IASI on MetOp-B
Status after 3 months of L1 Cal/Val

E. Péquignot[1], L. Buffet[1], J. Chinaud[1], S. Gaugain[1], E. Jacquette[1], D. Jouglet[1], V. Lonjou[1], C. Larigauderie[1], C. Villaret[1], J. Donnadille[2], B. Tournier[2], C. Baque[3]

[1]Centre National d'Etudes Spatiales (CNES)
[2]Noveltis (Toulouse)
[3]AKKA (Toulouse)

3rd IASI conference, 4-8 February 2013, Hyères, France

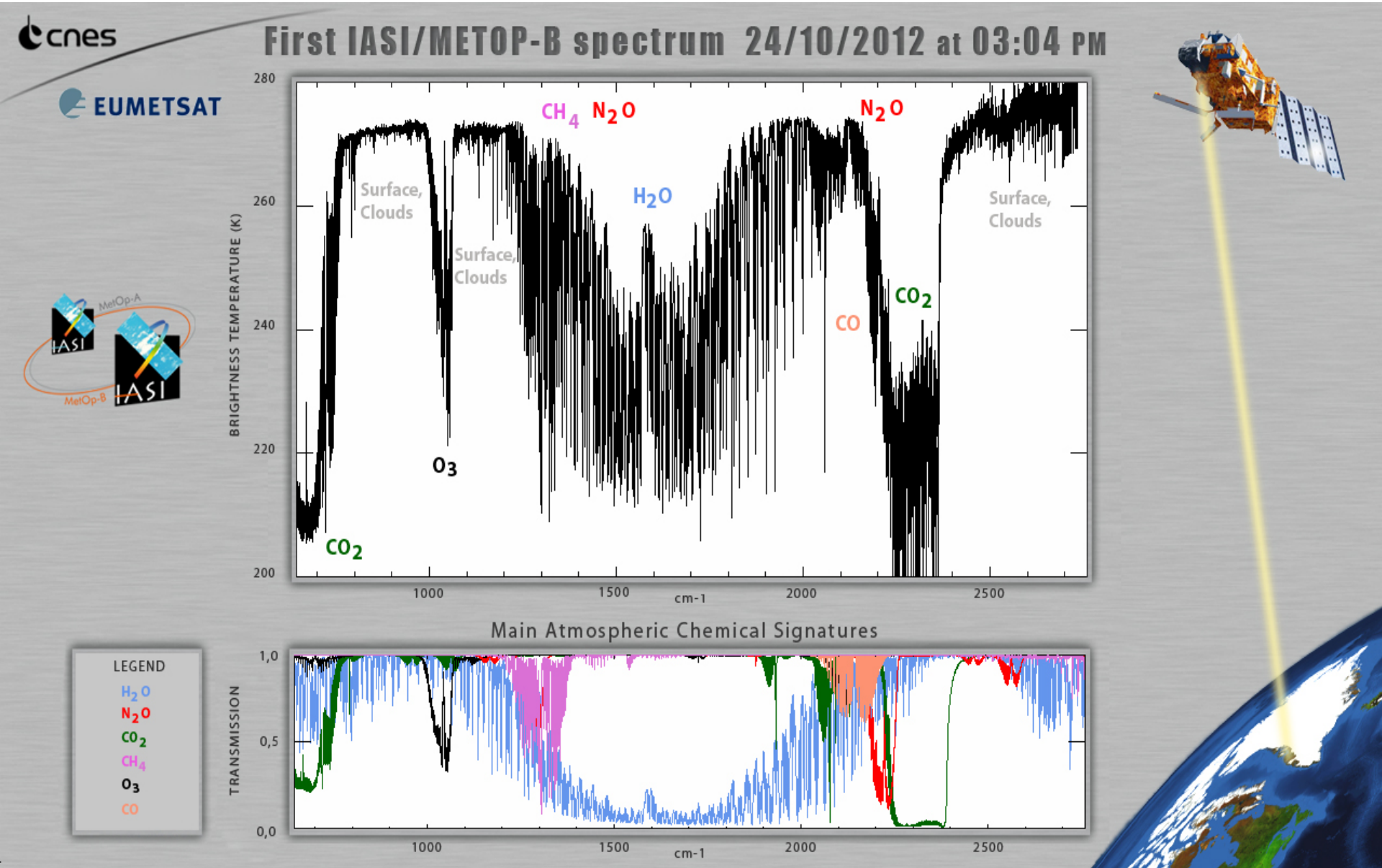
OUTLINE

- **Introduction**
- Instrumental artifacts removal
- Sounder performances
- Intercalibration
- Conclusions

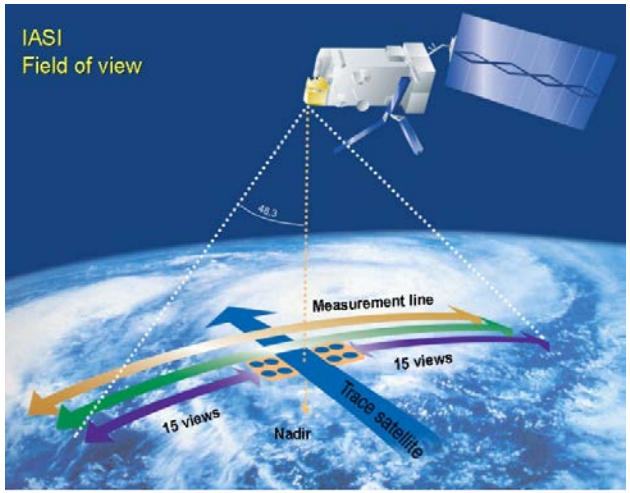
Key dates

- MetOp-B launch: 17th Sept 2012
- IASI first interferograms (start of L1 Cal/Val): 23th Oct 2012
- IASI first L0 spectra (computed on-board): 24th Oct 2012
- IASI first L1 spectra (calibrated on ground): 25th Oct 2012
- Last configuration update before IASI-B L1C trial dissemination:
  - On-board: 10th Jan 2013
  - Ground: 14th Jan 2013
- IASI-B L1C trial dissemination (Cal/Val partners) in Near Real Time: 22th Jan 2013
- IASI-B L1C trial dissemination (member states) in Near Real Time: 5th Feb 2013

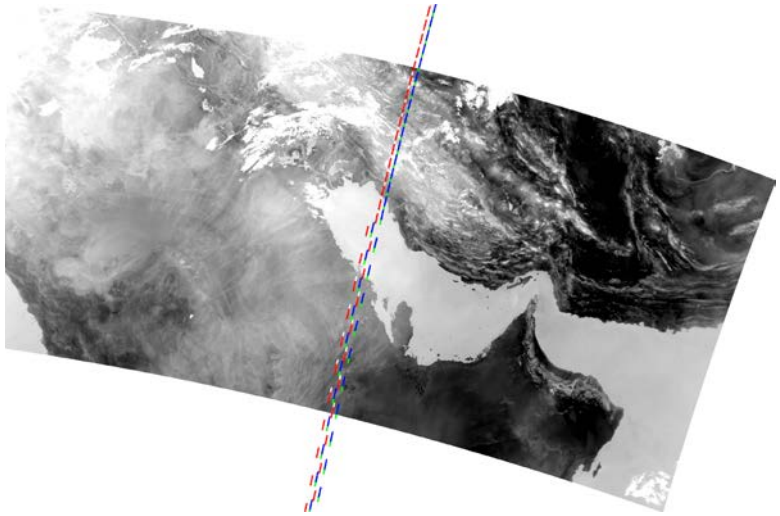
First IASI-B spectrum (24th October 2012)



IASI: 2 operational modes



- Normal Operation Mode
  - Scanning the swath
  - 30 Earth views / 8 s



(here quasi-nadir looking)

- External Calibration Mode
  - Fixed viewing direction: Earth, Hot Blackbody, 2 Cold Spaces, Back of the scan mirror)
  - 27 views / 8 s
- On-board programming

Space & Ground segments: algorithms and configuration tuning

The IASI L1 Cal/Val Plan describes the process, methods and data

- To obtain the ultimate performances of L1 IASI products (calibration),
- To demonstrate these performances (validation) during flight operations

General goal of the Level 1 Cal/Val activities is to ensure that

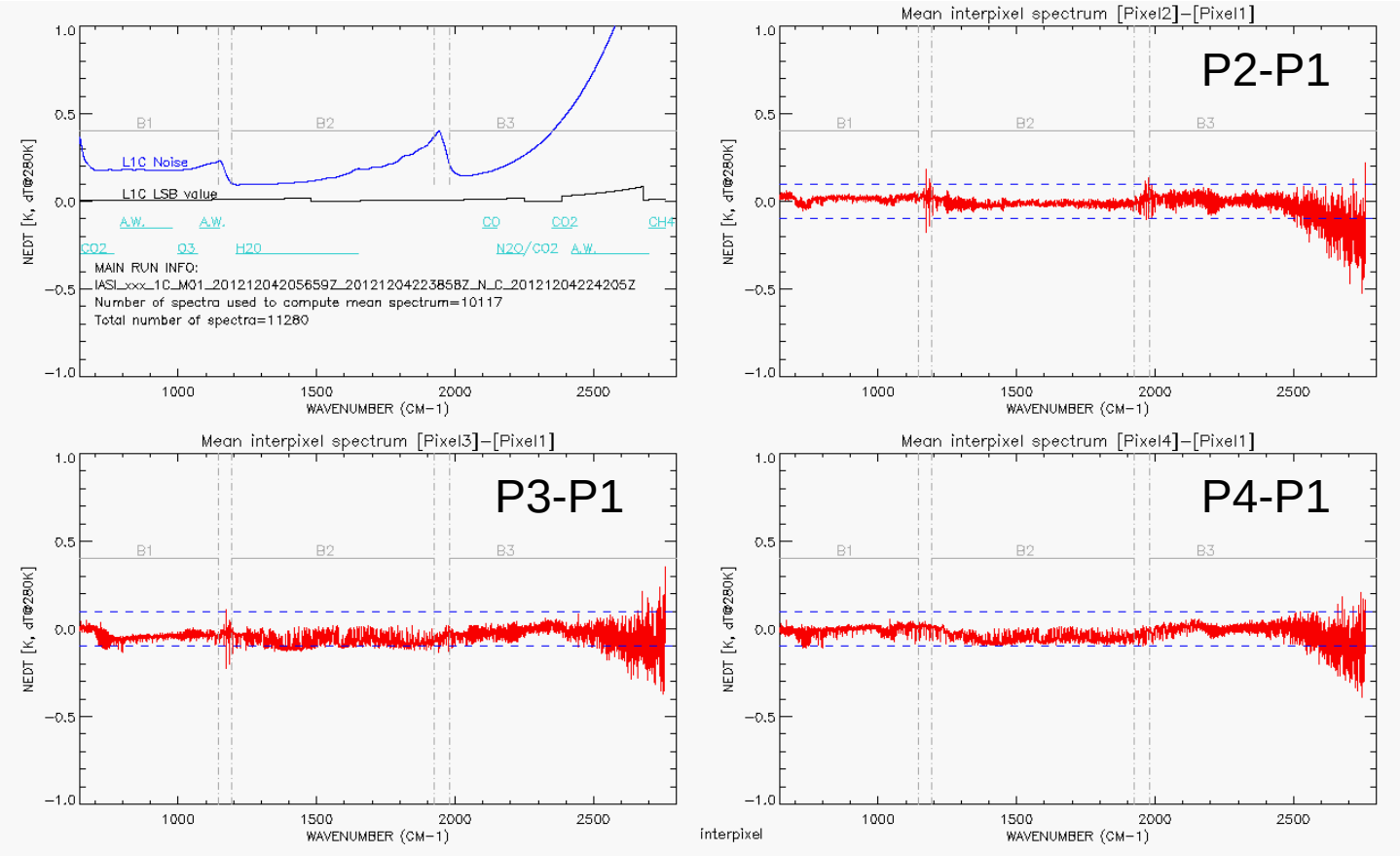
- The IASI Level 1 products are compliant with their specifications
  - ✦ radiometric (absolute & noise), spectral and geometric performances
- All instrumental potential artifacts have been removed at user level product (L1C)

In-flight Cal/Val activities broken in 2 main successive phases

- The second phase has started after the L1C “trial dissemination”
- The level of accuracy of the validation and diversity of the conditions in which the validations are performed increase with time

- Introduction
- **Instrumental artifacts removal**
- Sounder performances
- Intercalibration
- Conclusions

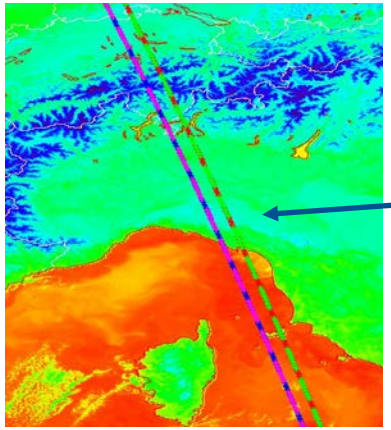
Interpixel radiometric calibration at L1C (Obs-Obs)



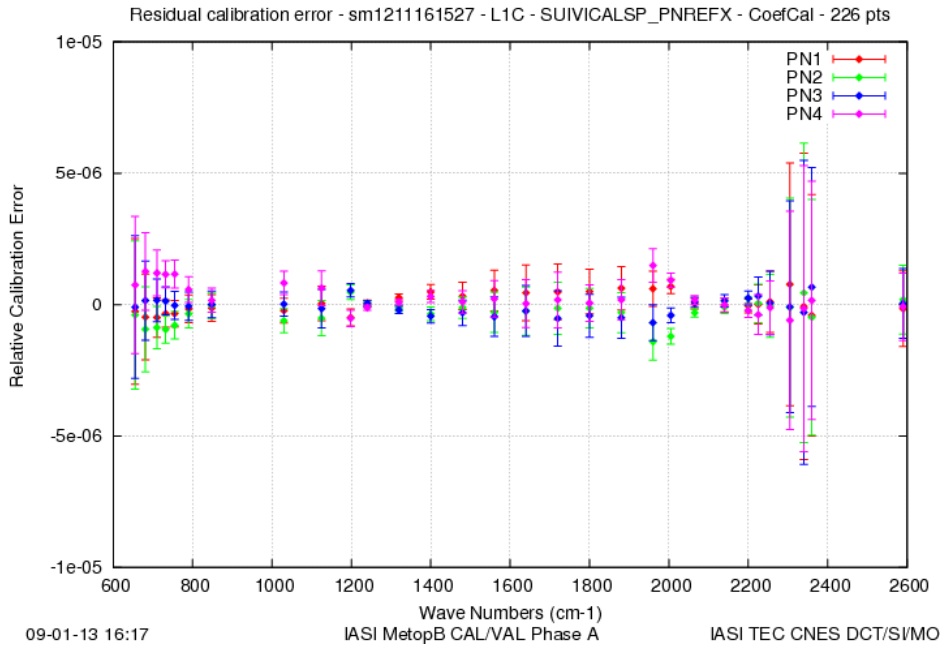
- Radiometric interpixel at L1C is better than 0.1 K -> at L1C all pixels are radiometrically independent -> on-board calibration & on-ground post-calibration work perfectly
- Still effects in the interbands. The limits will be optimized in phase B.

See Jordi Chinaud's presentation for more details

Interpixel spectral calibration at L1C (Obs - Obs)



- IASI-B in ExtCal “EW”
- Soundings oversampling of 1.5 km, only nadir viewing

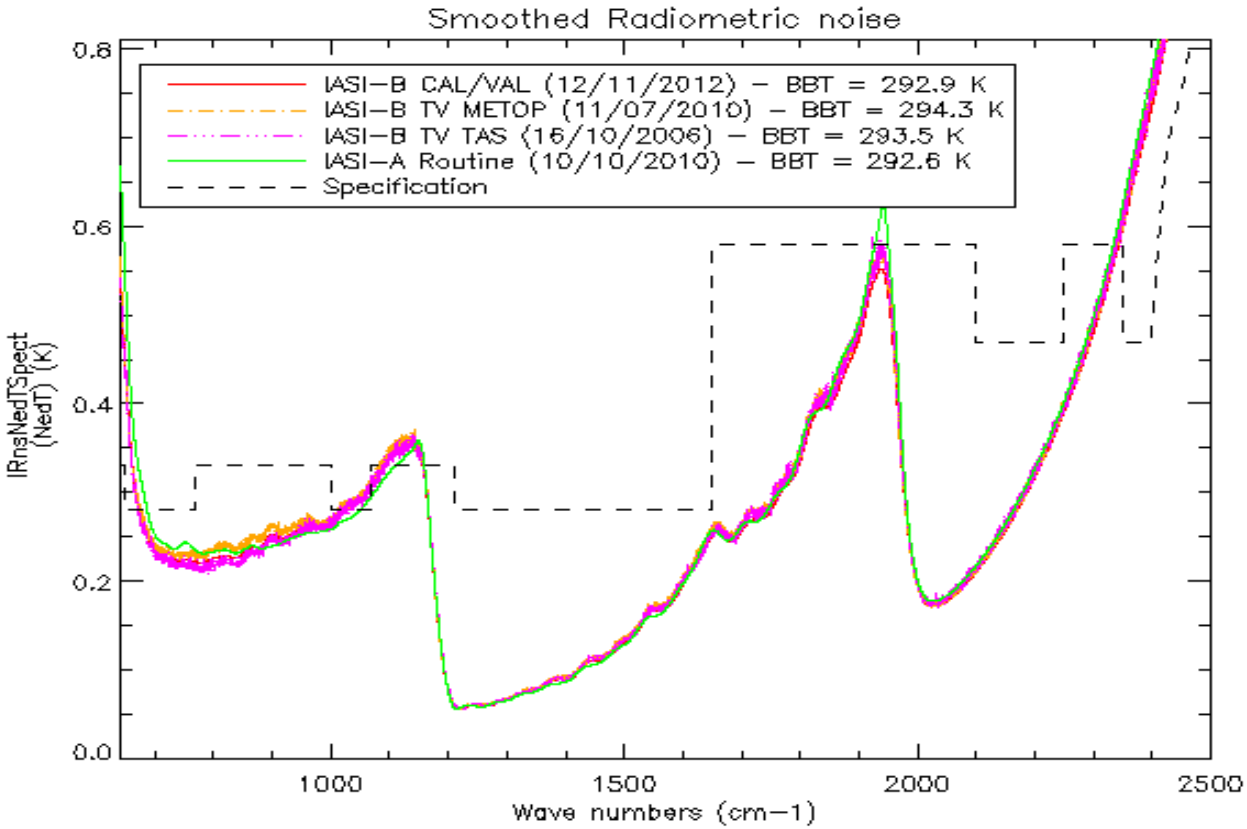


- Selection of collocated and homogeneous scenes
- Spectral interpixel at L1C is better than 0.25/0.5 ppm -> at L1C all pixels are spectrally independent -> L1B(spectral shift correction) & L1C(SRF removal) processing work perfectly

See Elsa Jacquette’s presentation for more details

- Introduction
- Instrumental artifacts removal
- **Sounder performances**
- Intercalibration
- Conclusions

Radiometric noise



IASI-B in-flight measured L0 NedT@280 K on BB targets is

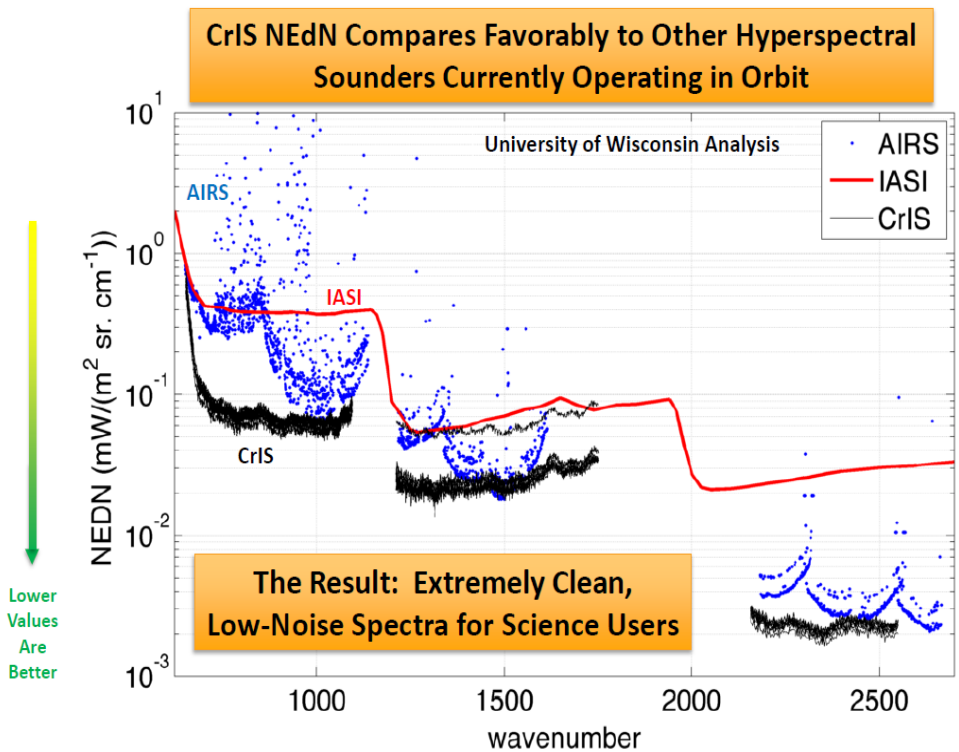
- close to Vacuum Test values (TAS 2006 and MetOp-B 2010)
- close to IASI-A in-flight

See Jordi Chinaud's presentation for more details

Radiometric noise: comparison with CrIS

- Usually this picture is presented ….

NPP On-Orbit Performance is Excellent: NEdN



ITT EXELIS CrIS This document is not subject to the controls of the International Traffic in Arms Regulations (ITAR) or the Export Administration Regulations (EAR).

But the NedL also depends on spectral sampling & spectral resolution which are not the same for IASI and CrIS.

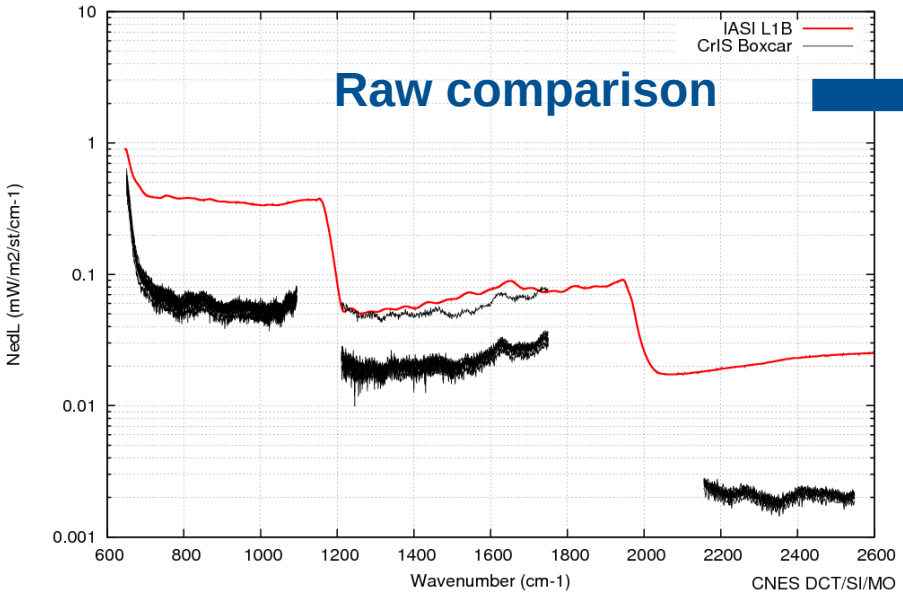
IASI	Bande 1		Bande 2		Bande 3	
Limites (cm^{-1})	645	1180	1180	1940	1940	2760
Echantillonnage (cm^{-1})	0.25		0.25		0.25	
X_{Max} (cm)	2		2		2	

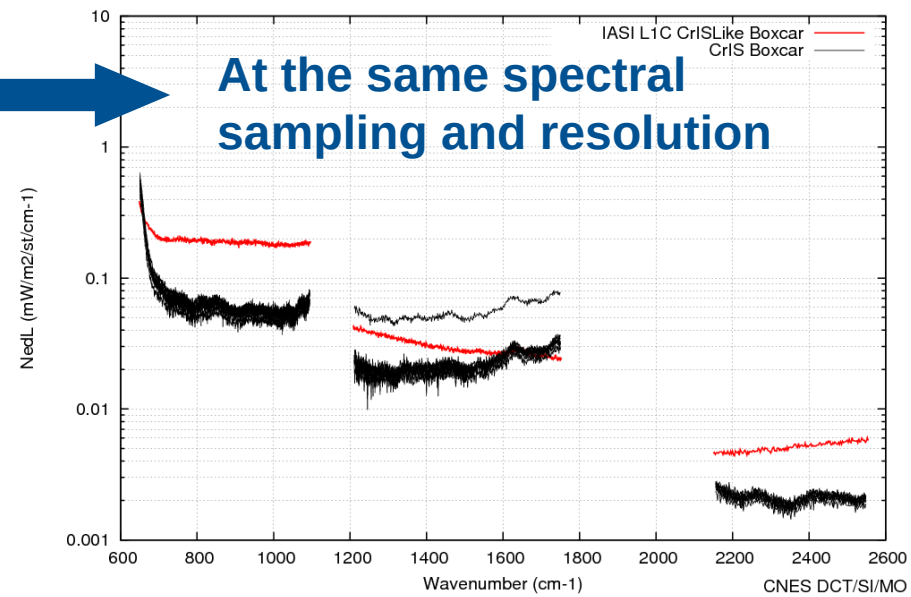
CRIS	Bande 1		Bande 2		Bande 3	
Limites (cm^{-1})	648.75	1096.25	1207.50	1752.50	2150.00	2555.00
Echantillonnage (cm^{-1})	0.625		1.25		2.50	
X_{Max} (cm)	0.8		0.4		0.2	

Radiometric noise: comparison with CrIS at user level

A much fair comparison is to perform it at the same spectral sampling and resolution

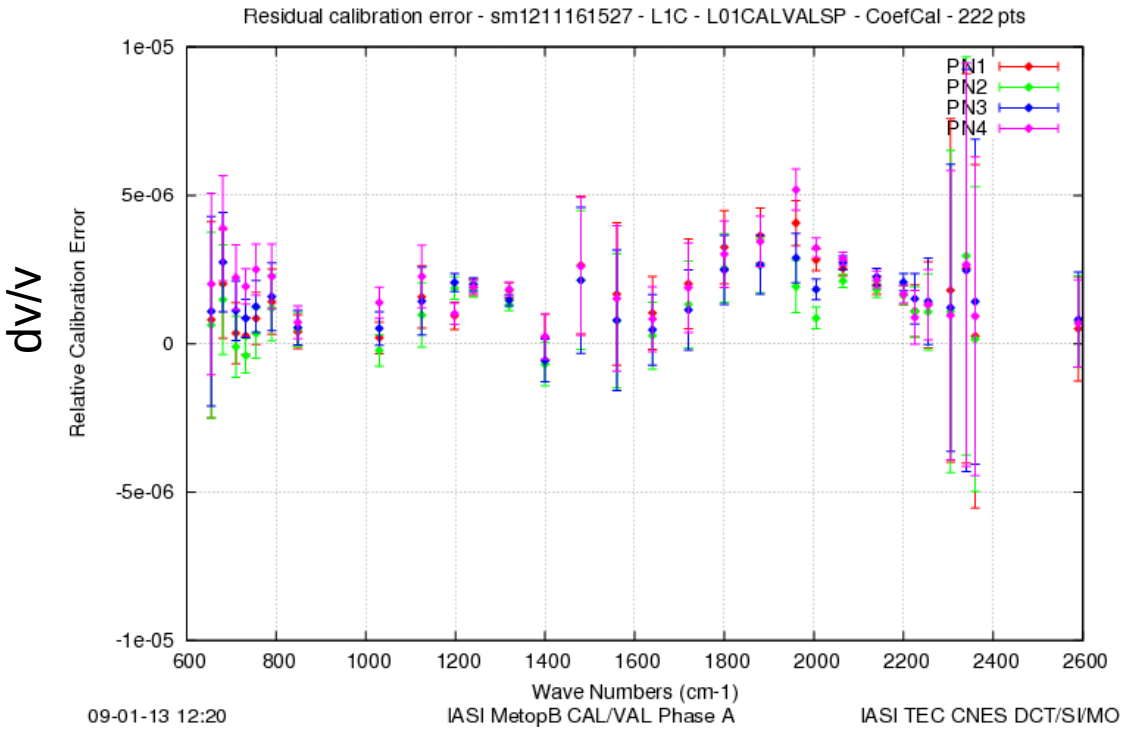
- To do so we have computed CrIS-like spectra from noisy BB L1C IASI spectra (920 random draws)
- The CrIS-like module works in the interferogram space using CrIS characteristics (OPD_{max} and apodisation functions)





IASI CrISlike / IASI (=overestimation factor of IASI noise in the raw comparison)	B1	B2	B3
	2.5	3	5

Absolute spectral calibration at L1C (Obs - Calc)

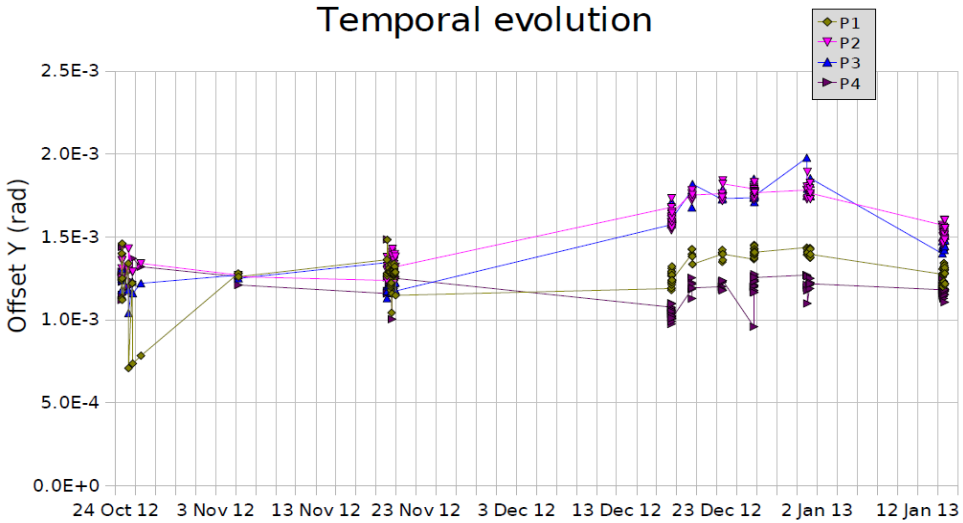


- Evaluation not straightforward
  - 1ppm@645 cm^{-1} =3/1000 of the spectral sampling
  - 1ppm@2200 cm^{-1} =1/100 of the spectral sampling
- Selection of collocated and homogeneous scenes

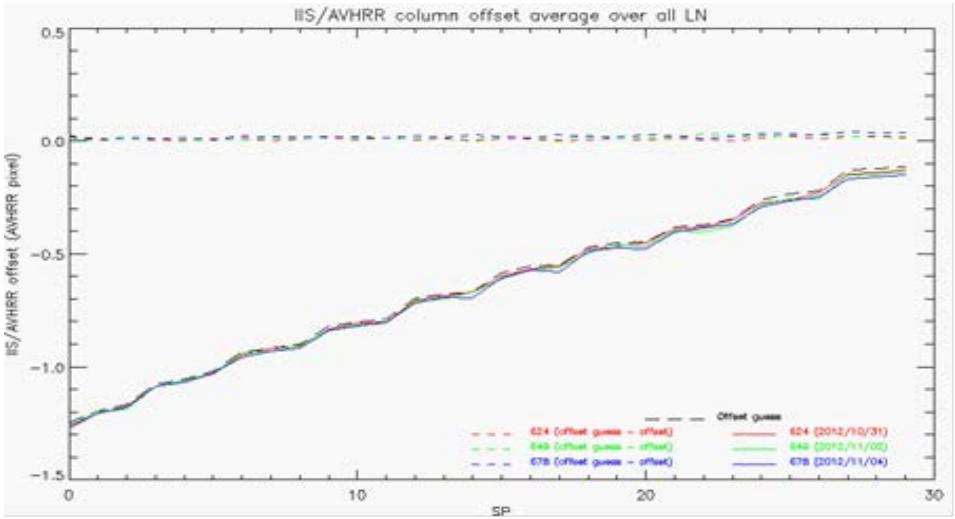
- Results still very dependent on scene selection, radiative transfer (spectroscopy, line-mixing, pressure shift), atmospheric profile used, algorithm (correlation, difference, peak finding), spectral line shape, instrument noise,…
- Consolidation of the results in phase B.

See Elsa Jacquette's presentation for more details

Geolocation



- Sounder / IIS ~ 0.3 km
- No orbital variations

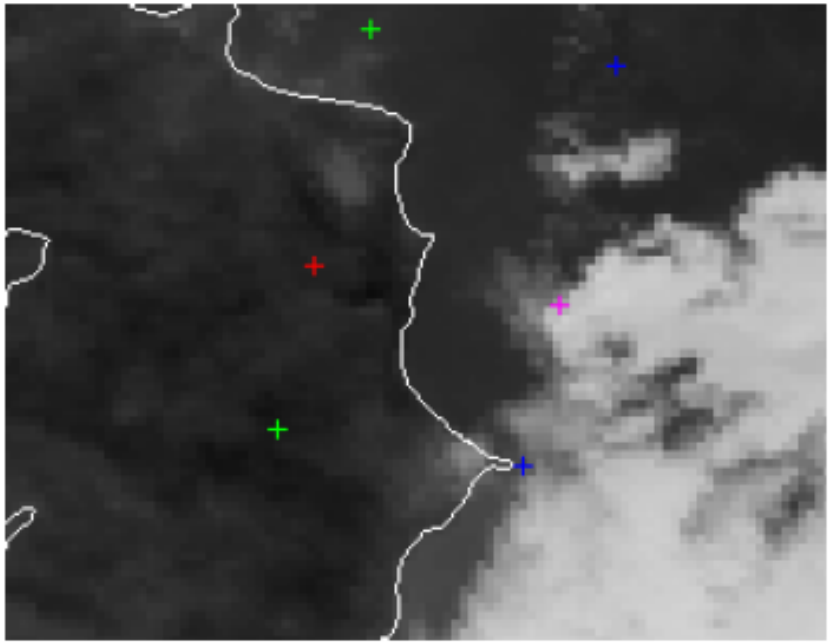


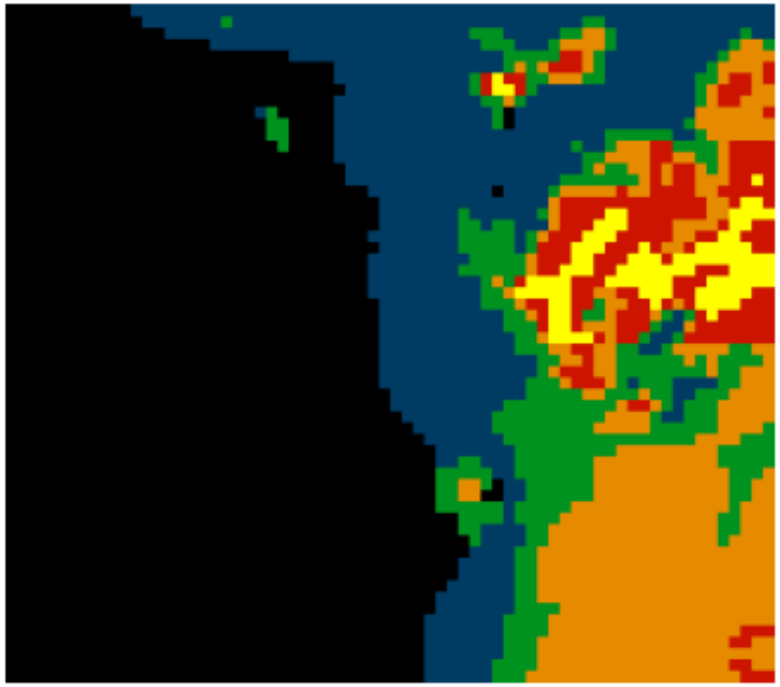
- IIS / AVHRR ~ 0.1-0.2 km wrt the offset guess in the current ground configuration
- No orbital variations

See Sebastien Gaugain's poster for more details

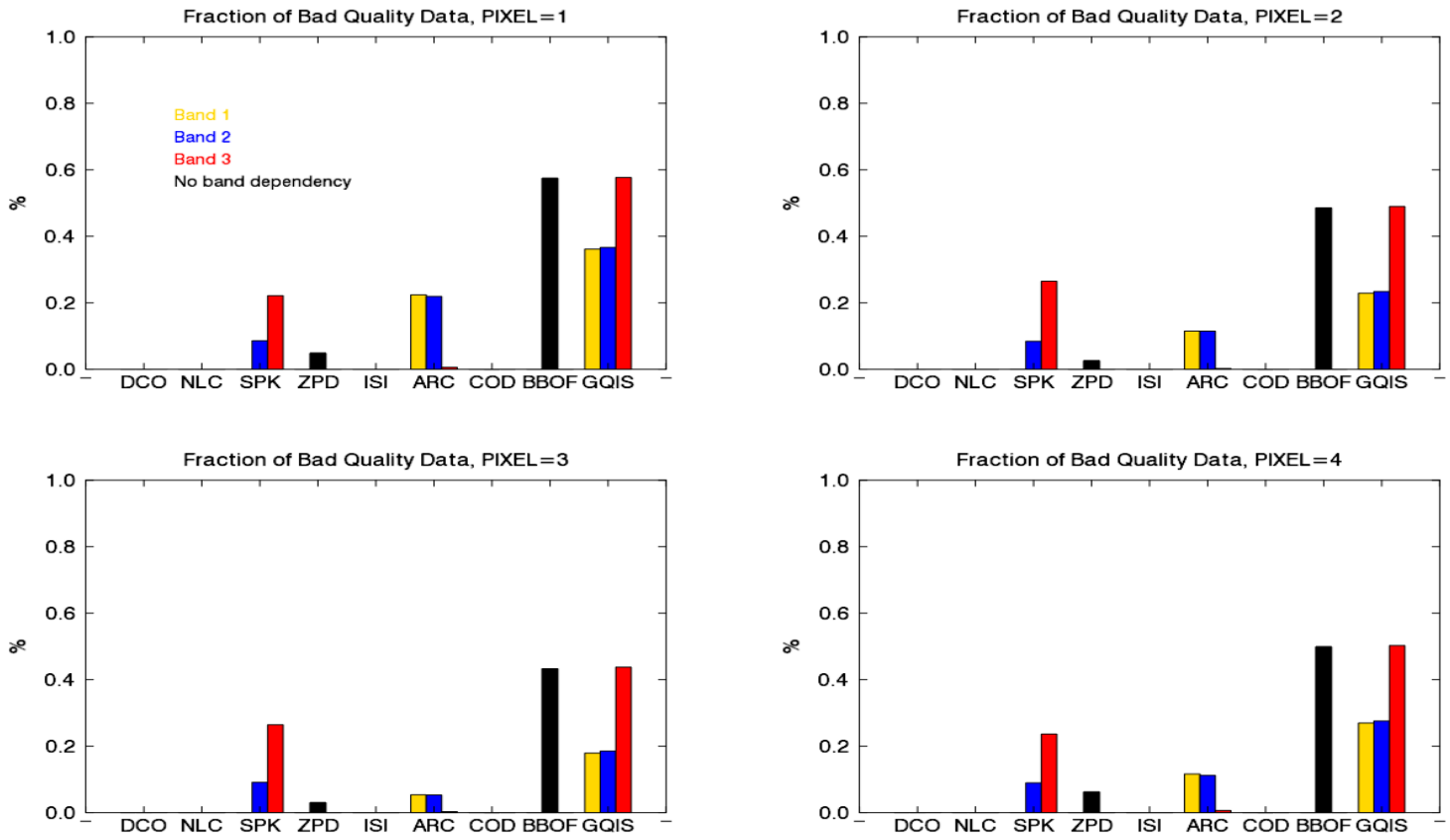
Radiance classification in L1C products (CCS)

- Sfax (Tunisia)
- AVHHR-4 image and the associated classification (6 radiometric classes)
- Black Blue Green (hottest scenes), Orange Red Yellow (coldest scenes)





L0&L1 data quality and availability

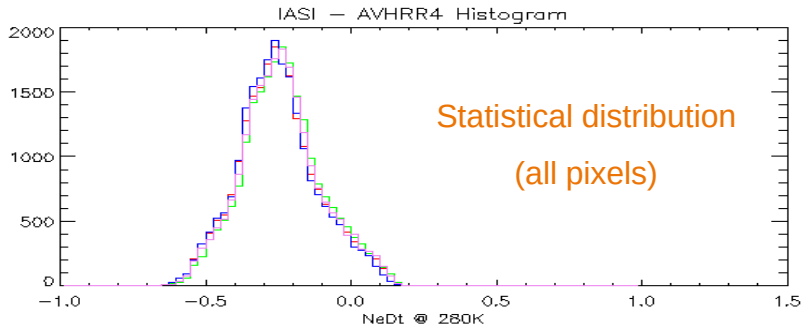


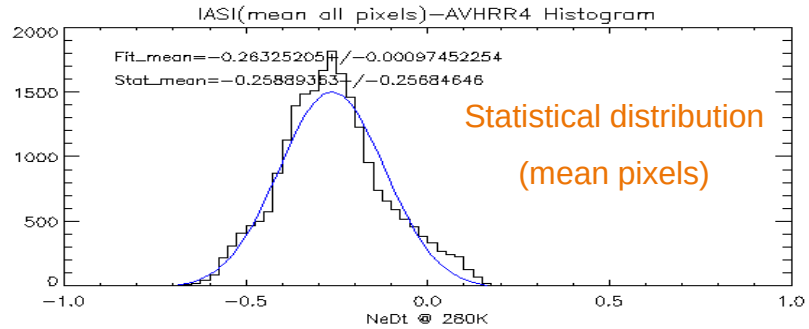
- PTSI-6: uploaded on the 10th of January 2013 @11:25
- Availability of L1C data: 99.4% (B3), 99.7% (B1&B2)

- Introduction
- Instrumental artifacts removal
- Sounder performances
- **Intercalibration**
- Conclusions

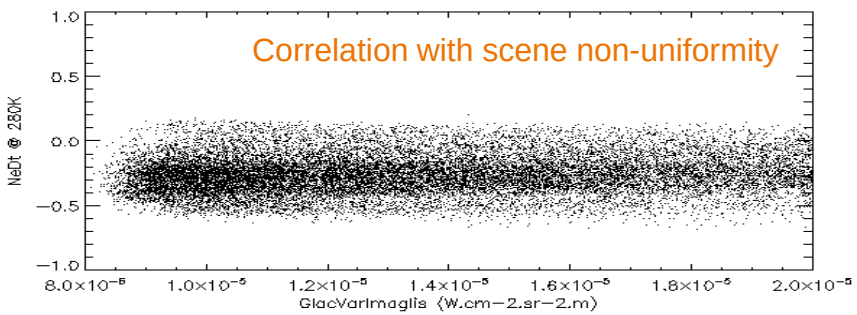
IASI / AVHRR / IIS intercalibration

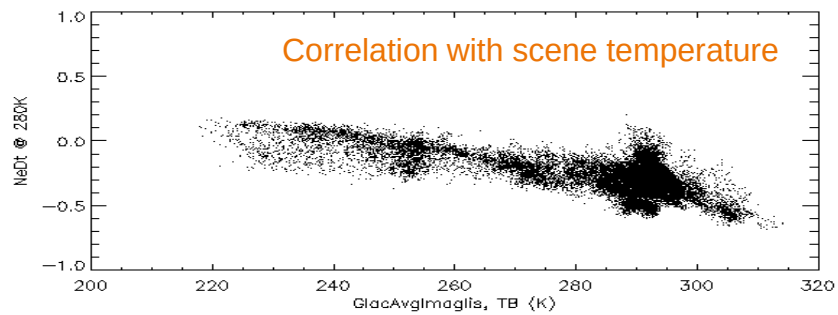
- 14 orbits of data (8-9th November): clear & homogeneous scenes
- We display results only for IASI - AVHRR4





- IASI-AVHRR4 = -0.26K, IASI-AVHRR5 = 0.02K, IASI-IIS = 0.06K

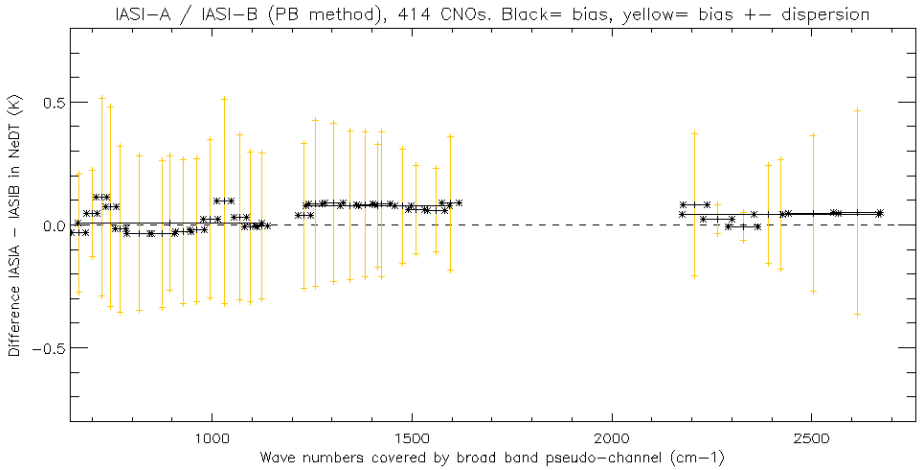




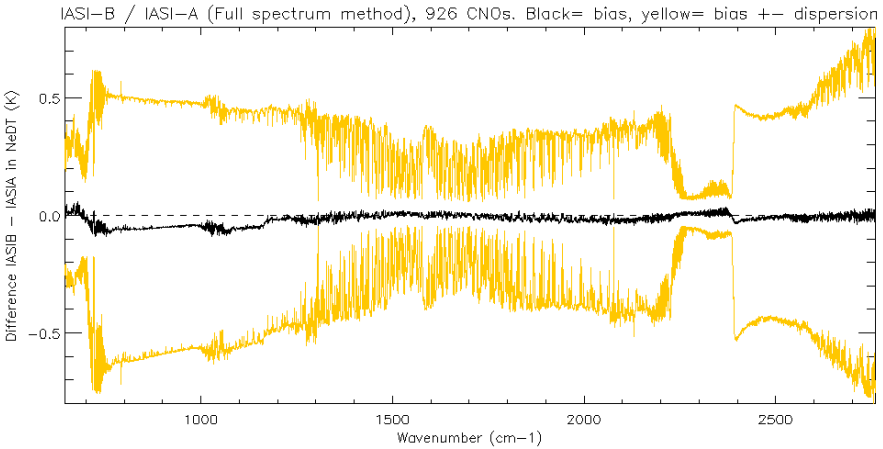
- Scene dependent bias only observed for IASI-AVHRR4
- -0.5 K between 220 K and 310 K

IASI-B / IASI-A radiometric inter calibration at L1C (Obs-Obs)

- Biases over a relevant dataset (homogeneous and stable scenes, night)



Broad band pseudo-channels

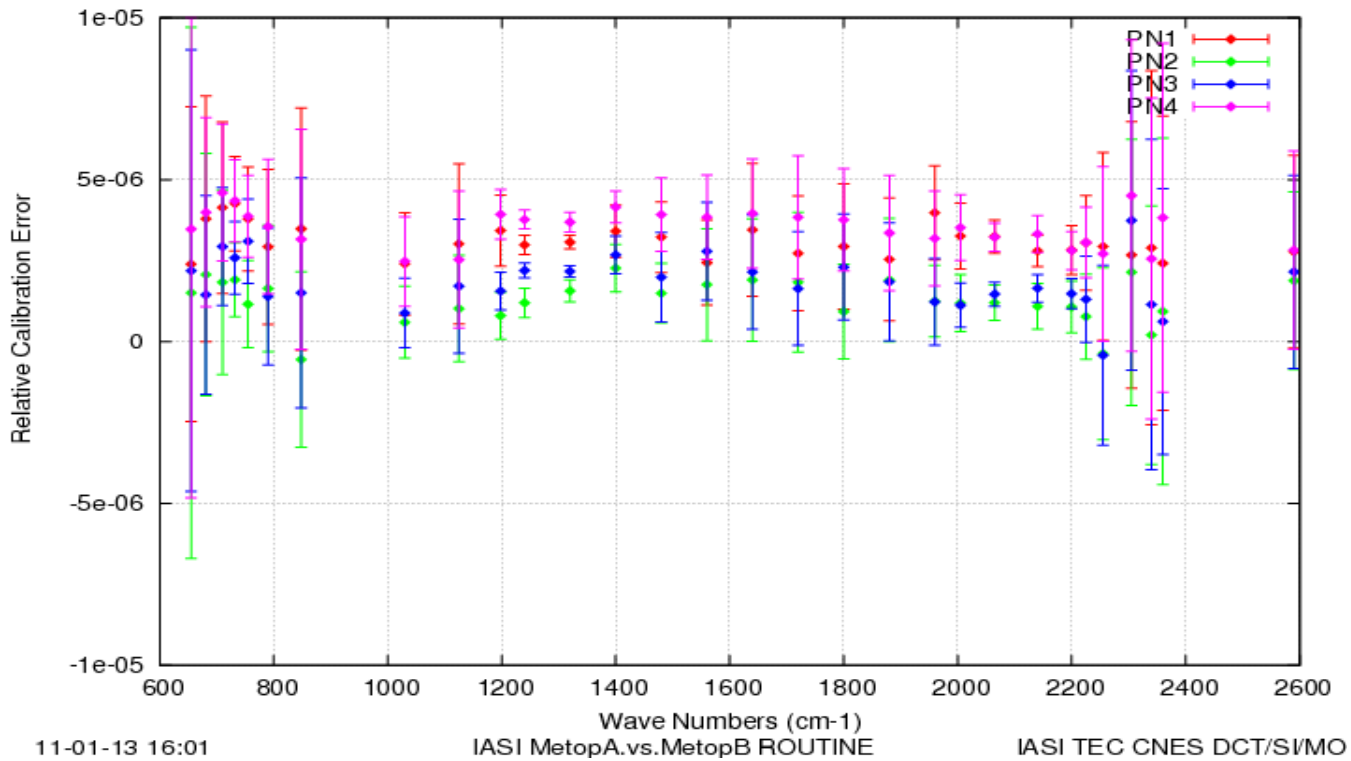


Full resolution

- Biases < ~0.1 K ➔ Very well cross calibrated wrt spec (absolute 0.5 K for each)
- Standard deviations mainly due to geophysics

See Denis Jouglet's presentation for more details and inter comparisons (AIRS,CrIs)

IASI-B / IASI-A spectral inter calibration at L1C (Obs-Obs)



- IASI-B / IASI-A ExtCal “MA_MB” : reprocessing of 26th November data with BSO-8
- Selection of collocated and homogeneous scenes : ~ 50 scenes
- Inter pixel at L1C display a constant bias of 2.5 ppm. A part of this bias (1.5 ppm) may be attributed to IASI-B laser misalignment. It will be improved in L1 Cal/Val phase B.

See Elsa Jacquette’s presentation for more details

- Introduction
- Instrumental artifacts removal
- Sounder performances
- Intercalibration
- **Conclusions**

Conclusions

After 3 months of IASI-B L1 Cal/Val

- Instrument & interferogram acquisition are very stable and work perfectly
- Space & ground segments are now working well with consolidated parameters. The in-depth tuning has started.
- Performances are very encouraging and already of order of IASI-A
- Thanks to both CNES and EUMETSAT teams

The Earth seen by IASI-B (26th October at 9:30 local)