ATSR Performance and Validation

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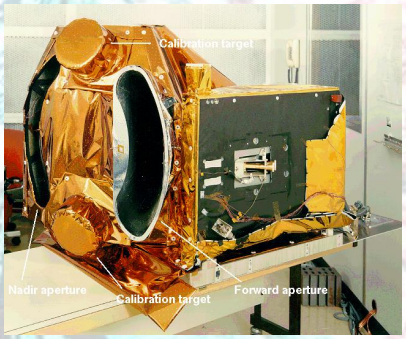
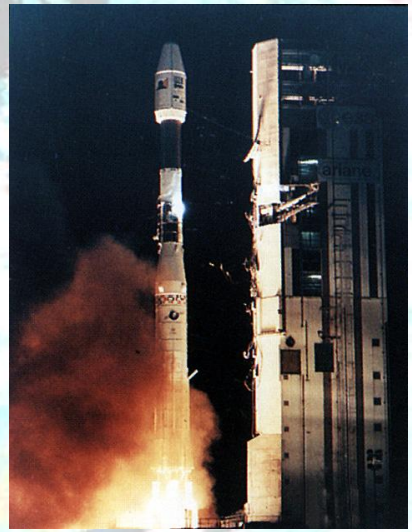
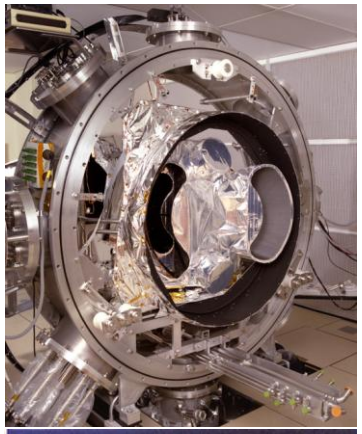
ATSR Series

1991-2000 ATSR-1

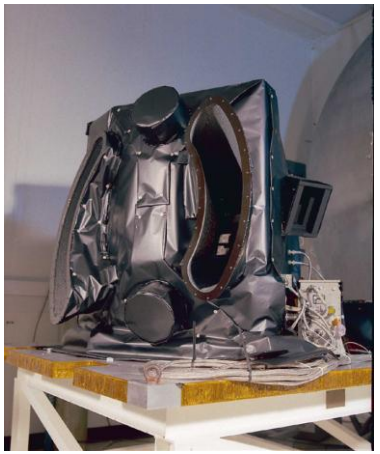




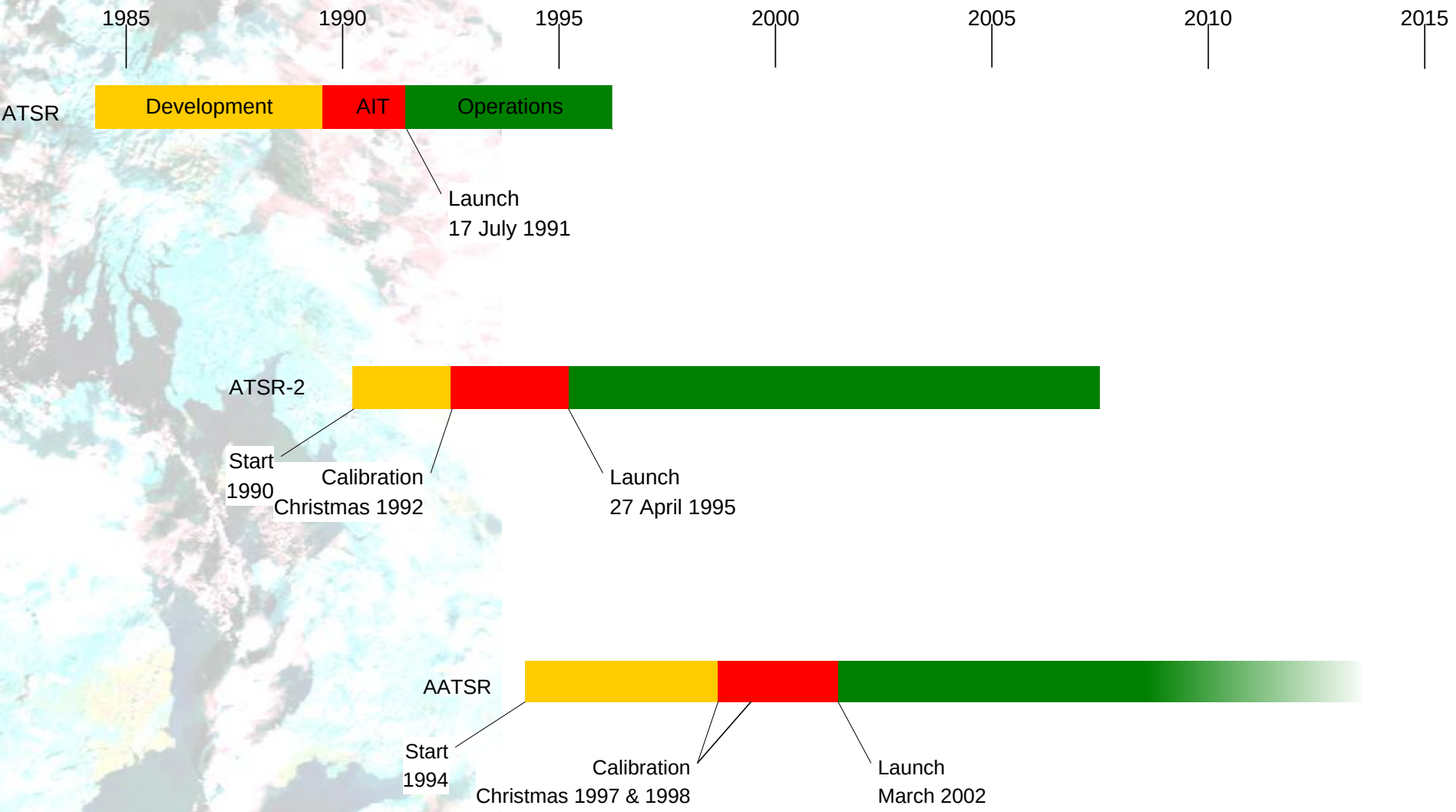
1995-2008 ATSR-2



2002- AATSR



Timeline

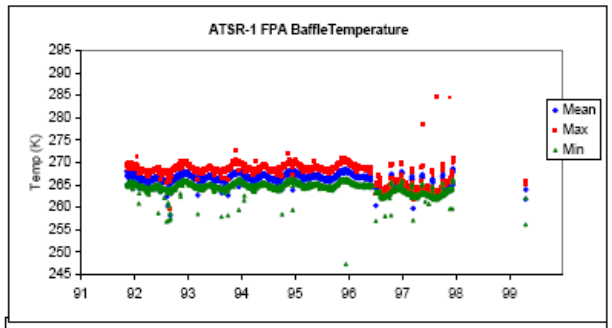

1985
1990
1995
2000
2005
2010
2015
ATSR
Development
AIT
Operations
Launch
17 July 1991
ATSR-2
Start
1990
Calibration
Christmas 1992
Launch
27 April 1995
AATSR
Start
1994
Calibration
Christmas 1997 & 1998
Launch
March 2002

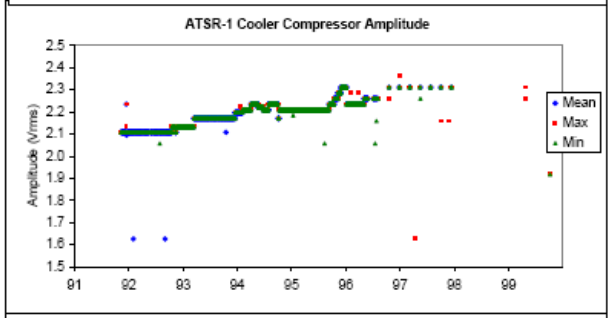
Some statistics

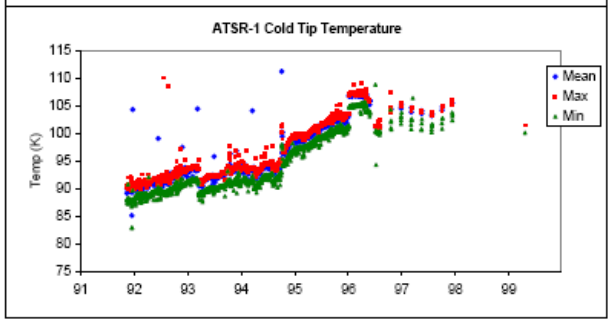
- The ATSR series combined has covered more than 5-billion km on ground
  - ATSR-2 Scan Mechanism had completed an estimated 2.5 billion revs. before the end of mission

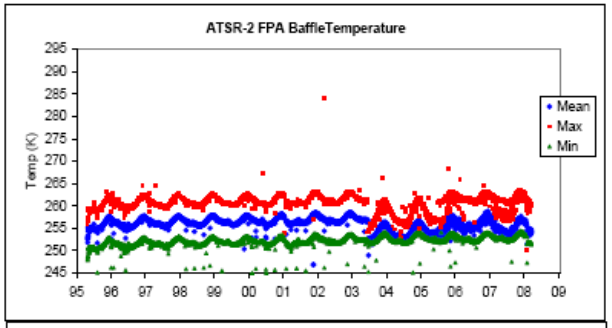
- The ATSR series has suffered only three major anomalies in >18years of operations
  - ATSR-1 3.7um failure in May 1992
  - ATSR-2 Scan mirror stalled between Dec-1995 to Jun-1996
  - ATSR-2 Scan mirror failure – Feb-1998

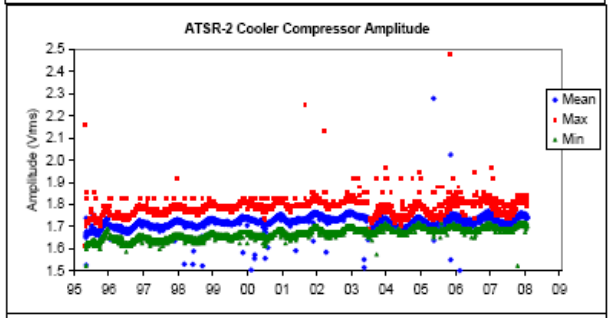
Cooler Performance

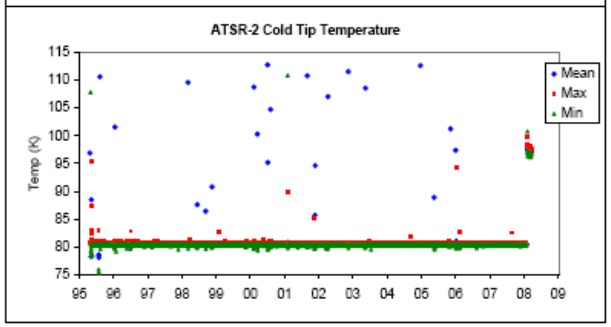


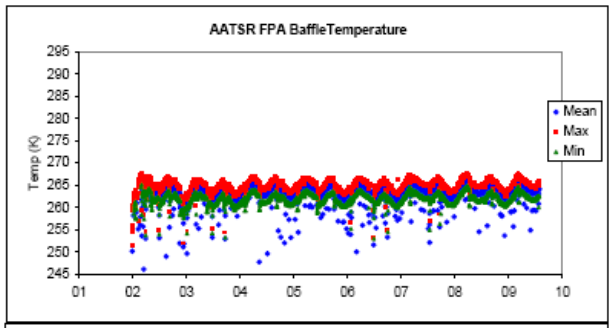


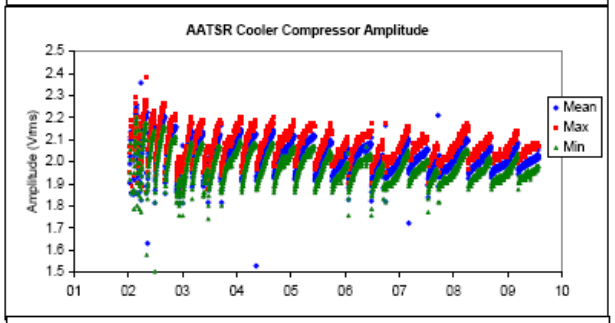


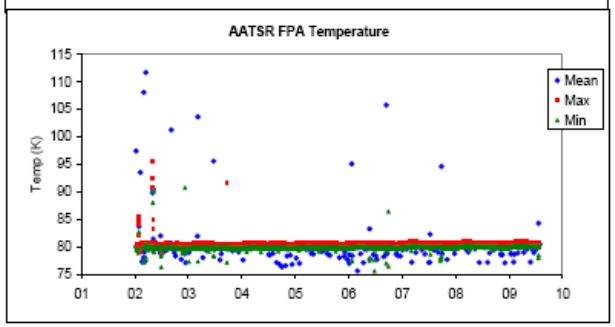




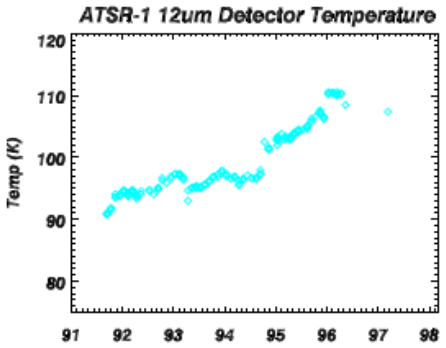


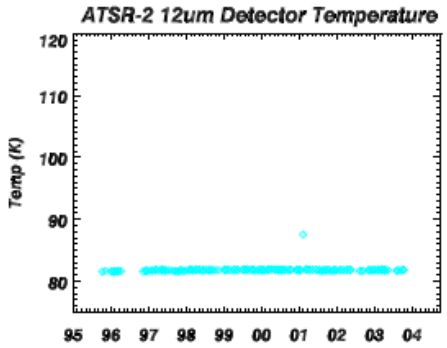


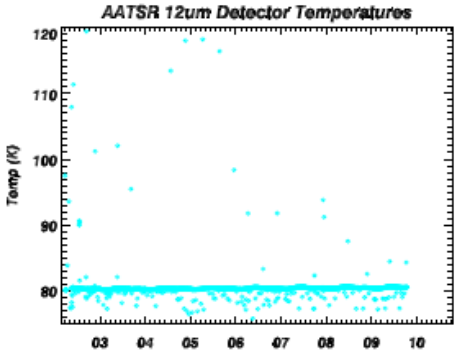


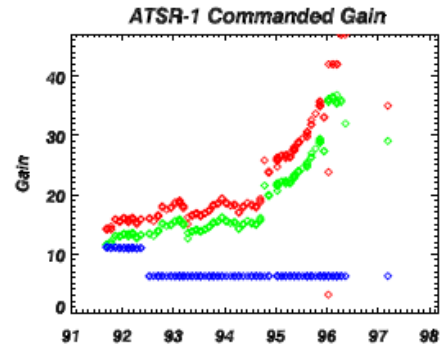


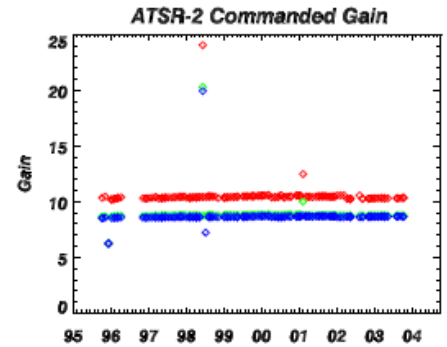
Detector Performance

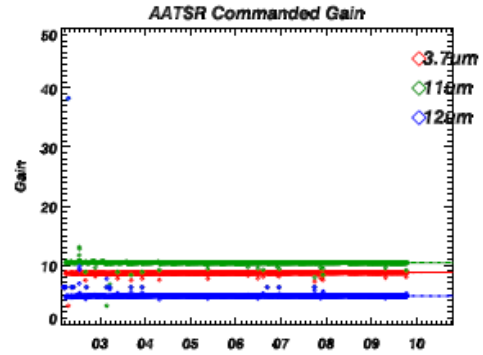


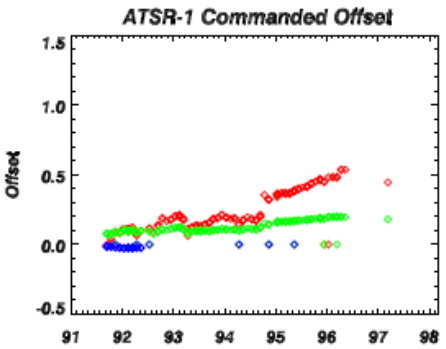


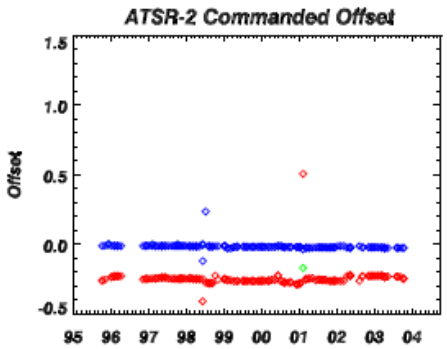


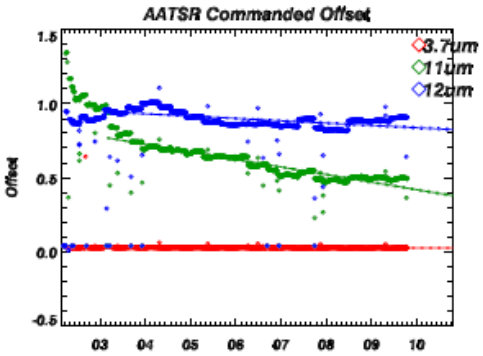




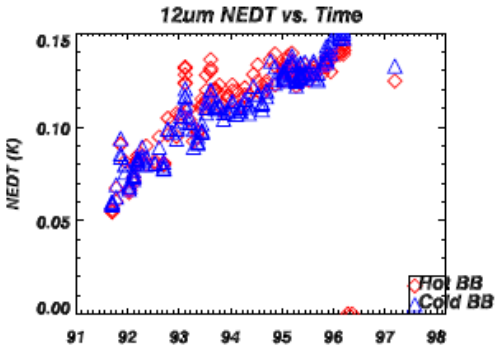


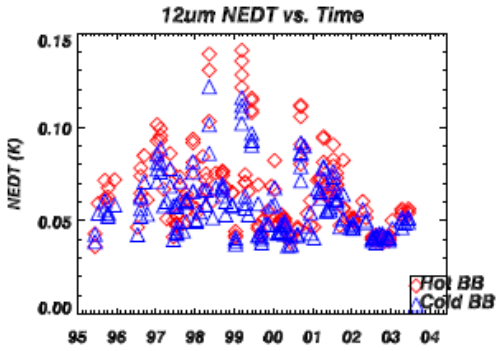


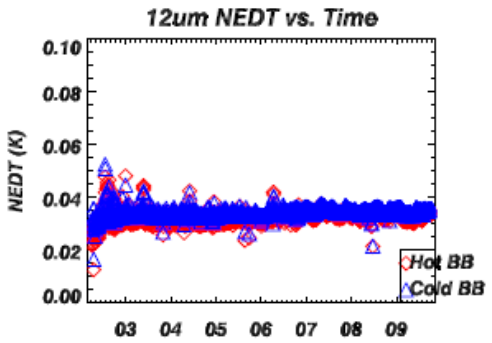


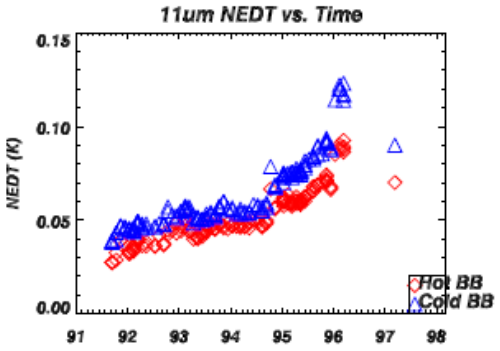


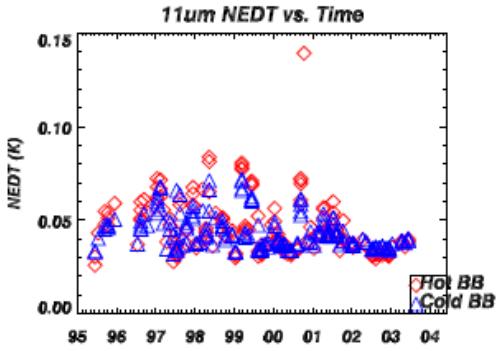
Radiometric Noise Performance

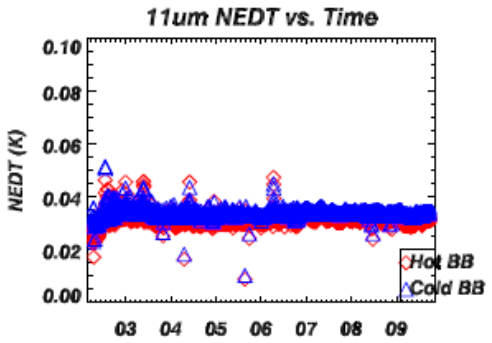


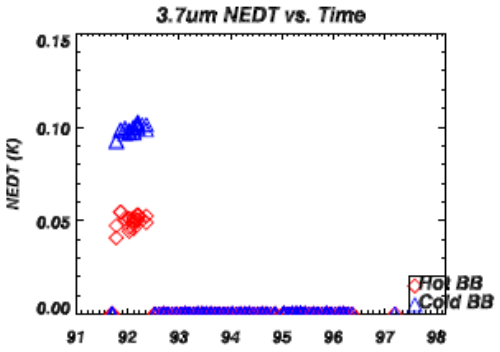


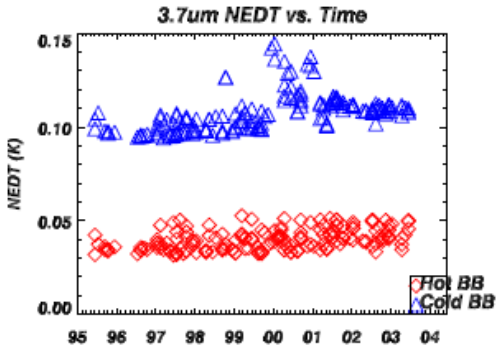


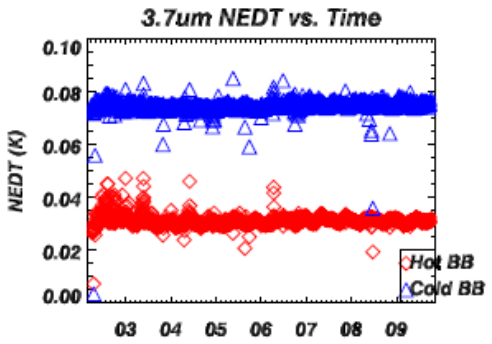




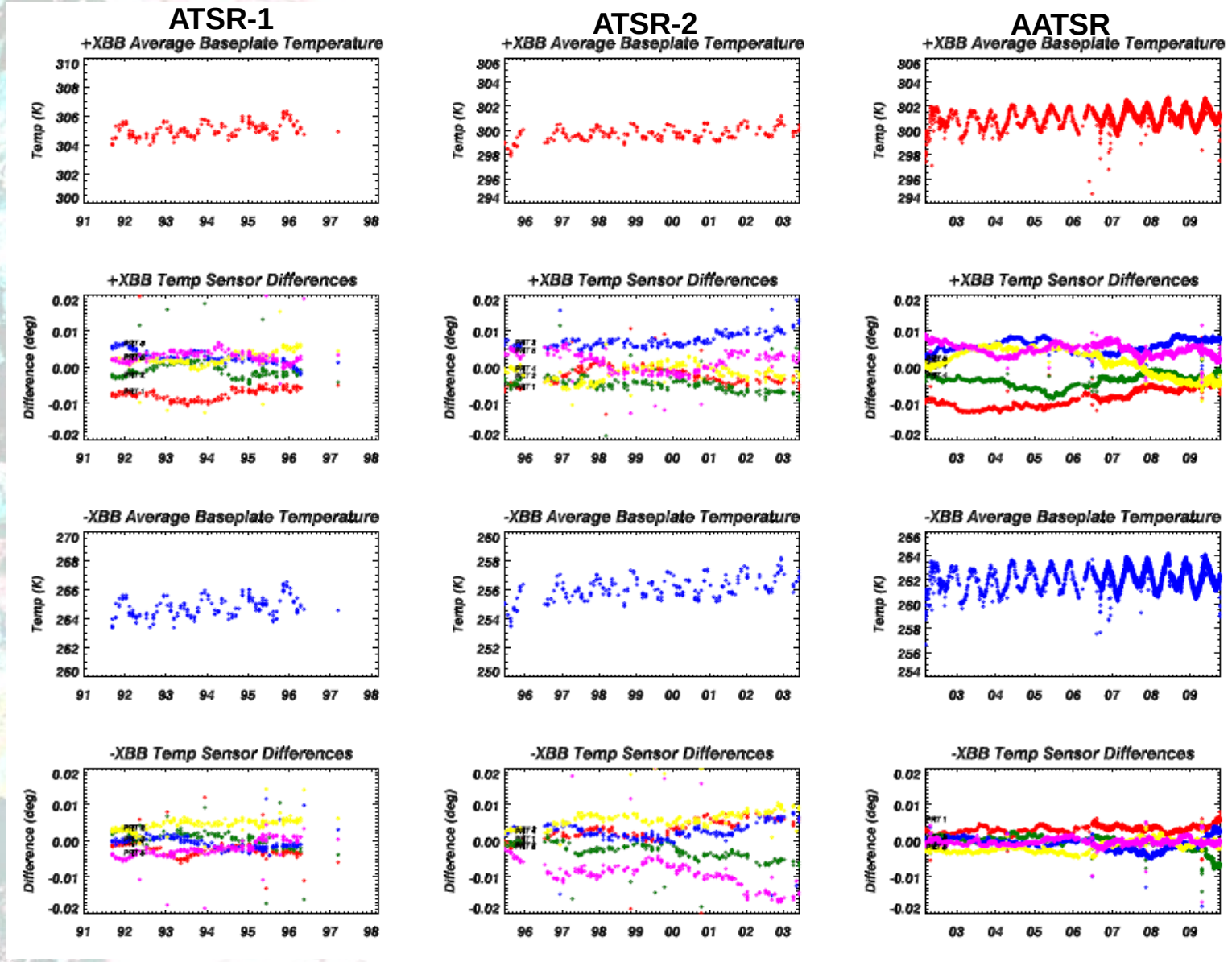




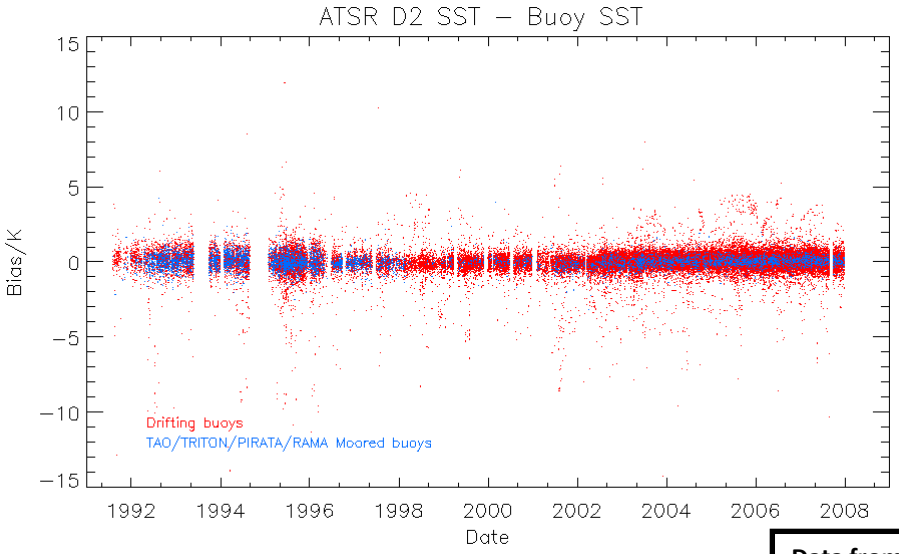


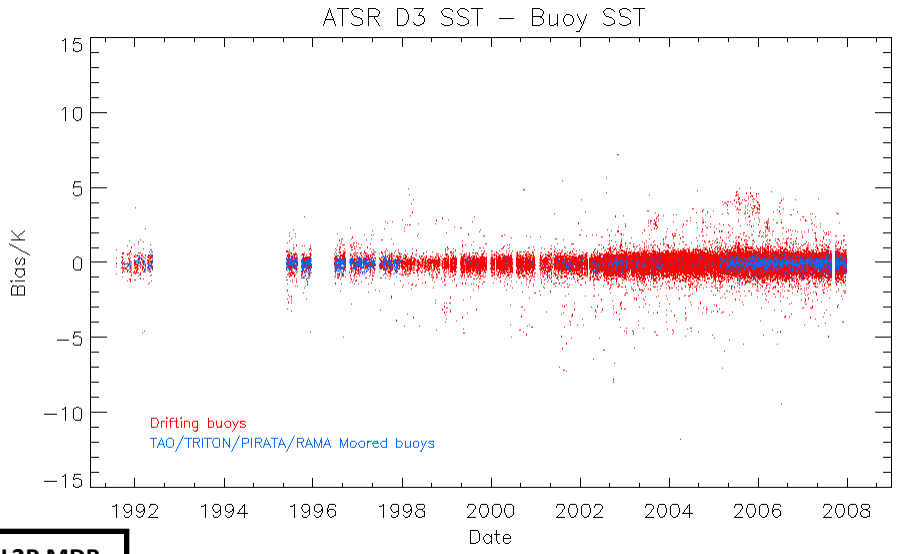


Blackbody Performance



ATSR: Long Term Stability





Data from ESA L2P MDB

- Match-ups of 1-km SST and nearest buoy observation within 1-km and 120 minutes
- No post-filtering, hence large number of outliers
- Match-ups shown for drifting buoys and TAO/TRITON/PIRATA/RAMA arrays

ATSR: Long-term accuracy

ATSR versus drifters

ATSR	Number	Mean (K)	SD (K)	Median (K)	RSD (K)
AATSR Night (3-ch)	10682	+0.09	0.36	+0.11	0.32
ATSR-2 Night (3-ch)	5349	+0.07	0.61	+0.07	0.37
ATSR-1 Night (3-ch)	252	+0.08	0.78	+0.07	0.50

Data from ESA L2P MDB

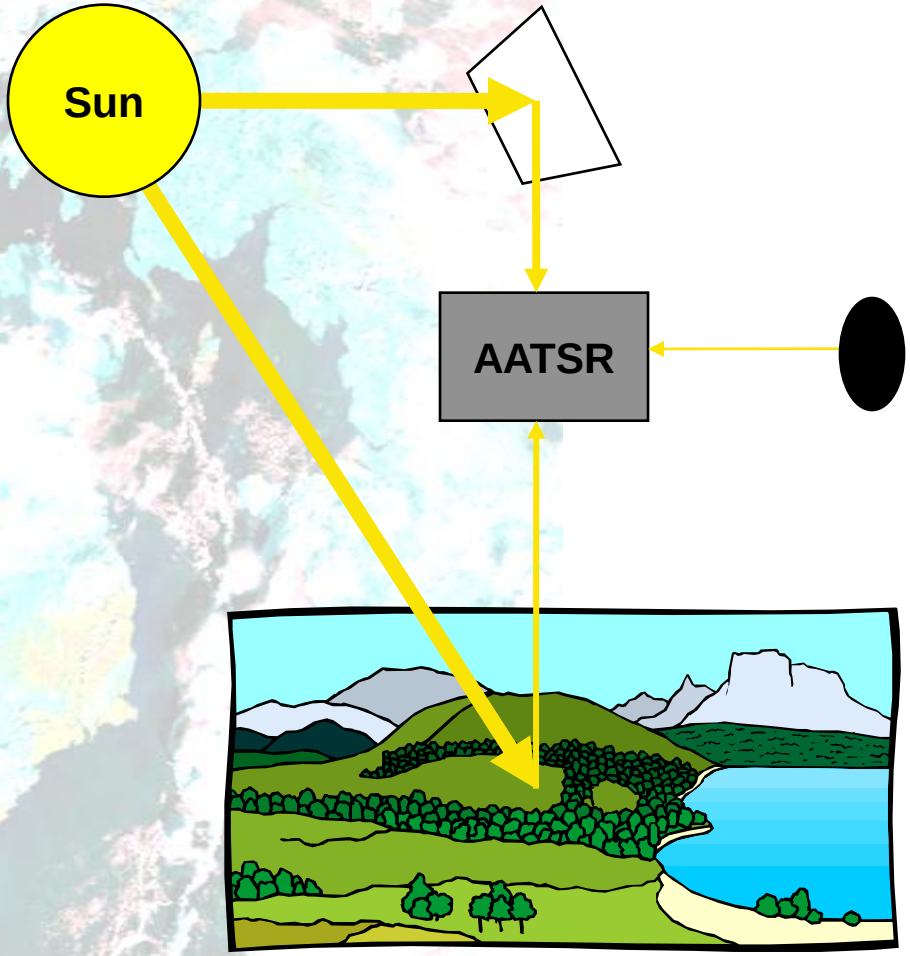
Buoy (sub-skin) vs. AATSR (sub-skin) and Radiometer (skin) vs. AATSR (skin)

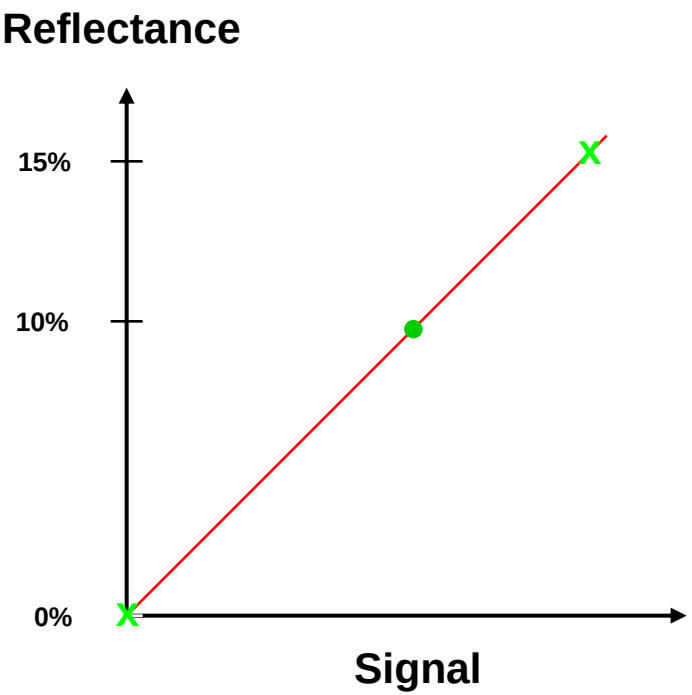
	Buoy			Radiometer		
Reference	No.	Mean (K)	SD (K)	No.	Mean (K)	SD (K)
ISAR Night	752	+0.03	0.27	1130	+0.02	0.24
M-AERI Night	372	+0.10	0.31	936	+0.09	0.29

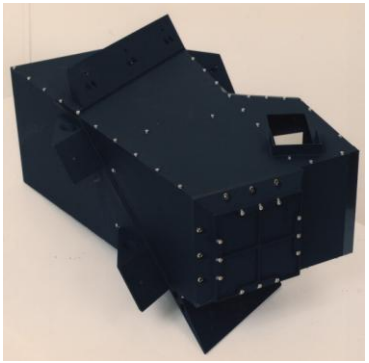
Data from Peter Minnett (RSMAS), Werenfrid Wimmer (NOCS) and Medspiration MDB

Visible Channel Calibration

- ATSR-2 pioneered the use of on-board solar diffusers to calibrate visible channels

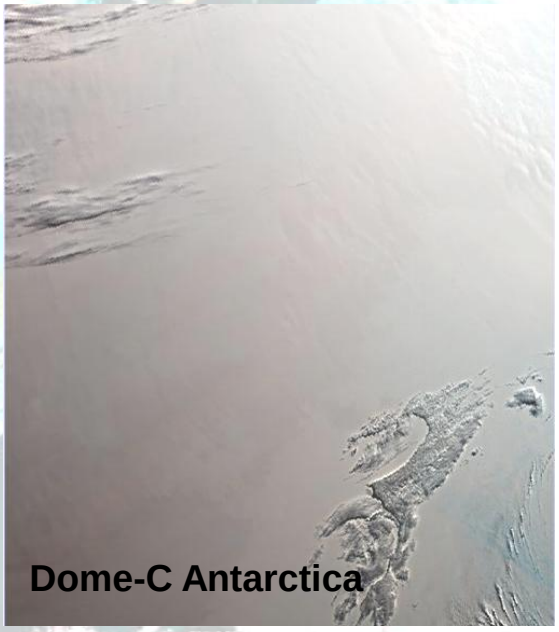






Vicarious Calibration Using Stable Targets

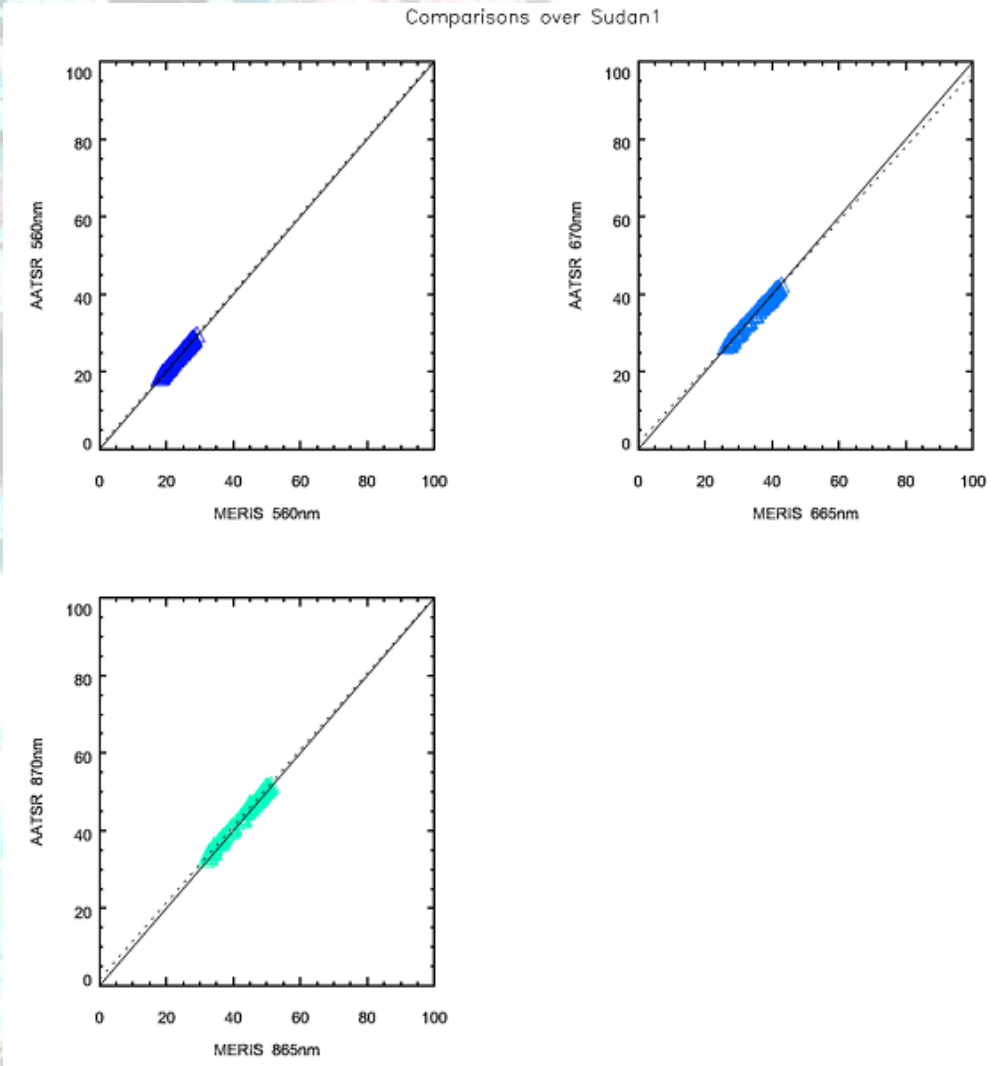
Sudan-1 – Sahara Desert



Dome-C Antarctica

- Large area desert and ice sites can provide a useful site for vicarious calibration optical sensors measuring reflected Sunlight such as AATSR
- Key Assumptions
  - Uniform reflectance over large area
  - Long term-radiometric stability of the calibration sites ensures long-term stability of the top-of-the atmosphere (TOA) albedo (and of seasonal variations, if any) or reflectance over large spatially uniform areas.
  - High surface reflectance to maximise the signal-to-noise and minimise atmospheric effects on the radiation measured by the satellite

AATSR vs. MERIS



- Bias (Dec 2008)

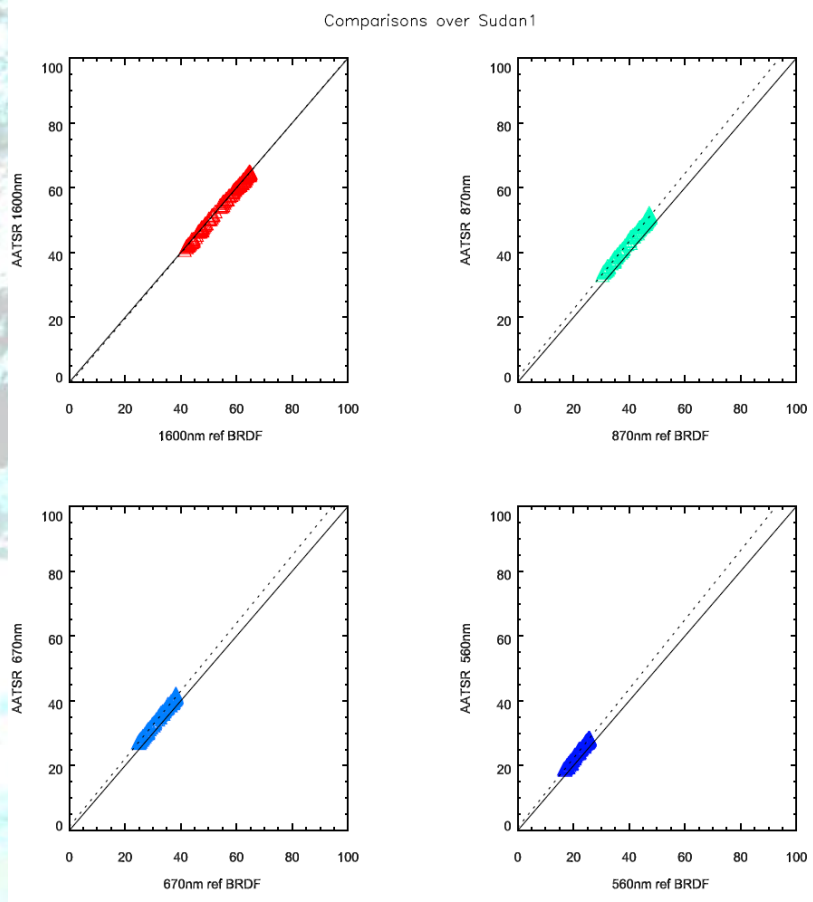
  R_{AATSR}/R_{MERIS}

  0.87µm = 1.027 0.011

  0.66µm = 1.001 0.010

  0.56µm = 1.025 0.010

AATSR vs. ATSR-2



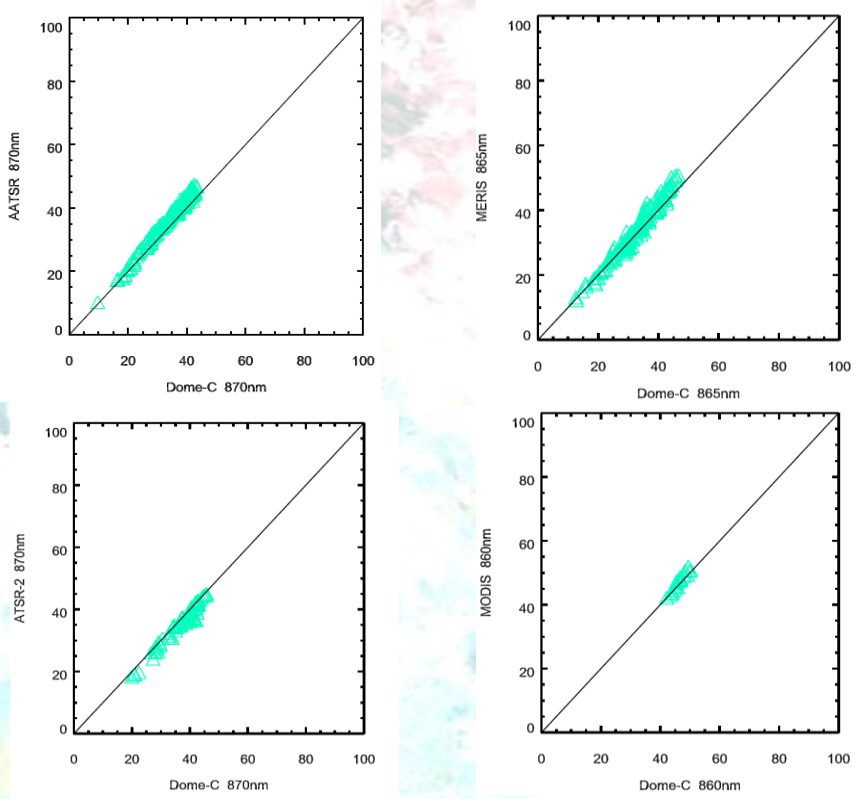
Comparisons made with 1995-2000 ATSR-2 data for same view/solar geometry

Drift correction and 1.6µm nonlinearity correction applied

Bias R_{AATSR}/R_{MERIS}

1.6µm	= 1.004	0.011
0.87µm	= 1.091	0.015
0.66µm	= 1.091	0.011
0.56µm	= 1.113	0.016

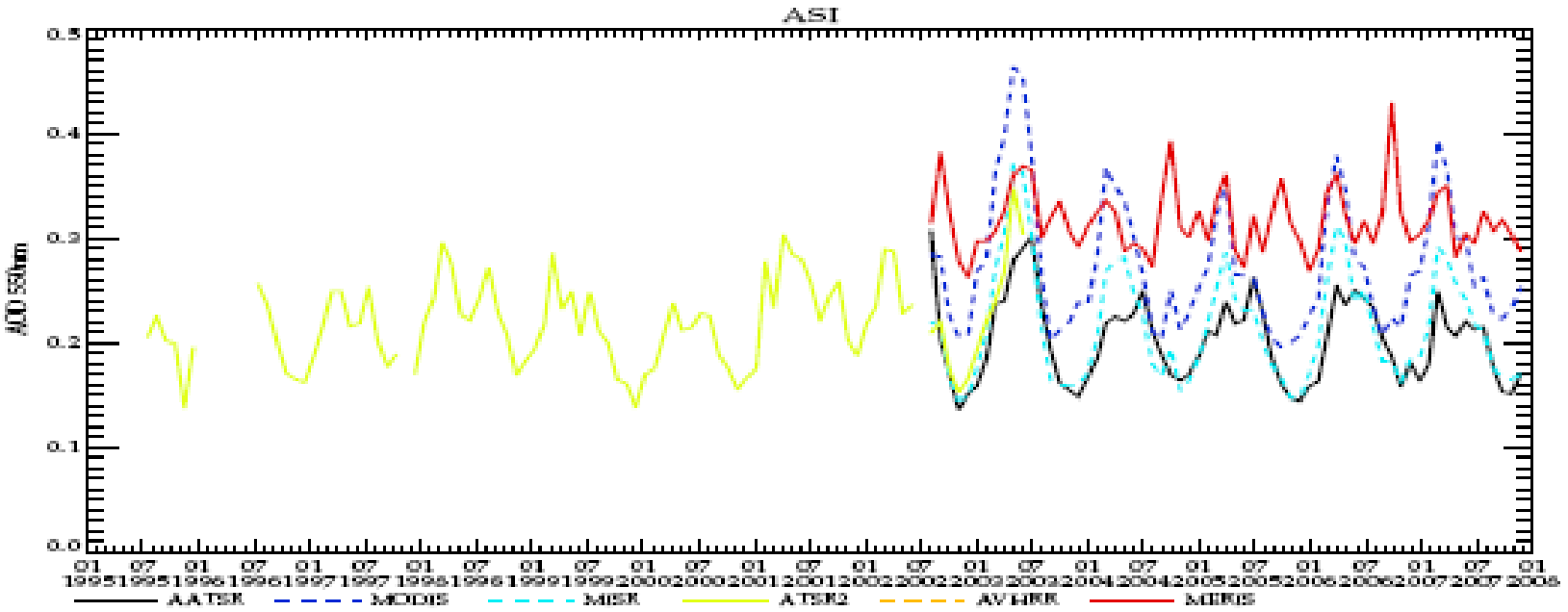
Multi-Sensor Comparisons over Stable Ice Target



Wavelength (nm)	R_{AATSR}/R_{Ref}					
	MERIS		MODIS		ATSR-2	
	Mean	Stdev	Mean	Stdev	Mean	Stdev
560	0.993	0.071	0.981	0.052	1.074	0.061
665	1.005	0.056	-	-	1.108	0.047
865	1.036	0.057	1.054	0.046	1.115	0.046
1640			Invalid	Invalid	1.008	0.489

- CEOS-IVOS intercomparison campaign over DOME-C site in progress
  - November 2008 to Feb 2009
  - Includes AATSR, MERIS, MODIS, VGT…

Why does this matter?



- **Time series of Aerosol Optical Depth over Asia derived from satellite measurements**
- **Multi-View instruments (ATSR and MISR) give good agreement – this would not be possible without on-board calibration**
- **With ATSR-2 data we have >14 years of data**

Data courtesy of GlobAerosol project