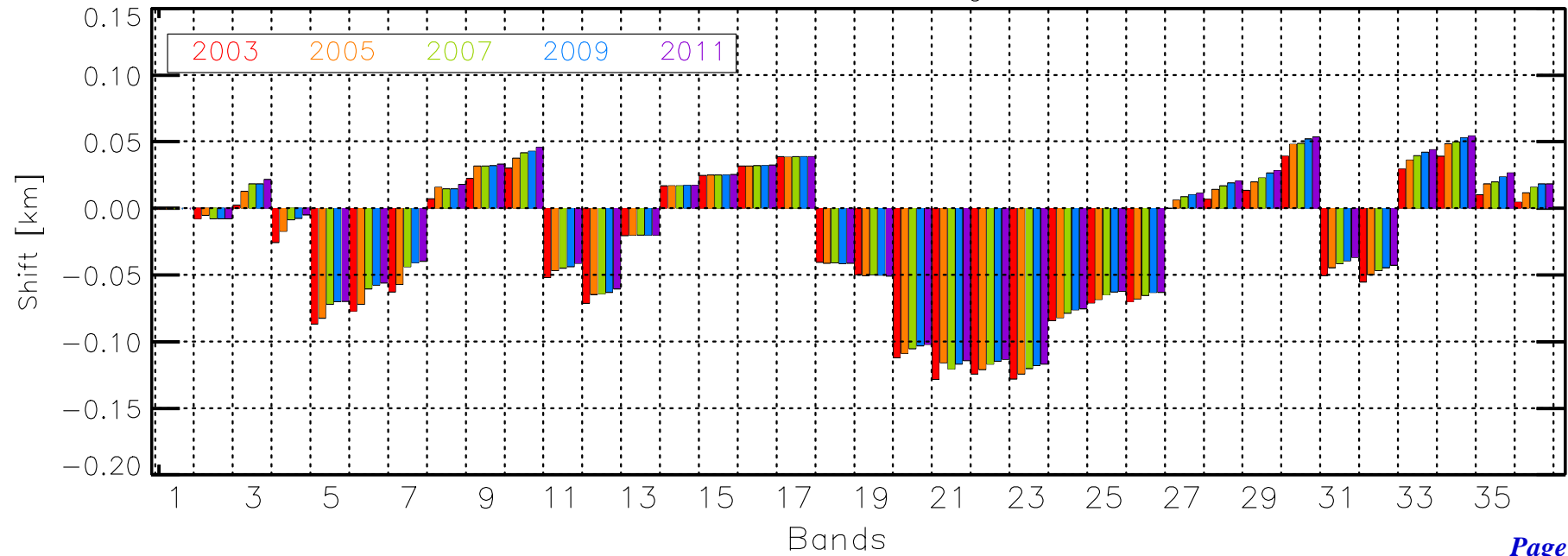




### Terra BBR Shift Along-scan

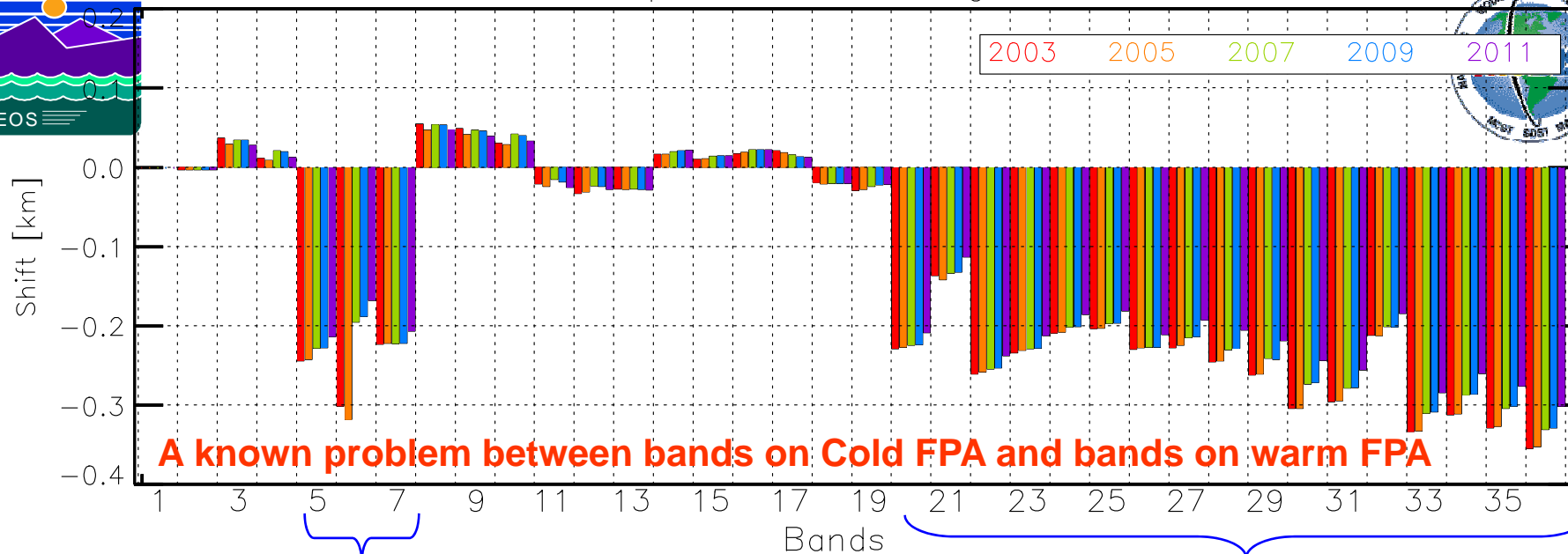
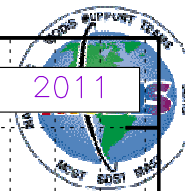


### Terra BBR Shift Along-track

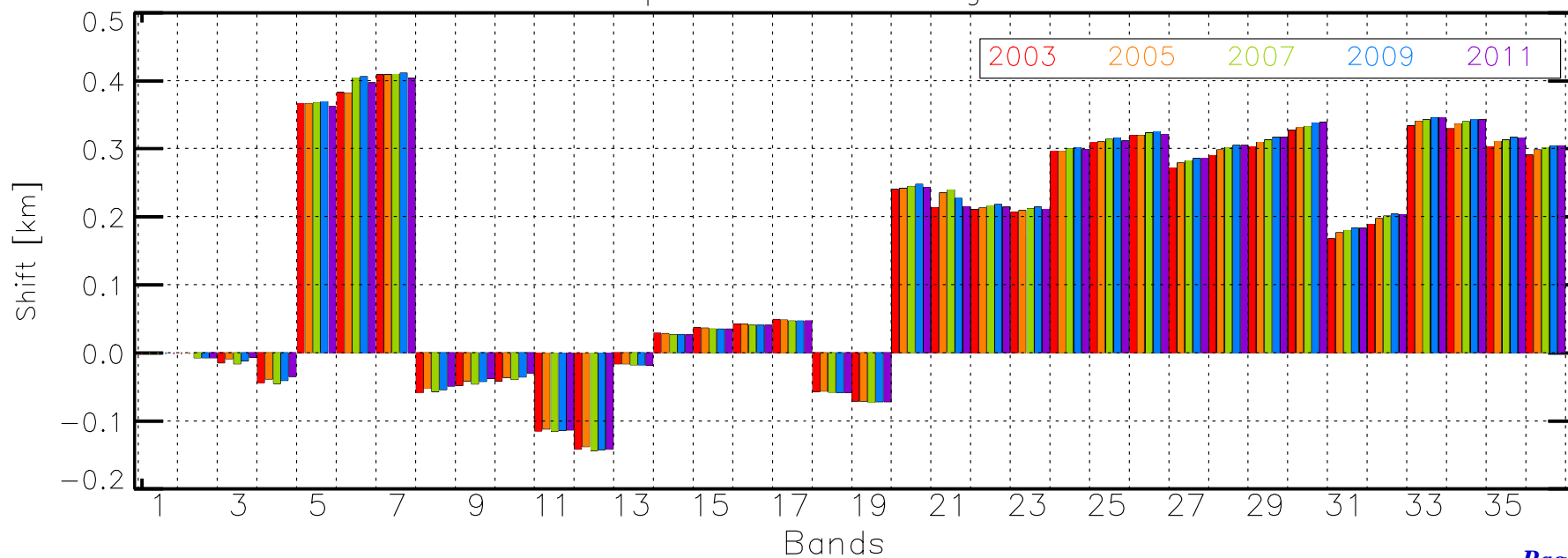




### Aqua BBR Shift Along-scan



### Aqua BBR Shift Along-track





# Collection 6 QA Backup Slides

*MODIS Characterization Support Team (MCST)*



*MCST Workshop at MST Meeting (May 17, 2011)*







# QA C6 Improvements



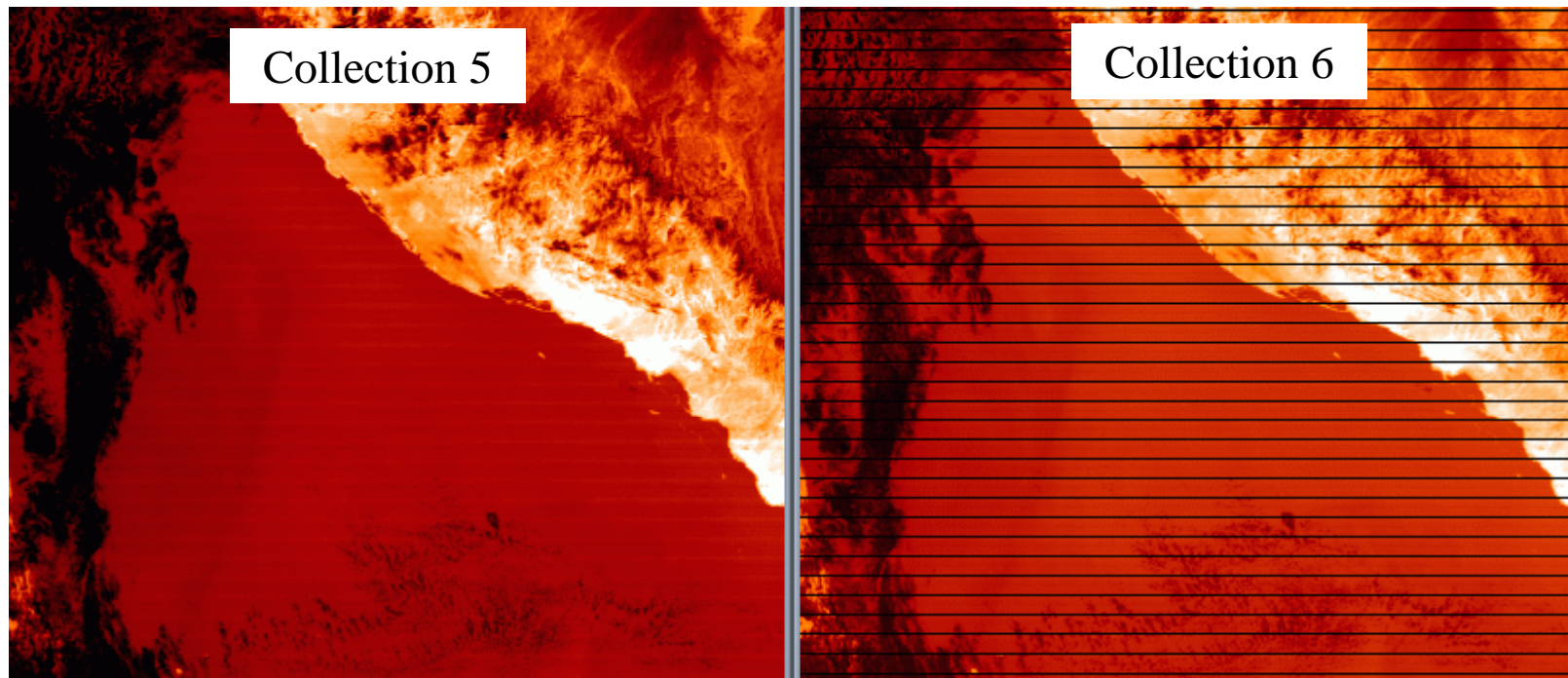
- Fill Values replace Interpolation in L1B for Inoperable Detectors
  - Code change needed
- Subframe level QA flags
  - Code change needed
  - New QA LUT



# QA C6 LUT – Fill vs Interpolation



- C5: Inoperable detectors filled with interpolated value from adjacent detectors
- C6: Science Team request to have no interpolation, explicit fill value for inoperable detectors



Terra Band 29



## QA C6 LUT – Subframe Flags



- C5: QA flags only on detector level
- C6: L1B code change implemented to allow QA flags at subframe level.
  - New QA LUT
  - Terra Band 2 Detectors 29 & 30 Subframe 1 flagged as ‘Noisy’ for V6 (known crosstalk issue)

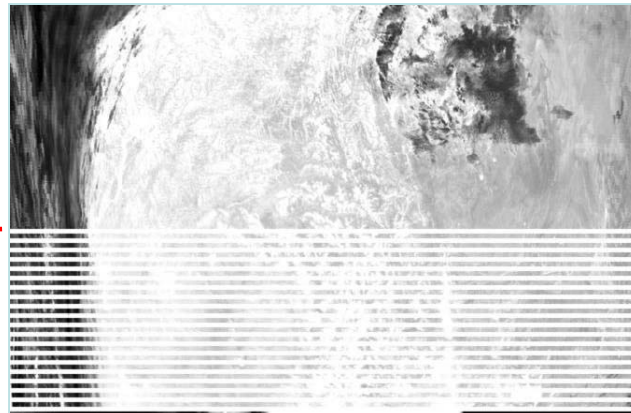


# C6 L1B Code Change

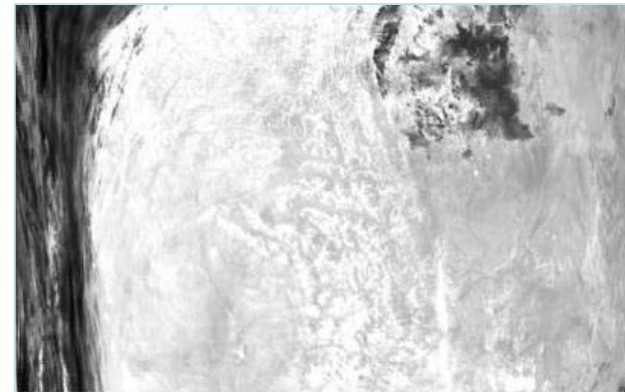


- Sector Rotation Timing Fix
  - Anomaly in TEB data during certain sector rotation events (lunar calibrations)

Anomaly causes artificially high radiance band immediately before sector rotation



Collection 5



Collection 6

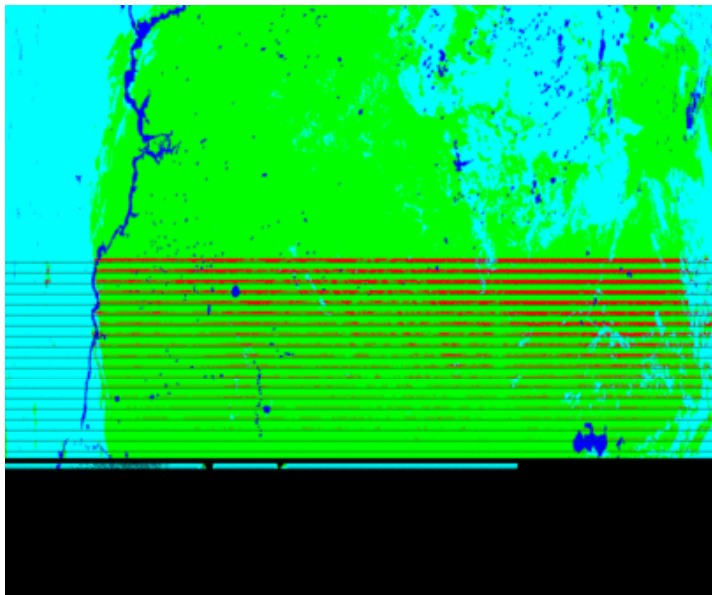
Plots courtesy of S. Devadiga



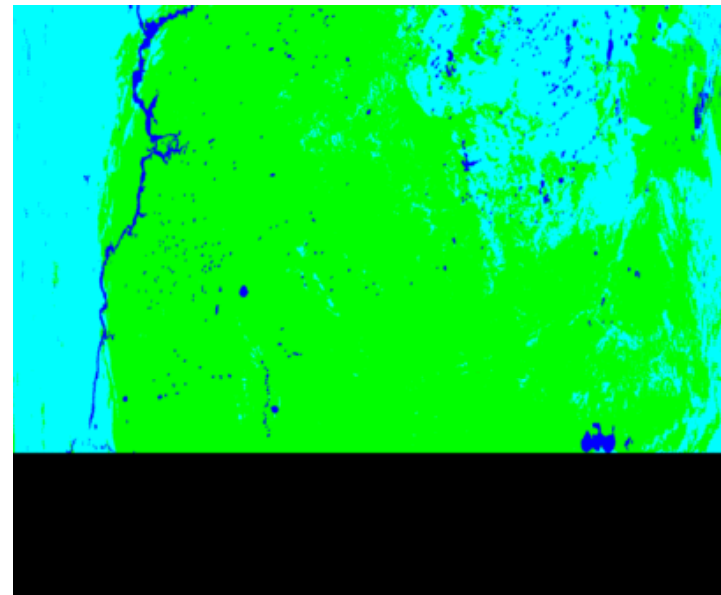
# C6 L1B Code Change



Fire Granule MYD14.A2008343.2235



C5 Fire Product using C5 L1B



C5 Fire Product using C6 L1B

Plots courtesy of S. Devadiga