Study of Sensor Calibration Consistency

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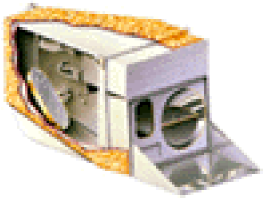


CEOS WGCV 28th Meeting, Sanya, China (26-29 February, 2008)

Outline

- Why Calibration Consistency Matters
- Inter-Calibration Approaches
  - SNO, ground targets, lunar viewing, a third sensor, aircraft, etc.
- Using SNO for Sensor Calibration Consistency
  - MODIS, AVHRR, AASTR
- Issues and Challenges (open discussions)
  - Spatial and spectral

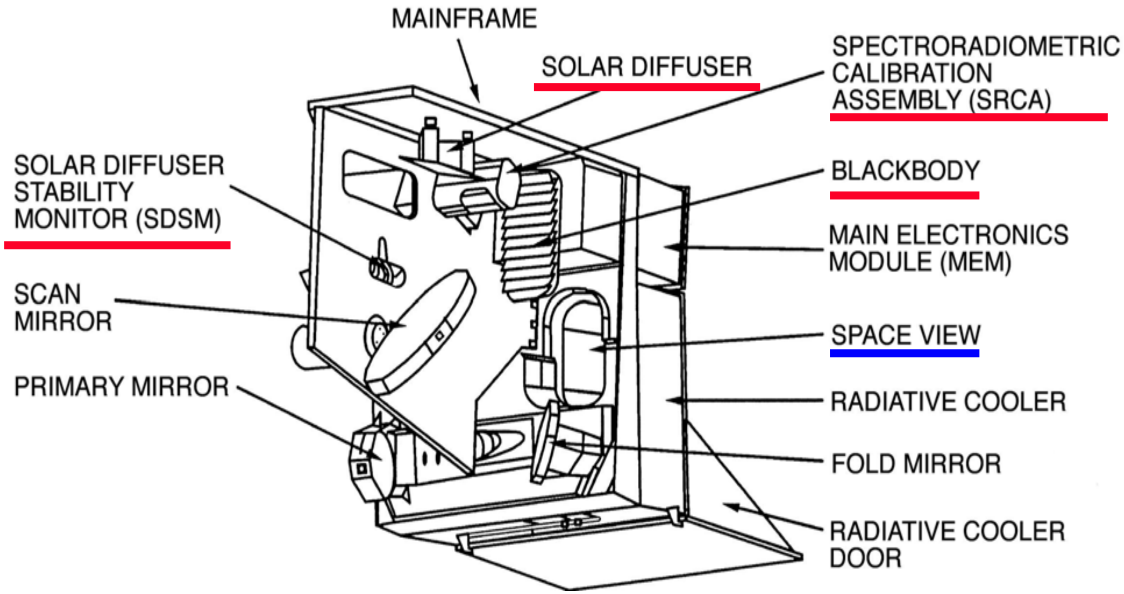
MODIS Instrument Calibration

Terra since Dec. 1999

Aqua since May 2002

- 20 Reflective solar bands (RSB): 0.41-2.2μm
- 16 Thermal emissive bands (TEB): 3.7-14.4μm
- 3 spatial resolutions at nadir: 250m, 500m and 1000m
- 4 Focal Plane Assemblies (FPA): VIS, NIR, SMIR, LWIR
- 5 On-Board Calibrators: SD, SDSM, SRCA, BB, and SV port

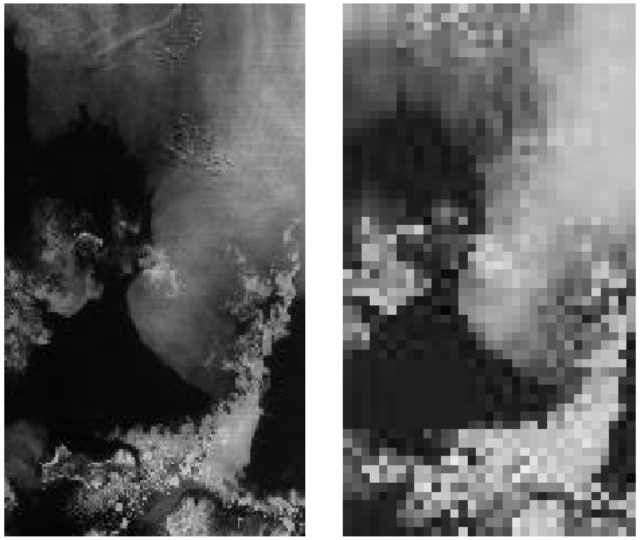
MODIS On-orbit Calibration: OBCs



Plus Regular Lunar Observations

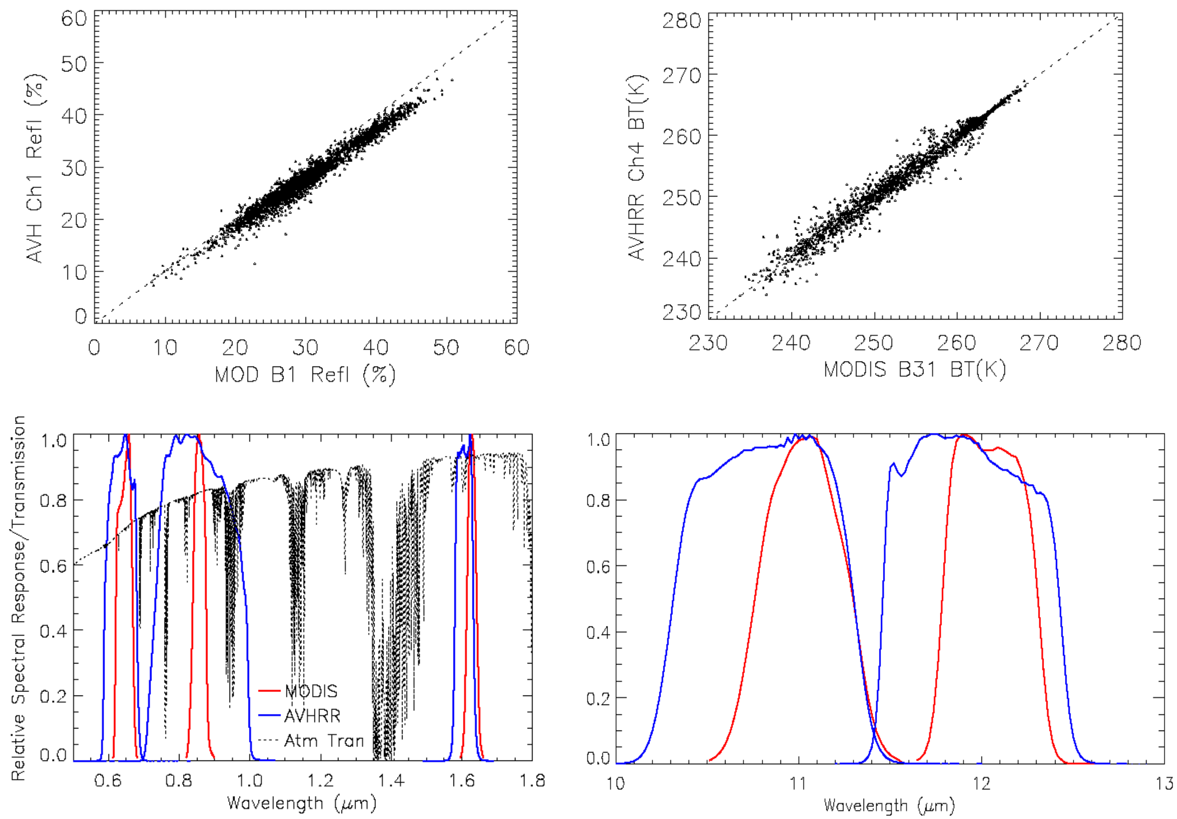
Using SNO for Sensor Inter-calibration

Visible band (time: 2006151.2300)

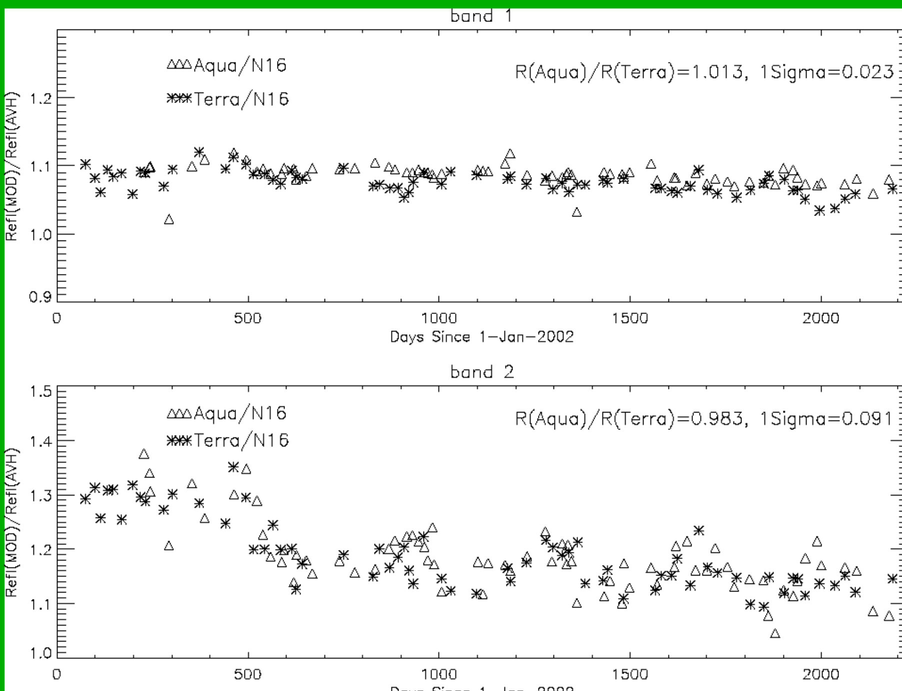


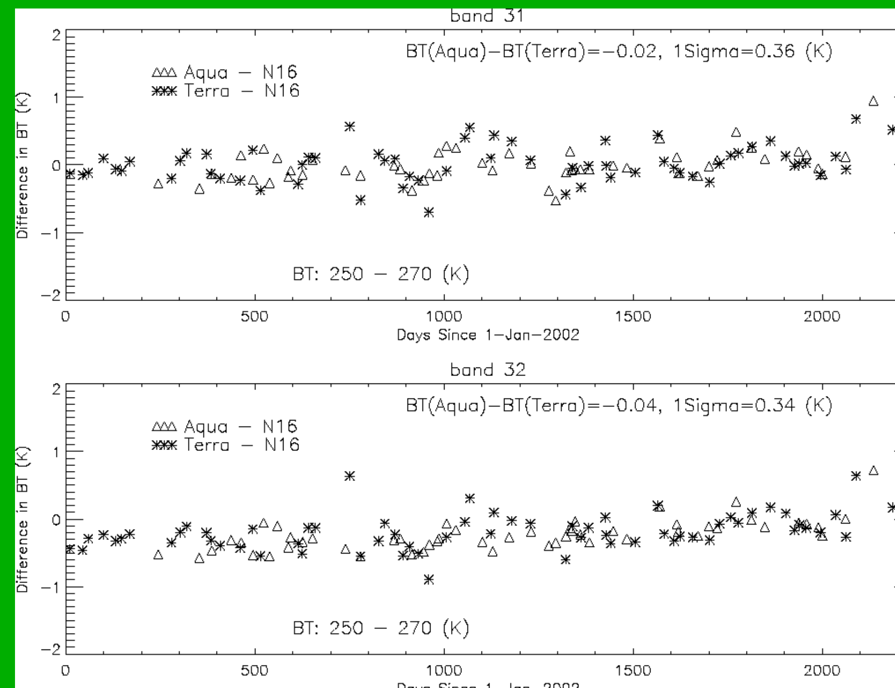
Terra MODIS | **N17 AVHRR GAC**

N-16 vs. Aqua (06/04/2006)



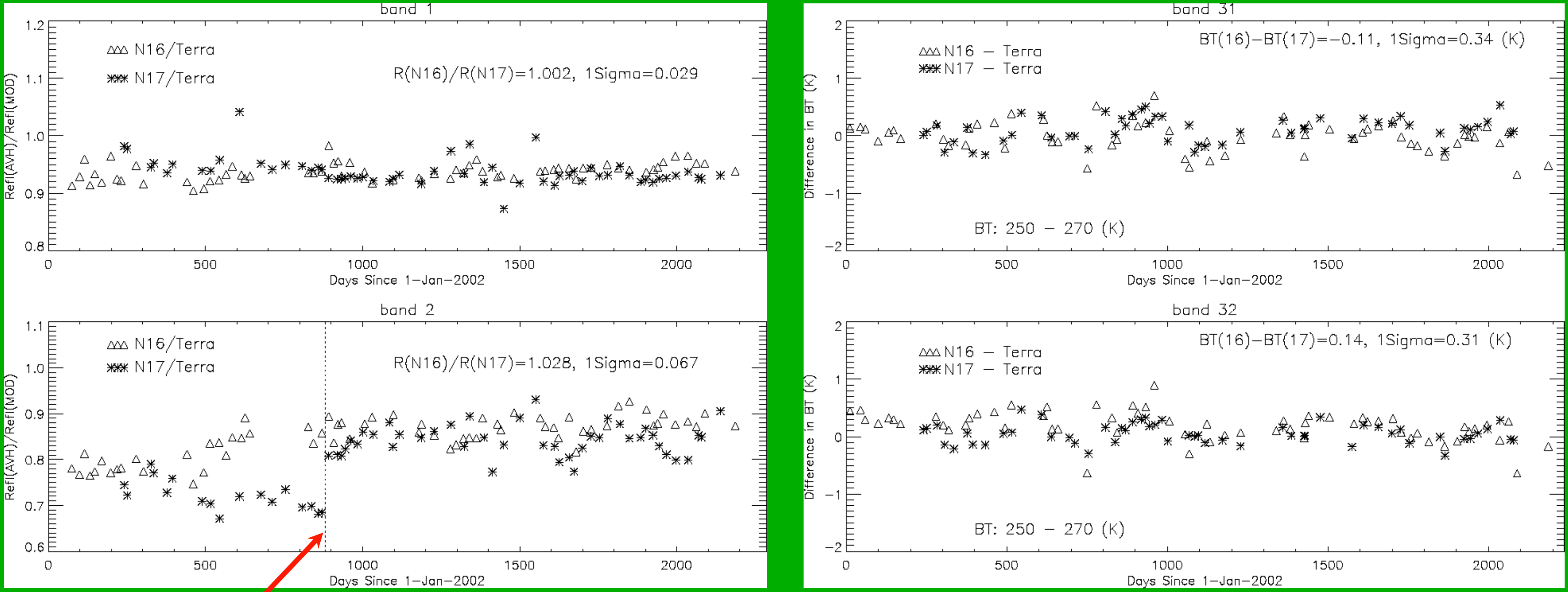
Using SNO for Sensor Calibration Consistency (Example: 1)





Using AVHRR to Study Terra and Aqua MODIS

Using SNO for Sensor Calibration Consistency (Example: 2)

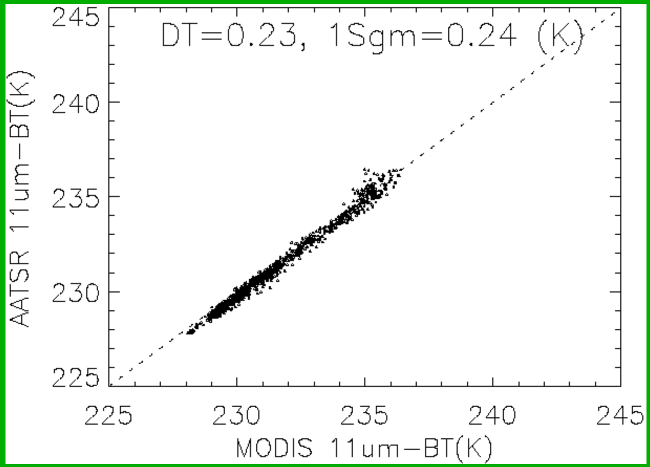


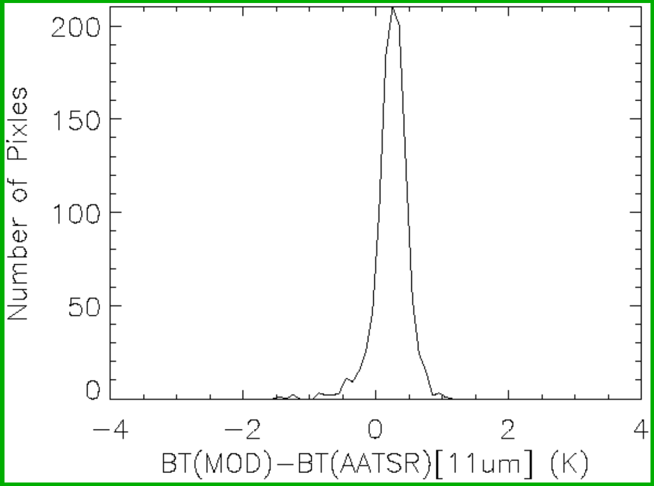
Gain Reset for N17 AVHRR Ch.2

Using MODIS to Study AVHRR 16 and 17

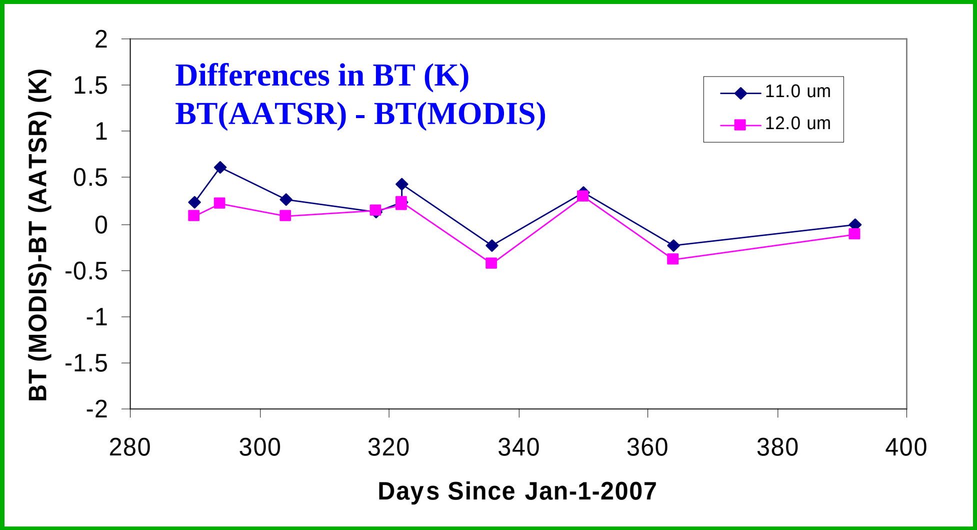
Using SNO for Sensor Calibration Consistency (Example: 3)

GMT Time: 2007322.2115
Location: 81.1ºS, 69.0ºE





MODIS and AASTR Calibration Comparison



Limited work on AASTR reflective solar bands (Coordination with D. Smith, RAL, UK)

MODIS Key Specifications

Primary Use	Band	Bandwidth[1]	Spectral Radiance[2]	Required SNR[3]
Land/Cloud/Aerosols Boundaries	1	620 - 670	21.8	128
	2	841 - 876	24.7	201
Land/Cloud/Aerosols Properties	3	459 - 479	35.3	243
	4	545 - 565	29	228
	5	1230 - 1250	5.4	74
	6	1628 - 1652	7.3	275
	7	2105 - 2155	1	110
Ocean Color/ Phytoplankton/ Biogeochemistry	8	405 - 420	44.9	880
	9	438 - 448	41.9	838
	10	483 - 493	32.1	802
	11	526 - 536	27.9	754
	12	546 - 556	21	750
	13	662 - 672	9.5	910
	14	673 - 683	8.7	1087
	15	743 - 753	10.2	586
	16	862 - 877	6.2	516
Atmospheric Water Vapor	17	890 - 920	10	167
	18	931 - 941	3.6	57
	19	915 - 965	15	250

Primary Use	Band	Bandwidth[1]	Spectral Radiance[2]	Required NEΔT(K)[4]
Surface/Cloud Temperature	20	3.660 - 3.840	0.45 (300K)	0.05
	21	3.929 - 3.989	2.38 (335K)	0.2
	22	3.929 - 3.989	0.67 (300K)	0.07
	23	4.020 - 4.080	0.79 (300K)	0.07
Atmospheric Temperature	24	4.433 - 4.498	0.17 (250K)	0.25
	25	4.482 - 4.549	0.59 (275K)	0.25
Cirrus Clouds Water Vapor	26	1.360 - 1.390	6	150[3]
	27	6.535 - 6.895	1.16 (240K)	0.25
	28	7.175 - 7.475	2.18 (250K)	0.25
Cloud Properties	29	8.400 - 8.700	9.58 (300K)	0.05
Ozone	30	9.580 - 9.880	3.69 (250K)	0.25
Surface/Cloud Temperature	31	10.780 - 11.280	9.55 (300K)	0.05
	32	11.770 - 12.270	8.94 (300K)	0.05
Cloud Top Altitude	33	13.185 - 13.485	4.52 (260K)	0.25
	34	13.485 - 13.785	3.76 (250K)	0.25
	35	13.785 - 14.085	3.11 (240K)	0.25
	36	14.085 - 14.385	2.08 (220K)	0.35

[1] Bands 1 to 19 are in nm; Bands 20 to 36 are in µm

[2] Spectral Radiance values are (W/m^2-µm-sr)

[3] SNR = Signal-to-noise ratio

[4] NEΔT = Noise-equivalent temperature difference

Reflective solar bands (RSB): 0.41-2.2µm; Thermal emissive bands (TEB): 3.7-14.4µm