CERES FM1 – FM5 Instrument Status

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Suomi NPP/CERES FM5 Status

CERES Flight Model 5 Instrument started Normal Operations in March 2012

Sensor Performance is evaluated with ICM Calibrations using on-board sources (Blackbody – 3 times/wk, SWICS – weekly) and Solar calibrations (biweekly).

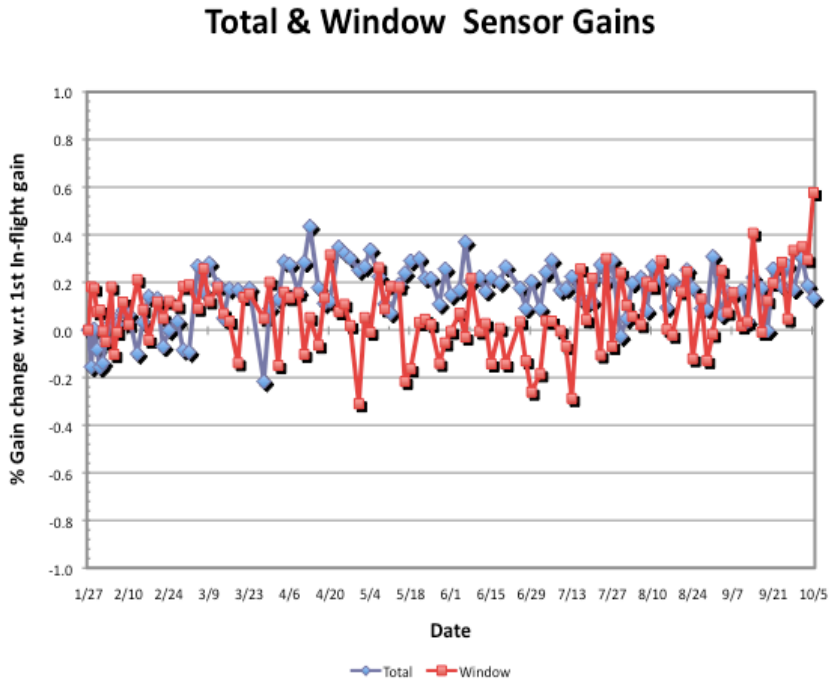
Started the generation of Edition1-CV Data Products in September 2012

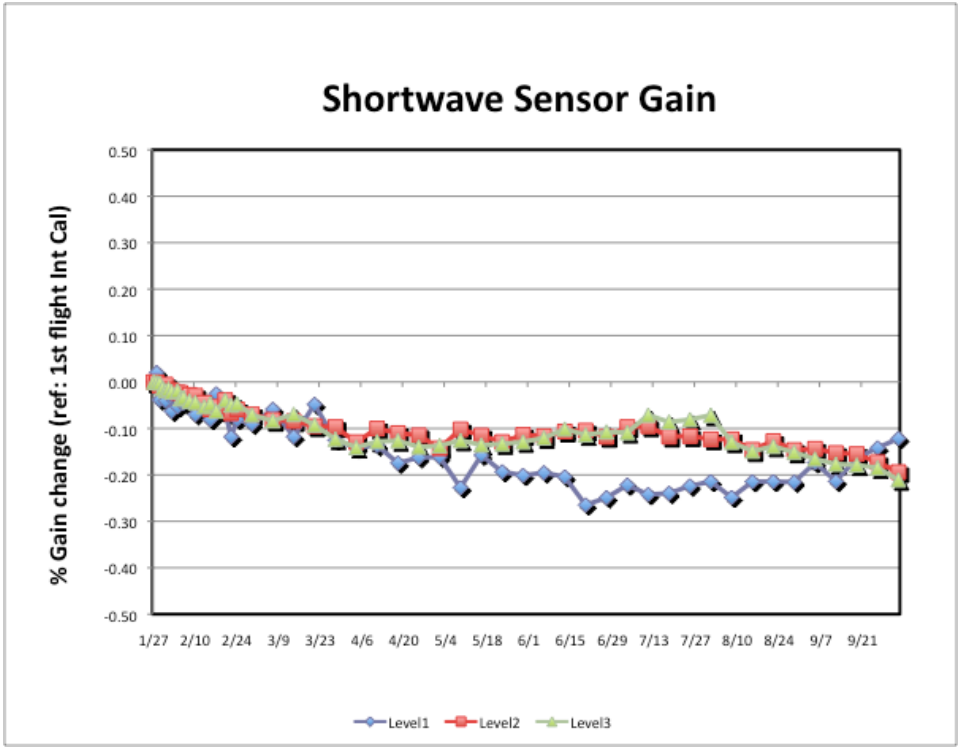
Changes in Instrument (BDS) Edition1-CV Product:

1. **Ground to Flight Sensor Gain variation**
2. **Scan Angle Offsets from Deep-space Pitch Maneuver**
3. **Second Time Constant Correction**

Suomi NPP/CERES FM5 ICM Calibrations

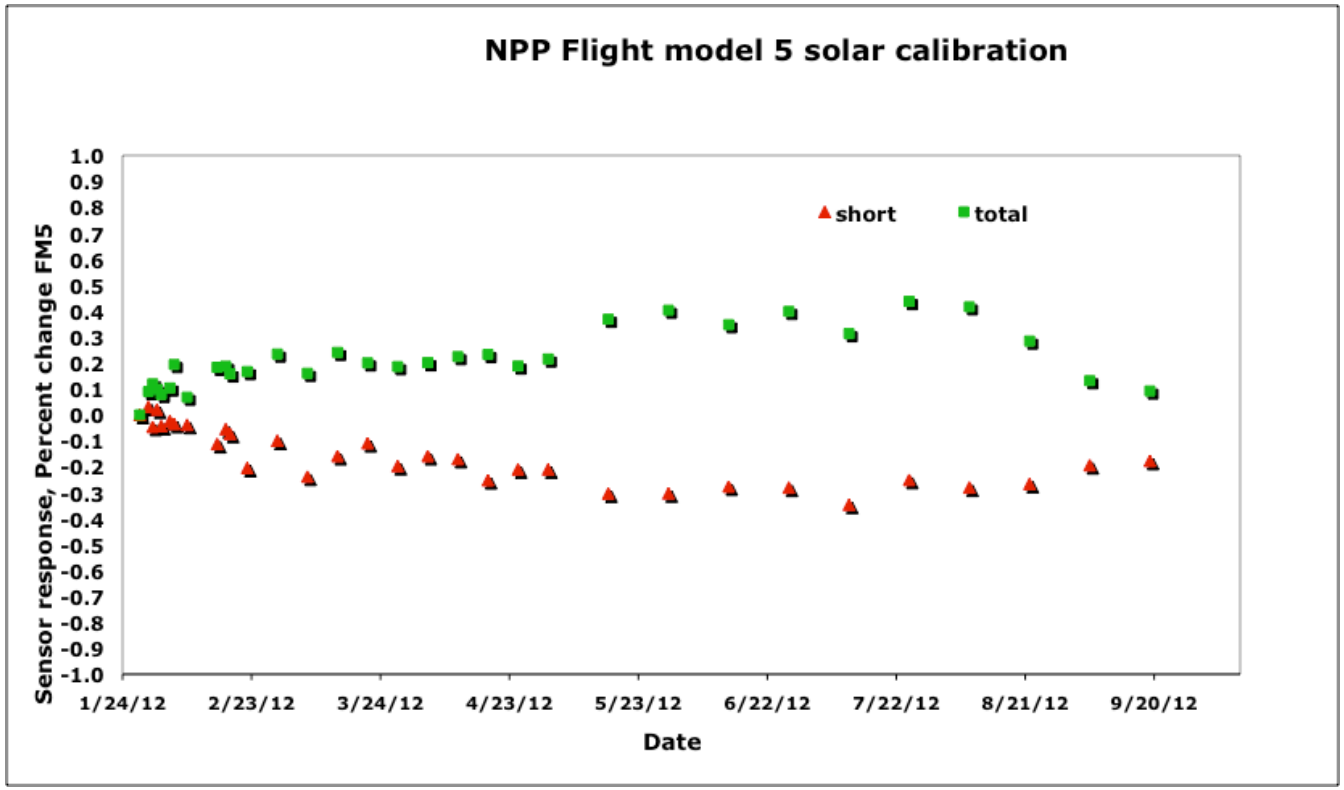
The performance of CERES sensors are within the expected range - +/- 0.5%





Suomi NPP/CERES FM5 Solar Calibrations

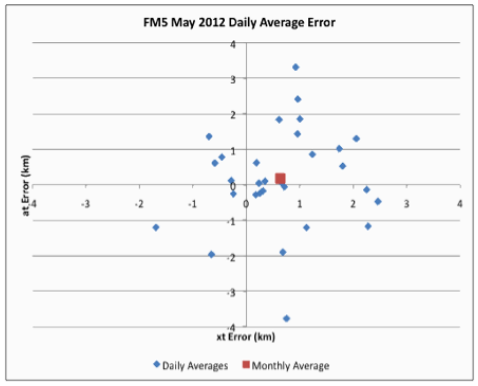
- Total and SW sensor results and the MAM performance are within the expected range of +/- 1%

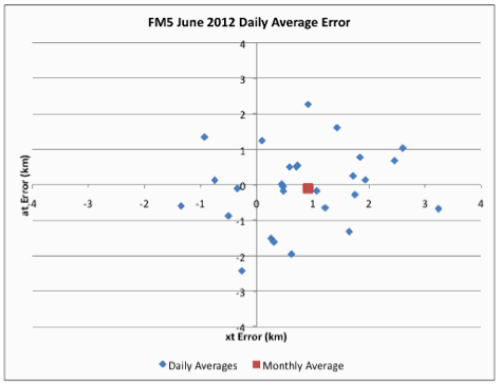


CERES FM5 Geolocation Validation

Coastline Detection Algorithm:

- Detect clear sky hot/cold radiance gradients provided by land-water boundaries (coastlines) during limb to limb scan.
- Determine corresponding geodetic coordinates at the inflection point.
- Compare with the coastline CIA map
- Calculate the along-track and cross-track errors based on calculated position of the coast and the map position.





	xt error (km)	xt 95% interval	at error (km)	at 95% interval
Feb 2012	0.26	+/- 0.77	- 0.53	+/- 0.57
Mar 2012	- 0.31	+/- 0.62	0.26	+/- 0.94
Apr 2012	0.65	+/- 0.57	- 0.22	+/- 0.87
May 2012	0.64	+/- 0.36	0.18	+/- 0.52
Jun 2012	0.92	+/- 0.47	- 0.10	+/- 0.41

CERES FM5 Validations – Flux Comparison

FM5 LW and SW Global Flux Average (Feb – June 2012) Comparison with CERES FM1 and FM3 [Edition3]

	FM5 Wm-2	FM1 Wm-2	FM5-FM1 Wm-2	FM3 Wm-2	FM5-FM3 Wm-2
LW_All	239.23	239.88	-0.65	239.9	-0.55
LW_Clear	267.71	267.01	0.70	267.18	0.52
SW_All	98.24	96.39	1.85	96.77	1.48
SW_Clear	50.99	49.55	1.43	50.26	0.72

CERES FM5 Validations

Tropical Mean: Average of All-sky tropical ocean(20°N-20°S) Radiance measurements

FM5 Radiance average for Feb - June 2012 comparison with CERES FM1 and FM3 (Edition3) Results

	FM5 Wm-2sr-1	FM1 Wm-2sr-1	FM5-FM1 Wm-2sr-1	FM3 Wm-2sr-1	FM5-FM3 Wm-2sr-1
LW-night	88.1	88.298	-0.198	88.343	-0.242
LW-Day	88.347	88.344	0.003	88.546	-0.199
SW	61.486	57.999	3.487	58.978	2.508

CERES FM5 (NPP) –FM3 (Aqua) Comparisons

- NPP and Aqua Simultaneous Observation Opportunities occur every 64 hours and last ~20 minutes with views < 1 minute apart.
- Comparison based on gridded 1^o x1^o averages with relative VZA <15 deg and RAZ < 10 deg.

All-sky Results: Feb – Aug 2012

(FM5-FM3)/ FM5	Radiance [W m^{-2} sr^{-1}]	Relative Error [%]	α-confidence	Number of samples
Shortwave	75.50	2.97	0.50	42
LW day	76.72	-1.40	0.19	42
LW night	66.60	-0.53	0.16	55

- Additional scene comparisons – Clear Ocean, Clear Land, Overcast – showed FM5 SW is measuring higher between 2 – 2.5 Wm-2sr-1.

CERES FM5 (NPP) –FM1 (Terra) Comparisons

- FM1/FM5 Minor Plane scan measurement from Jun 16–July 31, ’12.

  50 Orbits in 18 days produced the data.
- Comparison region is around 68^{o} N and duration is ~ 2.5 minutes. Time differential for comparison < 5 minutes
- Comparison based on gridded 1^{o} x1^{o} averages with relative VZA <15 deg and RAZ < 5 deg.

All-sky Results: June-July 2012

(FM5-FM1)/ FM5	Radiance [W m^{-2} sr^{-1}]	Relative Error [%]	α-confidence	Number of samples
Shortwave	84.49	0.69	0.31	46
LW day	78.82	-0.40	0.15	49

TERRA & AQUA INSTRUMENT STATUS

[CERES FM1 – FM4]

TERRA/AQUA DATA AVAILABILITY

Edition1-CV Data Products (Instrument & ERBE-like):
Start of Mission – September 2012

Edition3 Data Products (Instrument):
Start of Mission – December 2011

Edition3 Gains and Spectral Response Functions (SRF) in testing for Production Delivery: January – June, 2012

TERRA/AQUA EDITION-3 LW Trends

Validation studies for Edition3 data products have highlighted areas for further evaluation in Aqua LW-Day measurements.

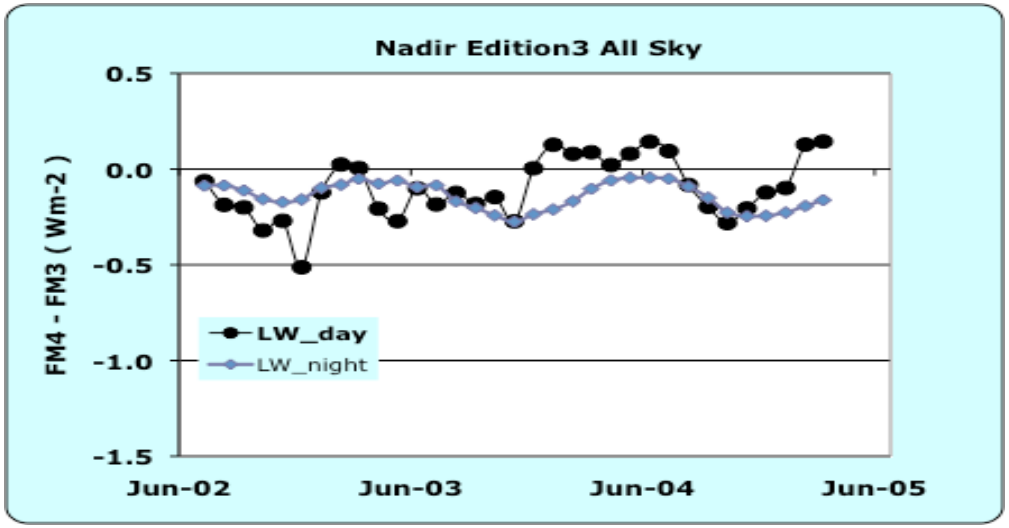
1. Dispersion in the Aqua/FM3 – FM4 LW-Day measurements between Ocean and Land Scenes.

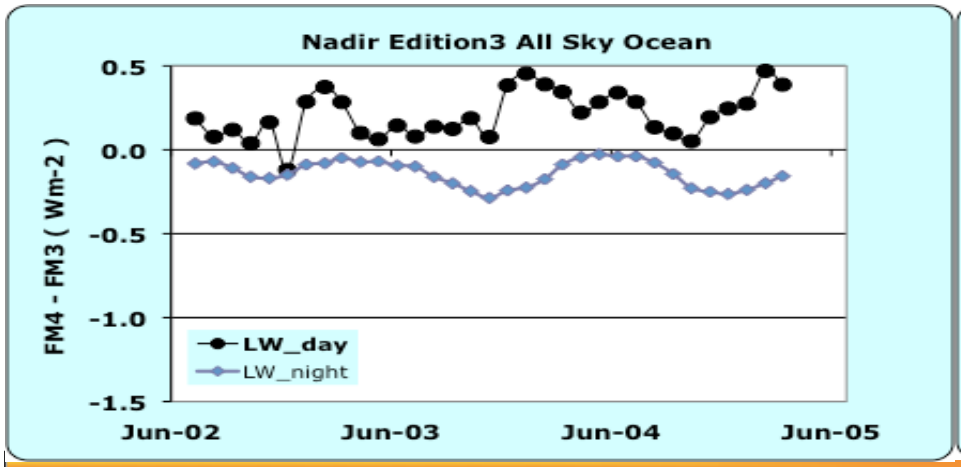
2. Trend difference for Ocean and Land scene measurements: Slope of Terra minus Aqua all-sky LW TOA Flux anomaly showed a negative trend over Land and a positive trend over Ocean regions.

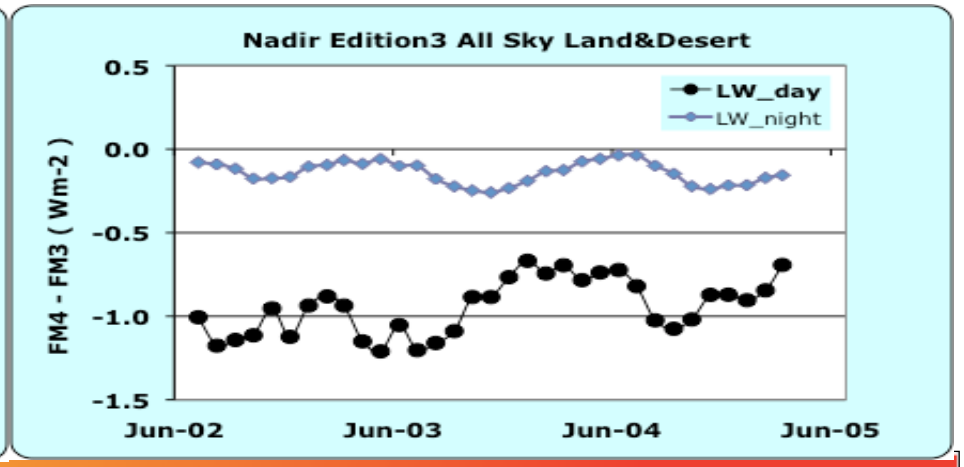
AQUA EDITION-3 LW Comparison

Aqua FM4-FM3
Direct Compare

ERBE-Like ES8
Nadir Dataset

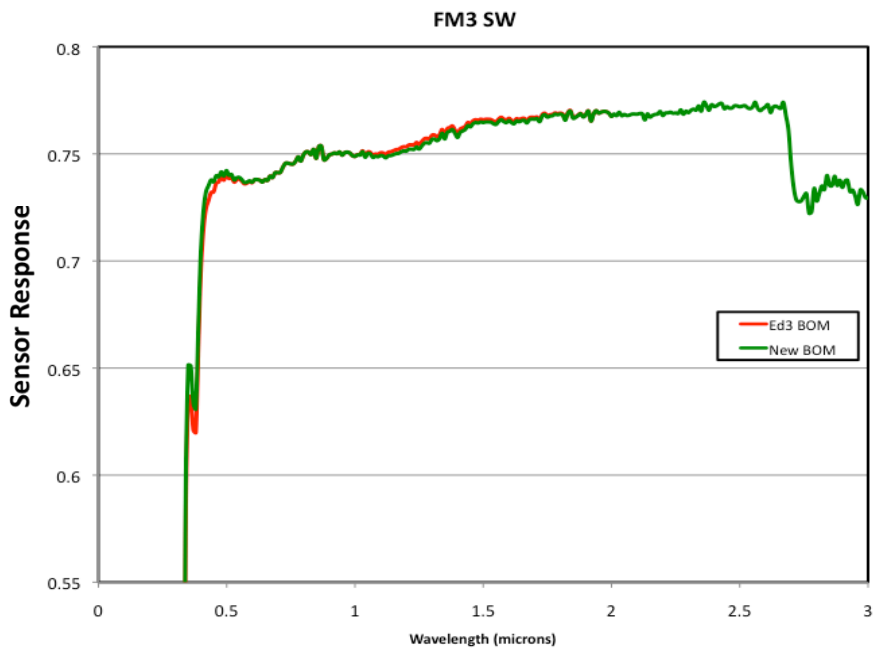


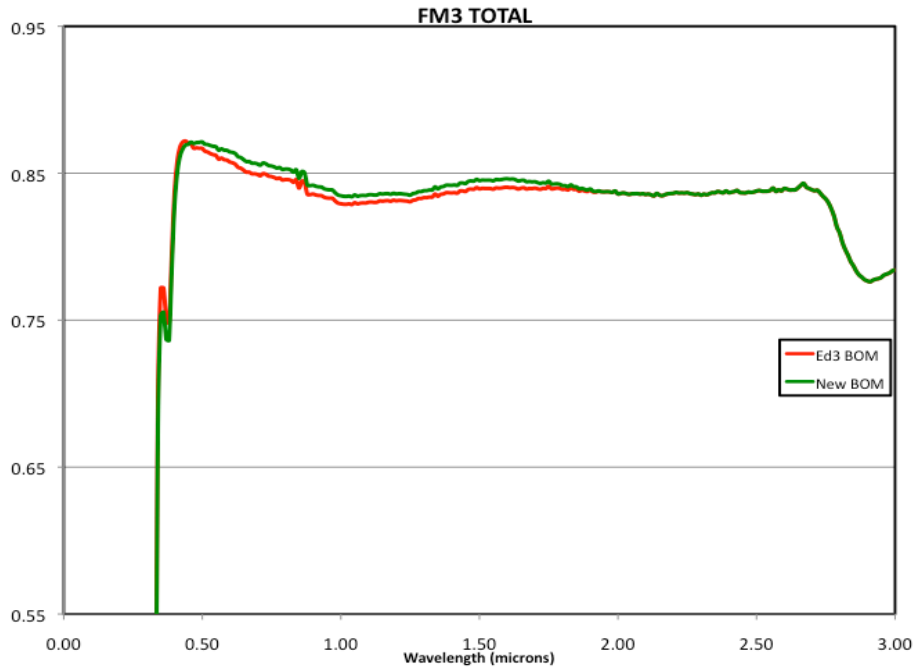




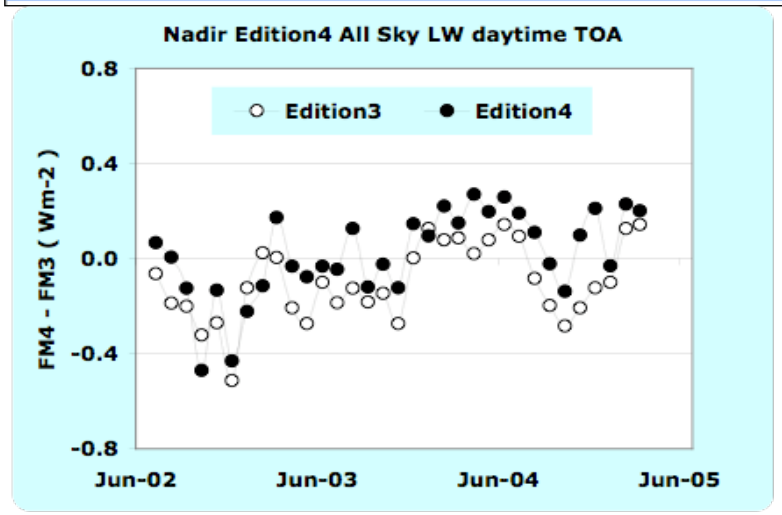
Edition-4 Efforts: AQUA Beginning-Of-Mission SRF

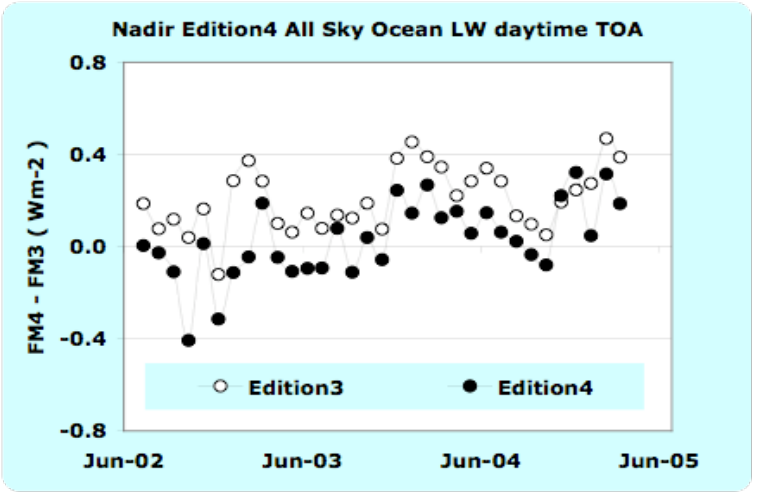
The Beginning-of-Mission (BOM) Spectral Response Functions (SRF) for SW and SW part of Total Sensor of Aqua/FM3 Instrument was revised, based on the Shortwave characterization data collected during the pre-launch testing. Radiometric adjustment to bring FM3 –FM1 to same scale was performed.

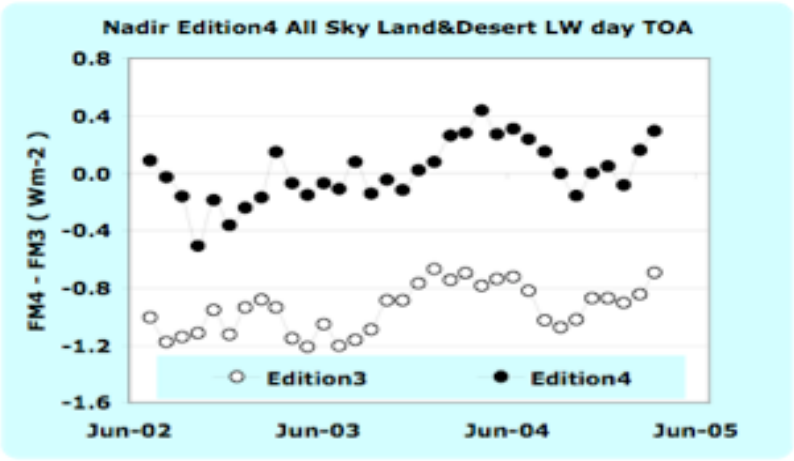




AQUA LW_Day Comparison



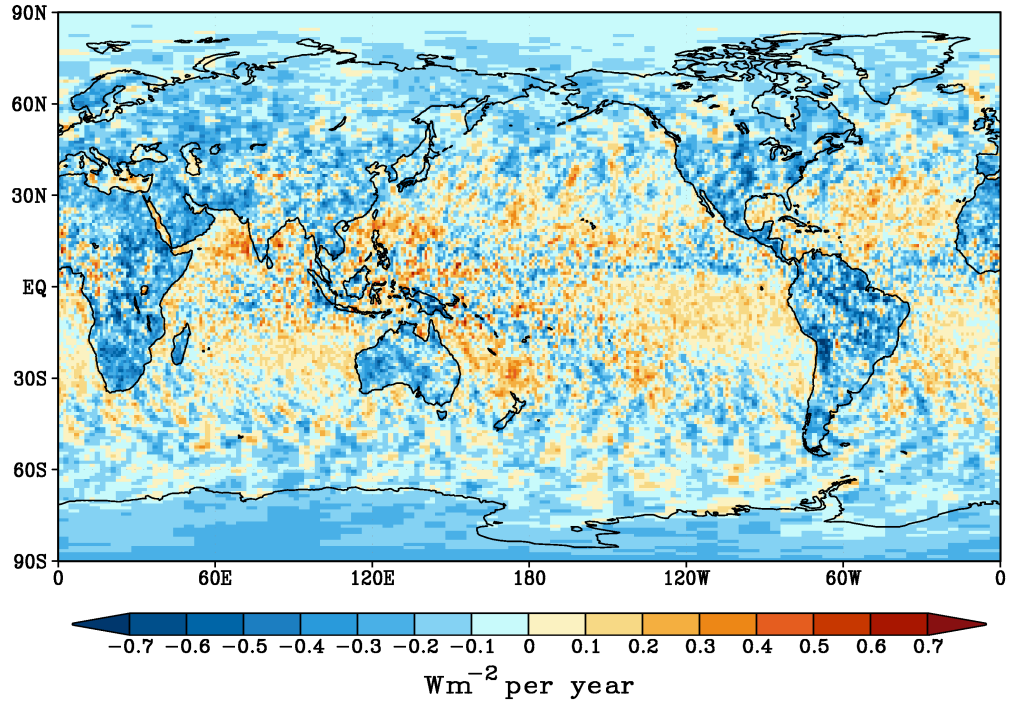




FM4-FM3 Radiance Difference Wm-2sr-1 (Jul '02)

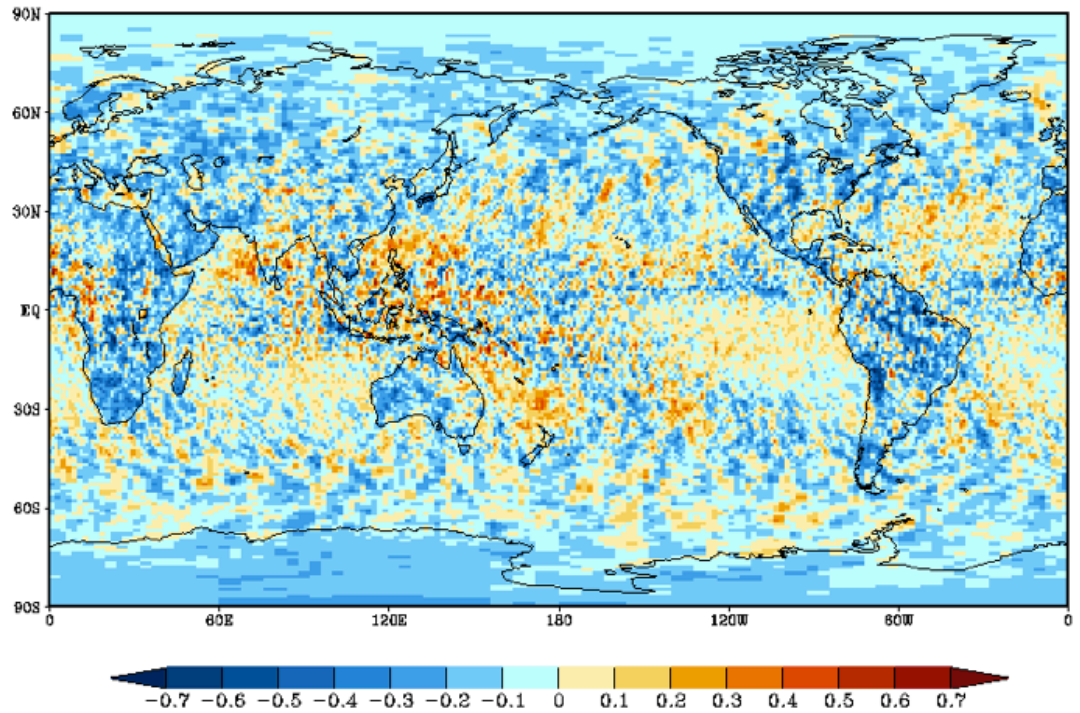
	Edition3	Ed4-Test
All-sky	-0.06	0.07
All-Ocean	0.19	0.0
All-Land	-1.01	0.09

TERRA/AQUA EDITION-3 LW Flux Anomaly



Slope of Terra minus Aqua all-sky LW TOA flux anomalies for July 2002-June 2009 from SSF1deg-lite_Ed2.5. (Units: Wm^{-2} per year)
Negative trend over the Land and a positive trend over Ocean region

TERRA/AQUA LW TOA FLUX with NEW SRF



Slope of Terra minus Aqua all-sky LW TOA flux anomalies for July 2002-June 2009 from SSF1deg-lite_Ed2.5. (Units: Wm^{-2} per year)
Improvement in the Negative trend over the Land region

CERES Terra- Aqua Comparison Campaign

CERES Terra/FM1 – Aqua/FM3

Minor plane scanning with 15 orbital crossing/day from June 1-30, 2012

Data Collected in 410 orbits for the 30-day period

Comparison region is around 68° N and duration is ~ 2.5 minutes. Time differential for comparison < 18 minutes

Comparison based on gridded 1° x1° averages with relative VZA <15 deg and RAZ < 5 deg.

All-sky Results

(FM3-FM1)/ FM3	Radiance [W m^{-2} sr^{-1}]	Relative Error [%]	α-confidence	Number of samples
Shortwave	95.55	-0.11	0.16	386
LW day	78.60	0.39	0.05	410
LW night	55.49	0.10	0.03	408

SUMMARY

- Suomi NPP/ CERES FM5 Instrument Edition1-CV Data Products were released on September 2012.
- Performance trends of FM5 instrument is within the normal range.
- CERES FM5 SW measurements are higher and LW-day measurements are lower than the corresponding FM3 and FM1 measurements.
- The scene dispersion on Aqua Edition-3 LW-day results is addressed through the Beginning of Mission SRF.
- Investigation of AQUA/TERRA Edition-3 LW-day measurement trends is on-going.