



Suomi NPP CrIS SDR Status

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Suomi NPP EDR Product Provisional Readiness Review
NOAA Center for Weather and Climate Prediction (NCWCP)
5830 University Research Park, College Park, Maryland
January 17- 18, 2013

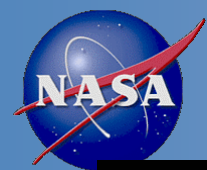




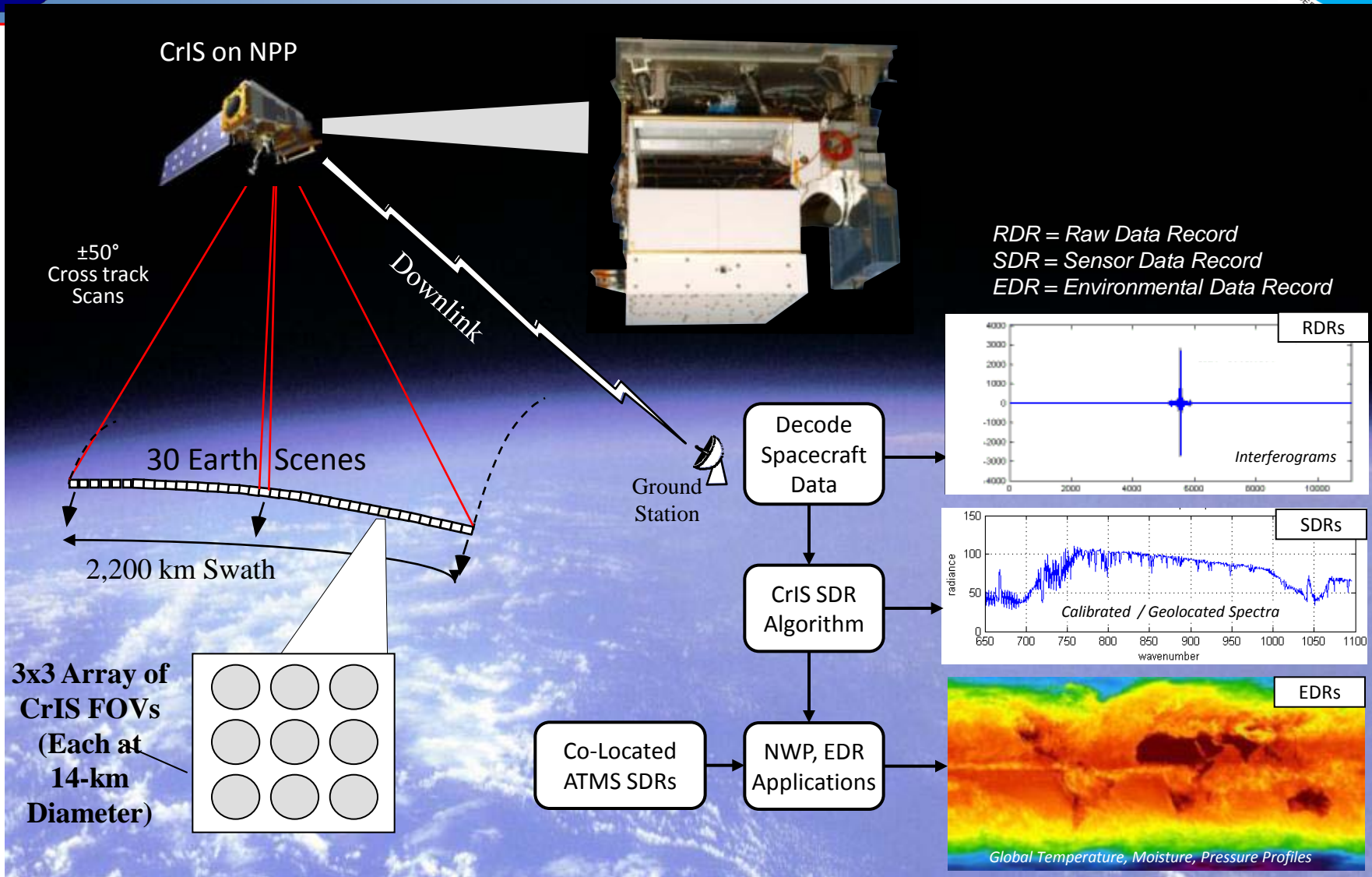
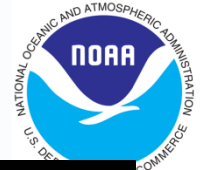
Outlines



- CrIS operational concept and SDR specification
- CrIS SDR Cal/Val milestones and events
- SDR Provisional Product highlights
- Product issues
- Summary



CrIS Operational Concept



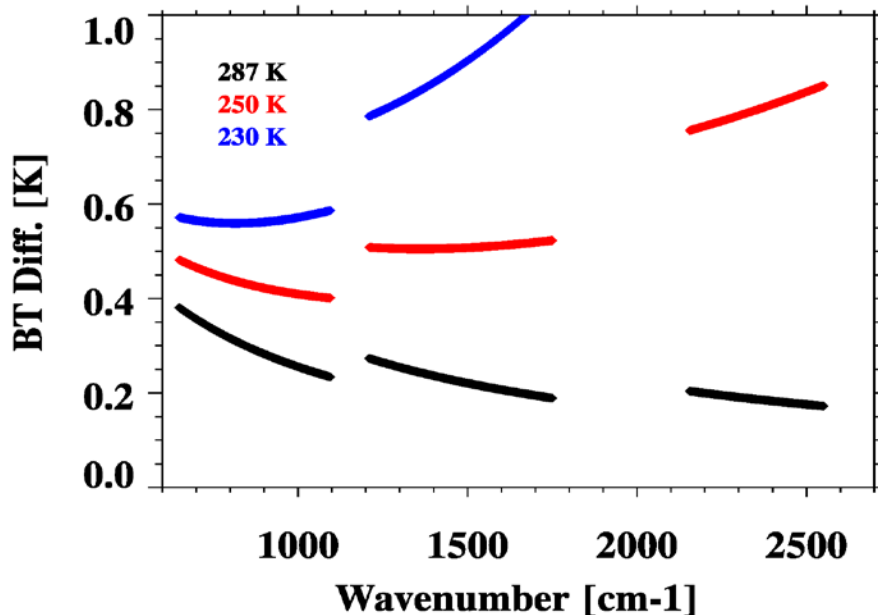


NPP CrIS Sensor Data Record Calibration Uncertainty Specifications



SDR Calibration Uncertainty

Band	Spectral range (cm ⁻¹)	N. of chan.	Resolution (cm ⁻¹)	FORs per Scan	FOVs per FOR	NEdN @287K BB mW/m ² /sr/cm ⁻¹	Radiometric Uncertainty @287K BB (%)	Spectral (chan center) uncertainty ppm	Geolocation uncertainty km
LW	650-1095	713	0.625	30	9	0.14	0.45	10	1.5
MW	1210-1750	433	1.25	30	9	0.06	0.58	10	1.5
SW	2155-2550	159	2.5	30	9	0.007	0.77	10	1.5



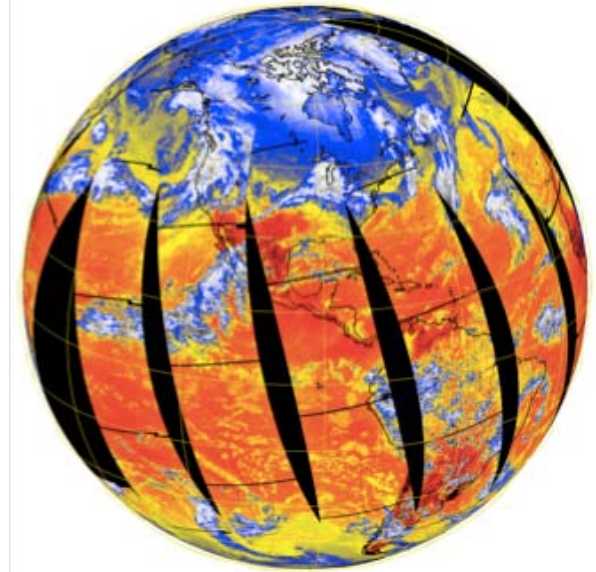
Radiometric uncertainty specification converted to that expressed in brightness temperature



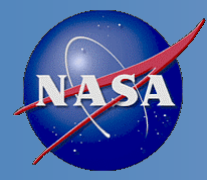
CalVal Milestones and Events



- January 18th 2012: CrIS was powered up; team started instrument checkout and optimization.
- February 8th : Engineering packet v32 was uploaded (PGA setting and bit trim mask updates).
- February 22nd : Full spectral resolution RDRs (0.8 cm maxOPD for all bands) were collected.
- April 11th : Engineering packet v33 was upload (spectral calibration parameters, nonlinearity coefficients and ICT emissivity table updates).
- April 18th: A new FIR digital filter was uploaded to replace the corrupted one.
- **May 15th : CrIS SDR product reached Beta maturity level .**
- June 27th: Engineering packet v34 was uploaded (temperature drift limit updates)
- **Product provisional review: October 23, 2012**
- Validated product: 2013



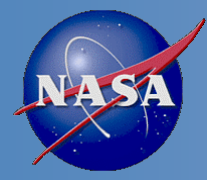
Jan. 25: First light image, 900 cm⁻¹ BT
20-Jan-2012 12:54 to 23:57 UTC from
CCAST SDR processing system,
UW/UMBC



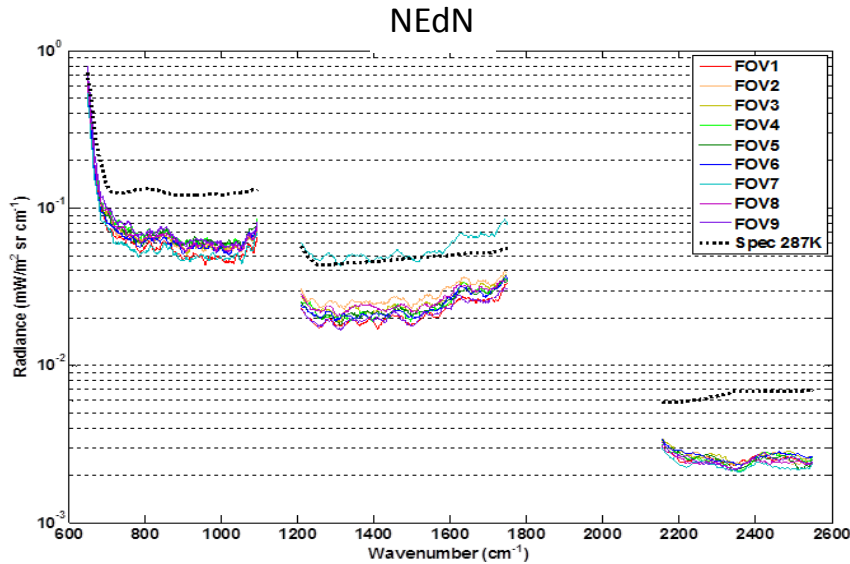
CrIS SDR Highlights



- Instrument noise (NEdN)
- Spectral calibration and uncertainty
- Radiometric calibration and uncertainty
- Accuracy assessment with RTM and inter-sensor comparisons
- Geolocation calibration and uncertainty
- SDR quality flag improvement

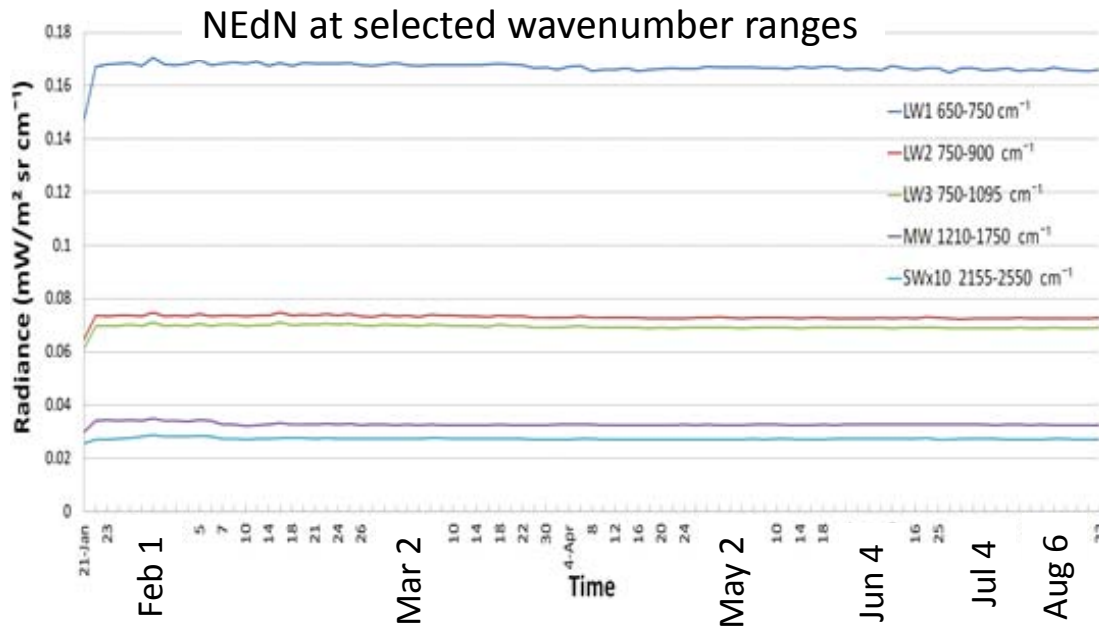


NEdN



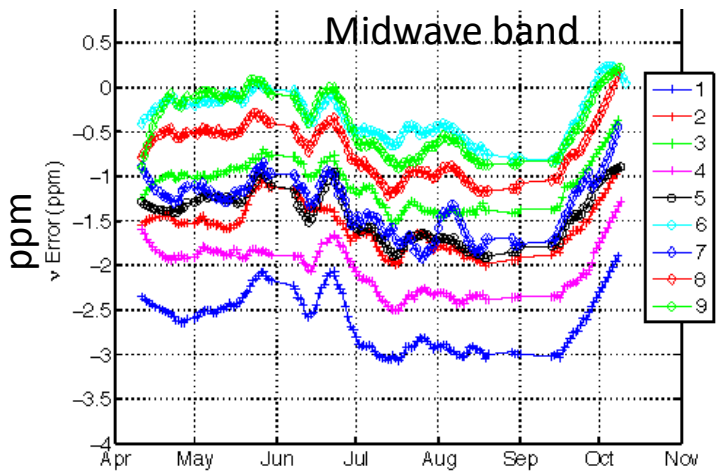
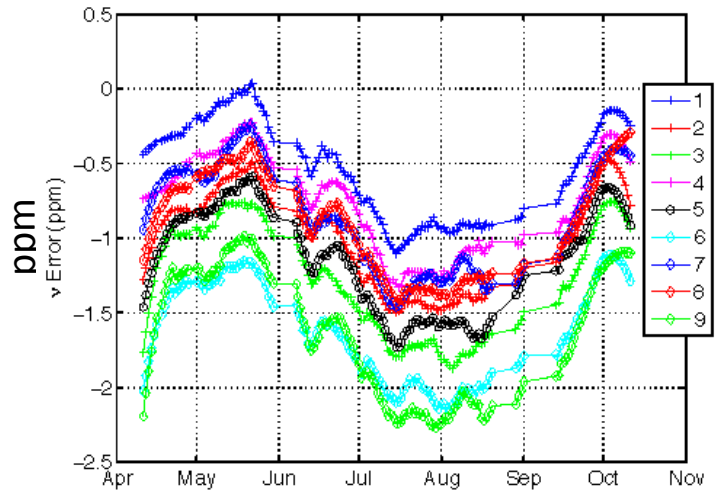
The noise levels are much better than the specification

The large NEdN at MW FOV 7 is a known issue before NPP launch

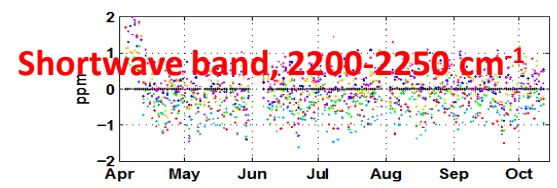
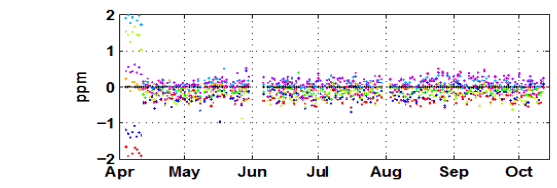
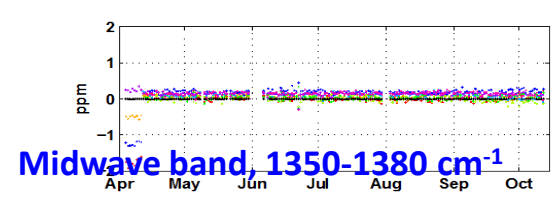
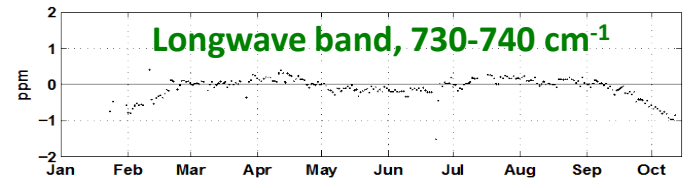


Stable NEdN over 8 months

Spectral shifts assessed with RTM



Inter-FOV spectral shifts relative to FOV5 derived from correlation analysis

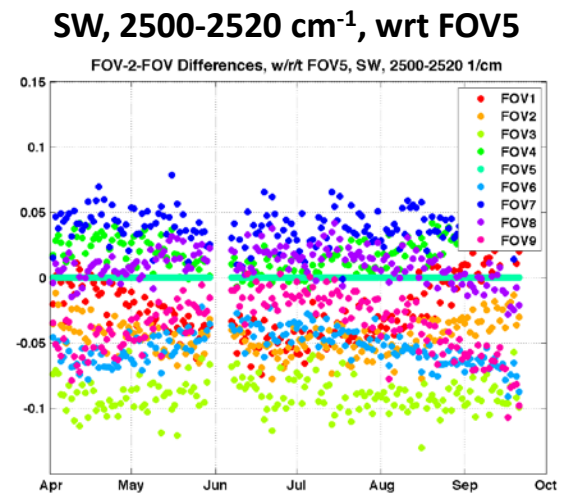
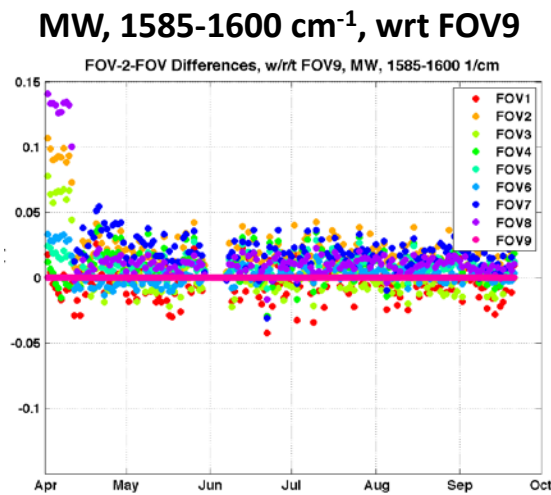
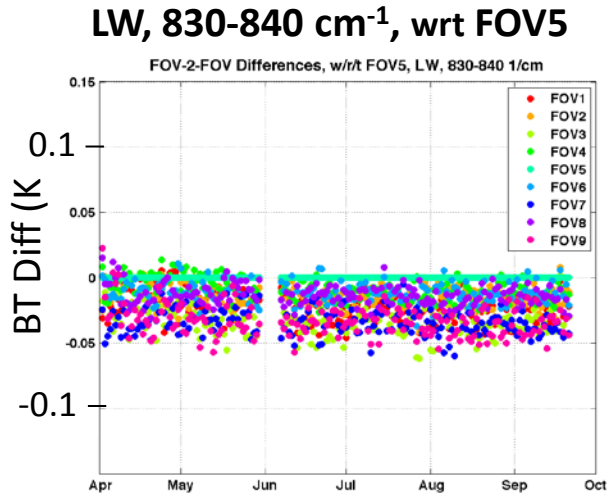
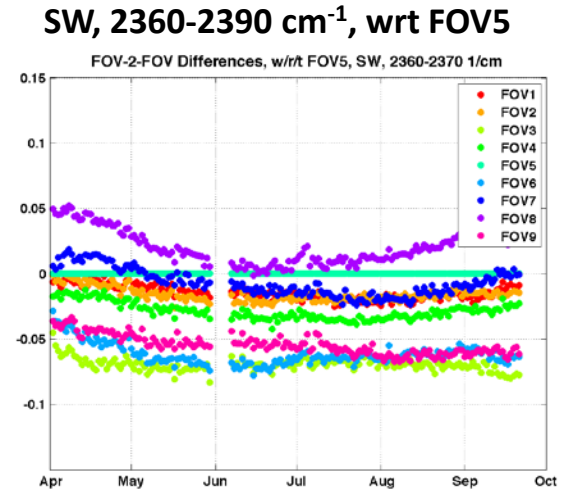
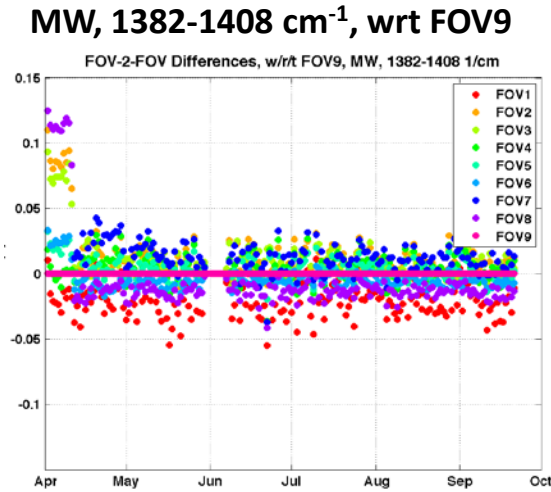
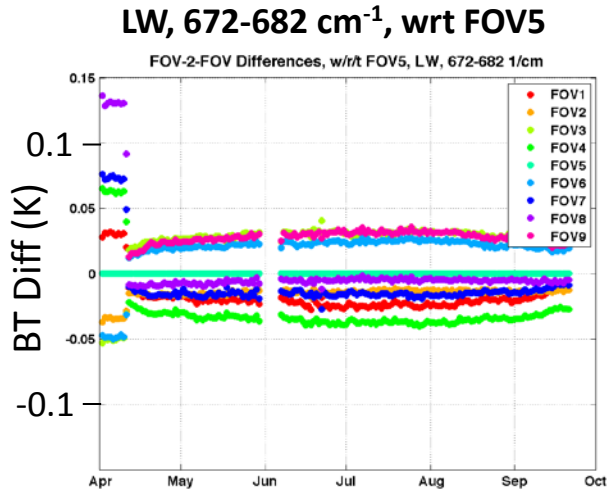


LW & MW band frequency uncertainty < 3 ppm (specification 10 ppm)
 SW band frequency uncertainty relative to FOV5 < 3 ppm



Radiometric Uncertainty Assessment

Inter-FOV difference

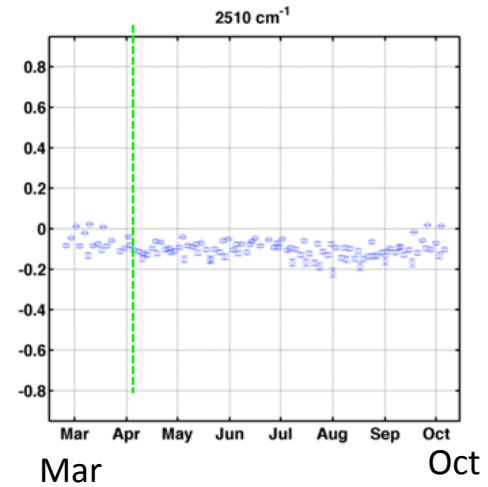
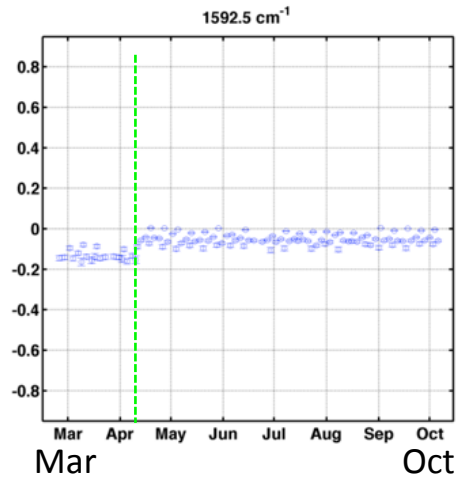
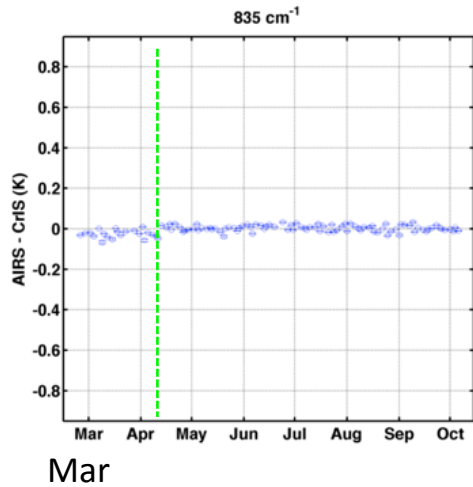
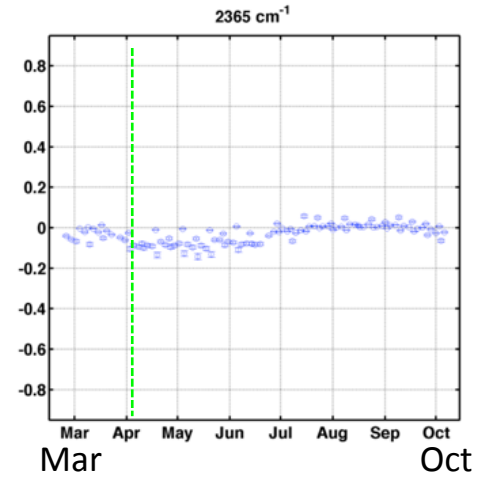
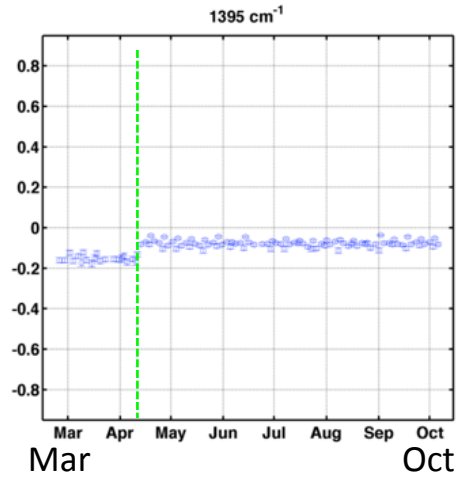
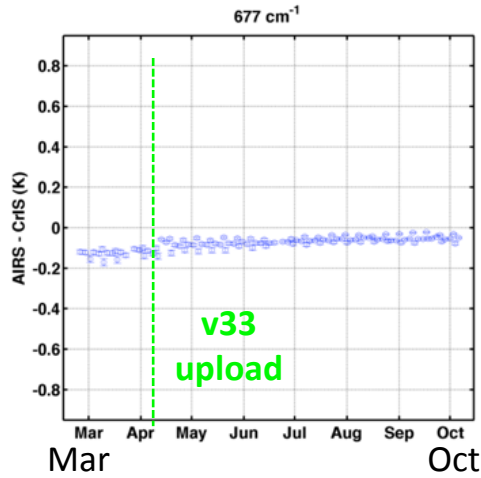


FOV-2-FOV differences are less than 0.04 K for LW and MW and less than 0.1 K for SW



Radiometric Uncertainty Assessment

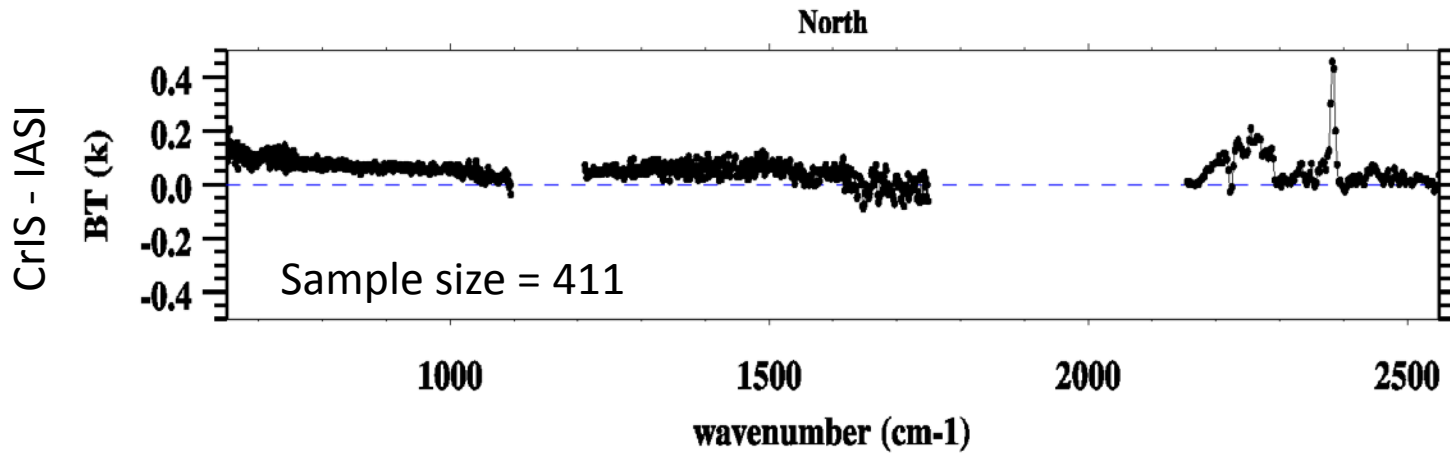
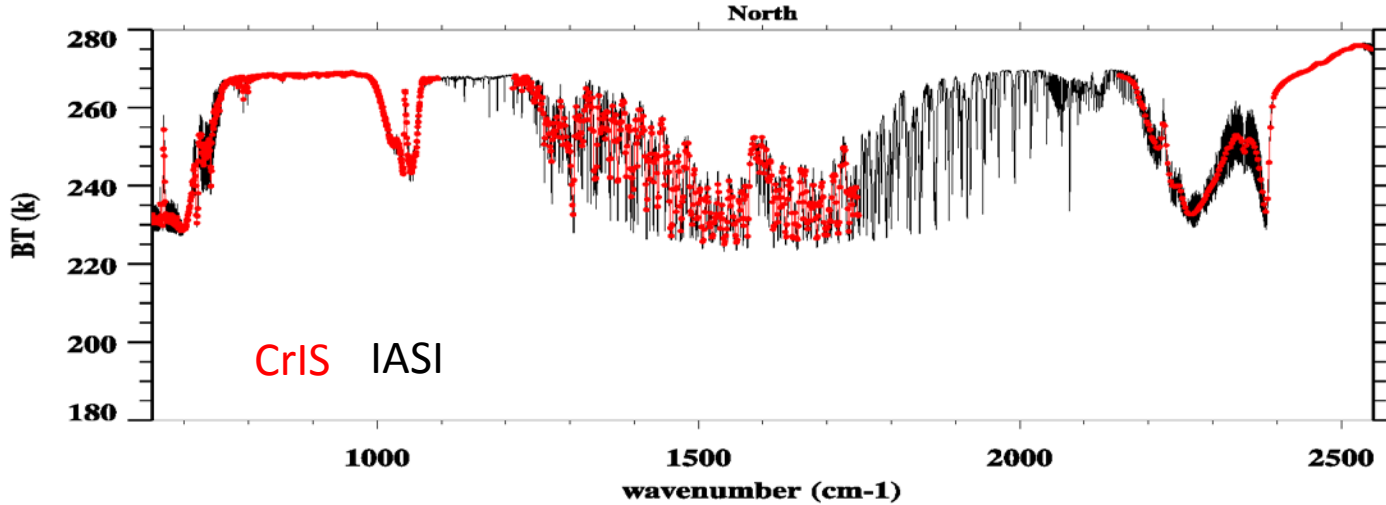
Daily Mean CrIS-AIRS Differences



Stable difference ~ 0.1 K



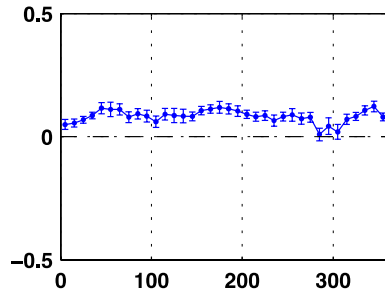
Radiometric Uncertainty Assessment CrIS-IASI SNO (North Pole)



The CrIS IASI difference is ~ 0.2 K



Radiometric Uncertainty Assessment CrIS/VIIRS (M13 4um) comparisons

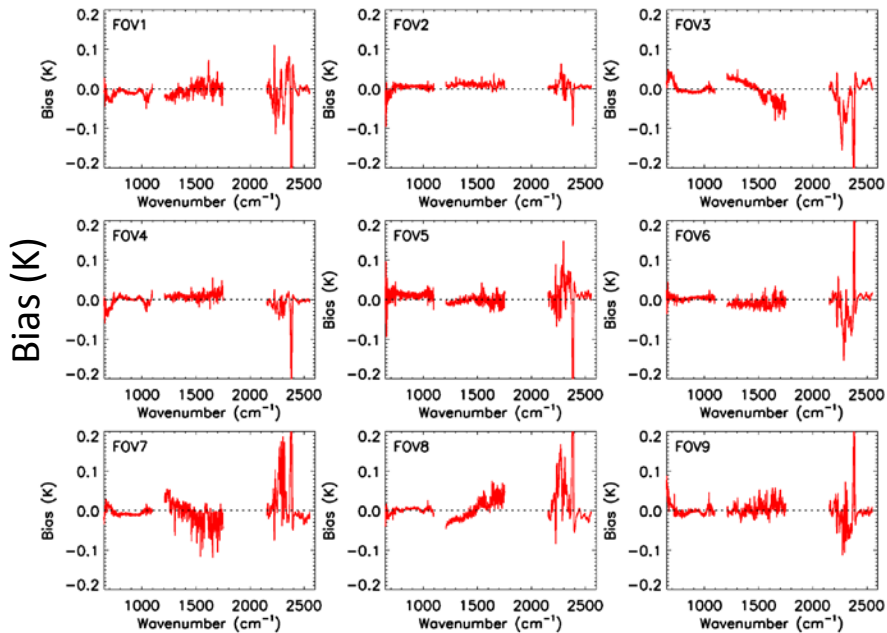


Difference is less than 0.2 K

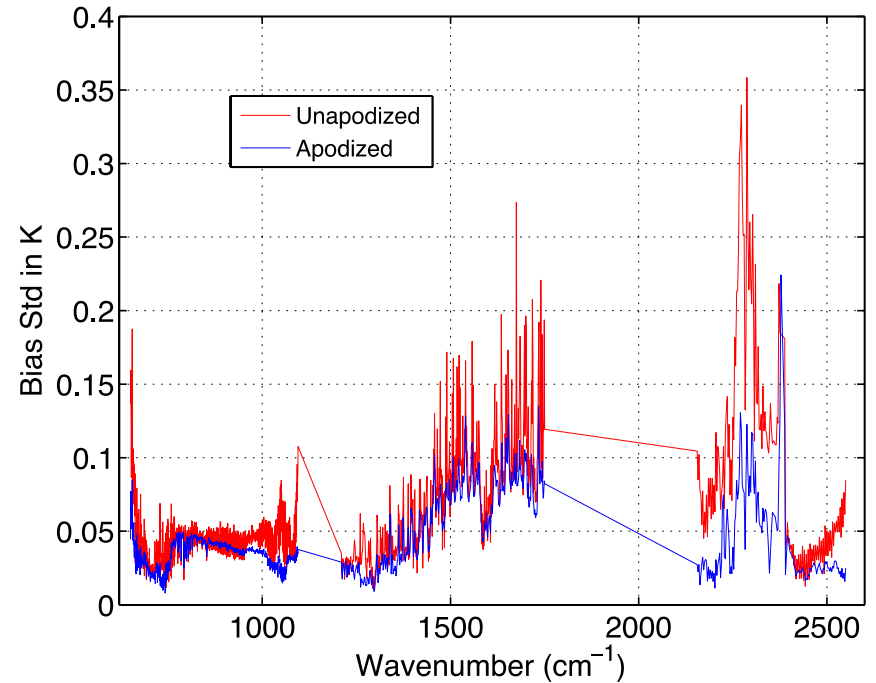
Radiometric Uncertainty Assessment

Radiance Bias Estimated with RTM

Standard deviations of Biases vs Radiative Transfer Model (RTM) simulated radiances



Standard deviation (over 9-FOVs) of Bias vs RTM simulated radiances



Overall bias < 0.2 K
FOV-2-FOV differences < 0.1 K

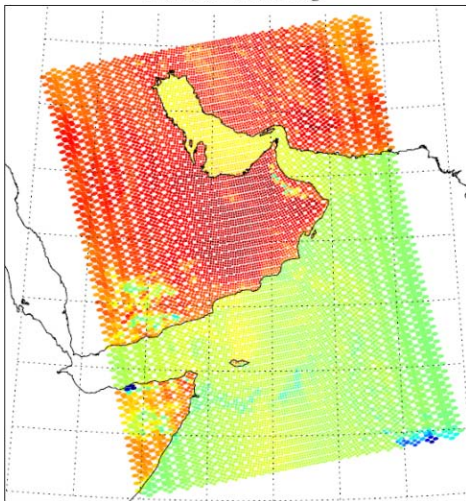
Geolocation uncertainty within 30° scan angles < 1 km (specification 1.5 km)

VIIRS geolocation uncertainty

	Bias (m)	RMSE (m)
Track	-21	80
Scan	-8	64

CrIS image

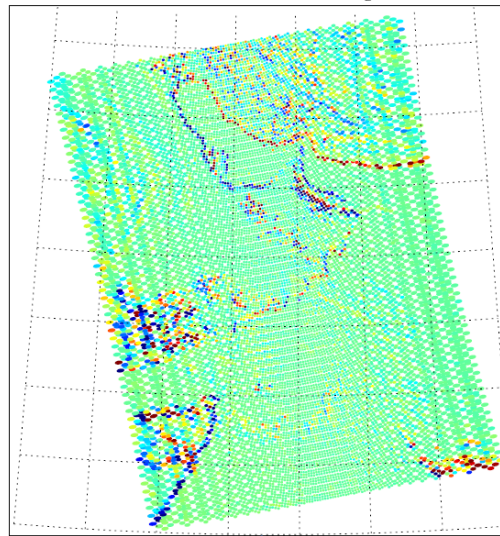
20120920.ADA CrIS Image



IDPS MX6.2

4.5 km geolocation error

20120920.IJPS CrIS-VIIRS Image



IDPS MX6.3

20120920.ADA CrIS-VIIRS Image

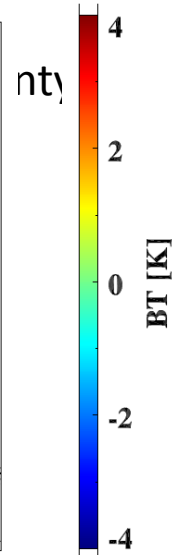
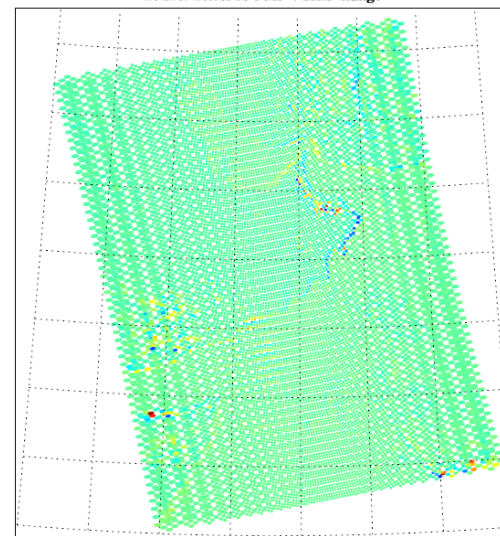


Image differences (CrIS – VIIRS) before and after a coding error fix

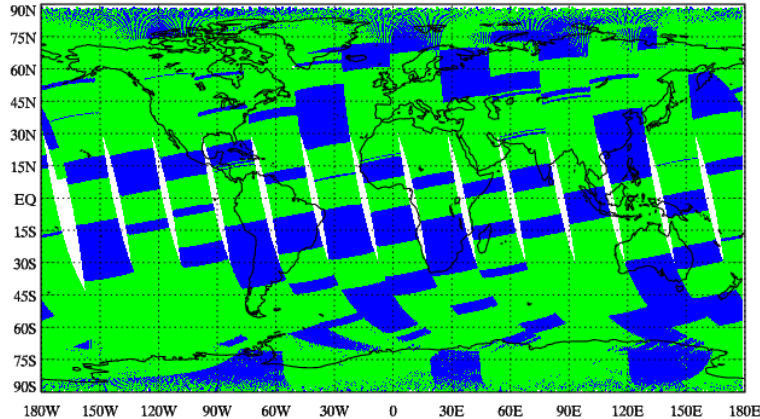


Overall Quality Flag Improvement



Beta product

Ascending_orbits: LW SDR_Quality Date: 2012-04-27
(Blue: Good; Green: Degraded; Red: Invalid)



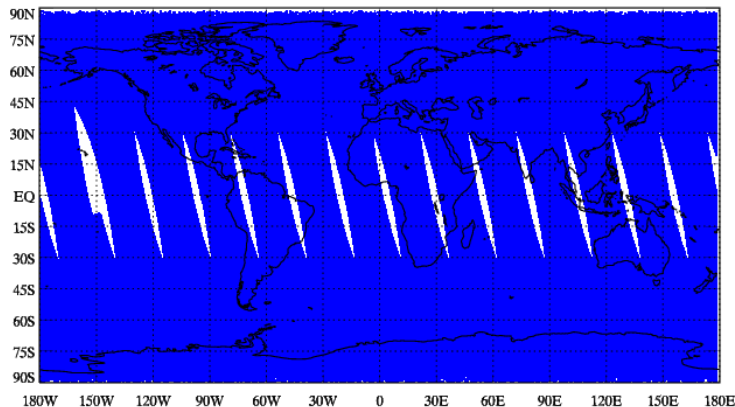
Quality flag:

Blue color – GOOD

Green color - DEGRADED

A false alarm (data labeled as Degraded) was fixed with code changes and parameter updates

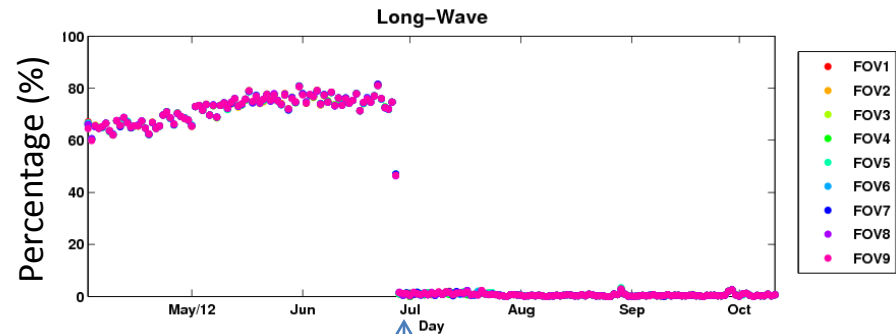
Ascending_orbits: LW SDR_Quality Date: 2013-01-12
(Blue: Good; Green: Degraded; Red: Invalid)



Current product

Daily Occurrence: Degraded SensorDataRecord

Created at 10/11/2012 – 15:18:34 UTC



Engineering packet v34 uploaded



Issues



- Software issues and IDPS SDR anomaly are still occurring
- Significant SW cold scene FOV differences
- Spectral ringing



Summary



- CrIS SDR has reached the Provisional maturity level
- All critical DRs and document issues have been addressed
- A number of CalVal and software issues have been identified and will be addressed for the Validated product
- The team has a clear path moving forward for both NPP and J1 missions

Calibration type	Meet Specification		
	LW band	MW band	SW band
NEdN	✓	✓	✓
Radiometric calibration	✓	✓	✓
Spectral calibration	✓	✓	✓*
Geolocation	✓**	✓**	✓**

* Relative to FOV5

** Within 30° scan angles