# IASI on MetOp-A & B: Performance Status

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## IASI mission

- The Infrared Atmospheric Sounding Interferometer (IASI) is a key element of the MetOp payload
- Application to weather predictions, climate studies and atmospheric chemistry
- Cooperation between CNES and EUMETSAT:
  - CNES leads the development of the instruments and the level 1 processing. It also operates the IASI Technical Expertise Center (TEC) [1]
  - EUMETSAT is responsible for development of level 2 processing, instrument and level1/2 operations and data distribution

- IASI measurements allow to retrieve temperature (1K accuracy) and humidity profiles (10% accuracy) at a 1 km vertical resolution. Trace gases column amount (CO, CH4, N2O) are retrieved with an accuracy better than 10 %, and 5 % for O3
- 3 IASI flight models:
  - IASI FM2 on MetOp-A launched on October 19th 2006
  - IASI PFM-R on MetOp-B planed to be launched on May 2012
  - IASI PFM3 on MetOp-C planed to be launched between 2016 and 2018.
- IASI provides radiance spectra, in a spectral range from 645 $cm^{-1}$ to 2760 $cm^{-1}$ (3.6 µm to 15.5 µm), with a spectral resolution of 0.5$cm^{-1}$ and an absolute radiometric accuracy of 0.5K. It has 4 pixels, the sounder pixel size is 12 km (at nadir).

## IASI-A performance monitoring

- A successful in-orbit commissioning phase: 2 months in-orbit functional validation + 6 months calibration/validation
- IASI instrument is in routine operation phase since July 2007
- IASI TEC takes care of in-depth performance monitoring and processing parameters updating
- This poster gives a status of IASI radiometric, spectral and geometric performances after 5 years in orbit.

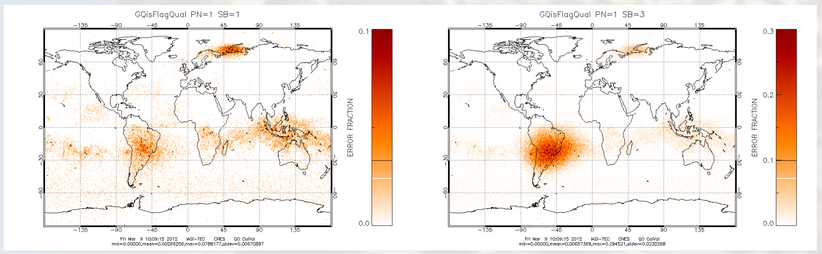
## Overall quality

The total of rejected spectra by L0 + L1 processing is < 1%

Main contributors to rejections:
- Spikes in B3
- NZpd computation failure
- Over/Underflow
- Radiometric calibration failure

**In Normal Operation: 99% of good quality spectra**
**Ground segment is very reliable**

Spatial distribution of rejected spectra for January 2012:




Band 3 is the most affected by spikes

Most anomalies located in SAA

## Geometric performances

Geometric calibration is performed on ground (level 1 processing), mostly during external calibration.

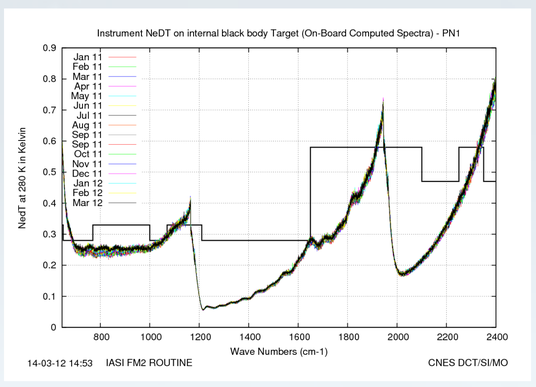
- IASI / IIS (infrared imager) co-registration: mechanically linked, co-registration stable at about 1.1 mrad (equivalent to 1 km on ground)
- IIS / AVHRR co-registration: IIS offset in AVHRR raster is 0.1 AVHRR pixel along-track and 0.04 AVHRR pixel across-track (specification: 0.3 AVHRR pixels). Very good stability since the end of the Cal/Val.

IASI pixel centre localisation accuracy in AVHRR raster ~ 100 m
**The geolocation of IASI pixels are considered stable and well within specification (5 km)**

## Radiometric performances

- Monthly estimation of radiometric noise

NeDT computed on the hot black body target during external calibration



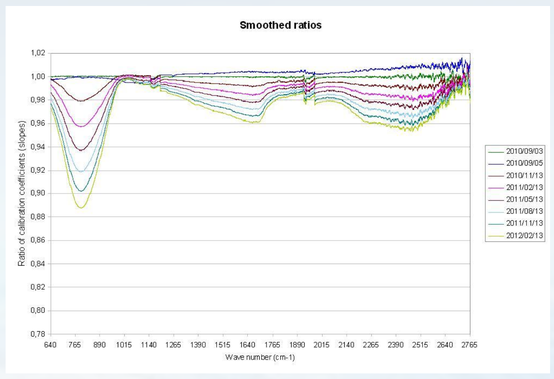

Stable since 2nd IASI routine decontamination (August 2010), except ice effect between 750 and 900 $cm^{-1}$

- Instrument transmission

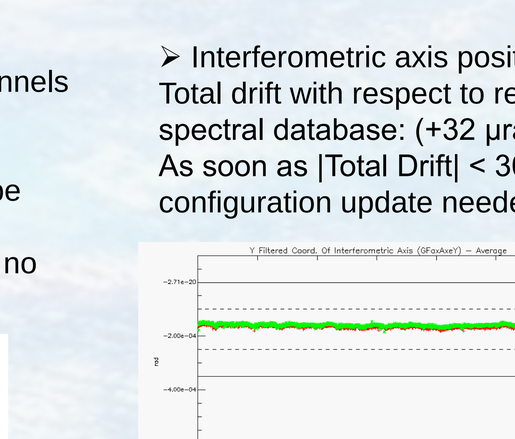
Ice contamination on field lens at the entrance of Cold Box Subsystem (100K)

Decontaminations done in 12/2006, 03/2008 and 08/2010. Next decontamination: end of 2014.
Maximum acceptable degradation of transmission: 20% loss at 850 $cm^{-1}$ (which corresponds to an ice deposit thickness of about 0.5 µm).

Estimation of the instrument transmission evolution by using radiometric calibration coefficient (slope)




- Evolution of scan mirror reflectivity

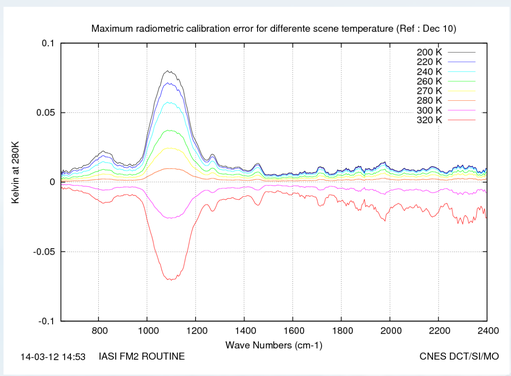



Scan mirror reflectivity is monitored on a monthly basis. Its variation with incidence angle is estimated by using L0 spectra from 2 cold space targets (at 10° and 60° incidence angle), during external calibration.

Scan reflectivity evolution is corrected by L1 processing (radiometric post-calibration)

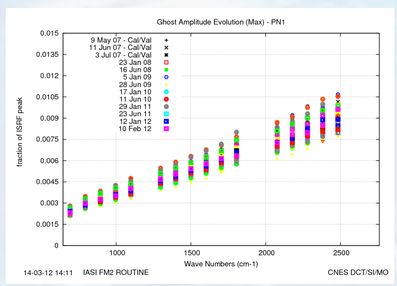
Maximum impact of scan reflectivity variation on radiometric calibration within a scan line for different scene temperature:

**Inter-pixel and inter-scan radiometric calibration maximum error is lower than the specification of 0.1K**



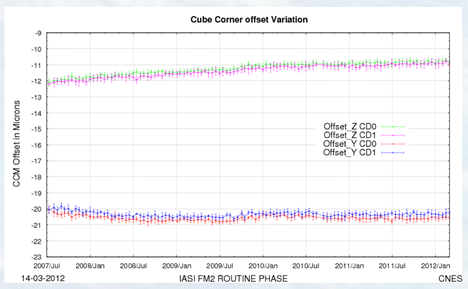

## Spectral performances

Goal of the spectral calibration: to provide the best estimates of spectral position of the 8461 IASI channels
Specification: **maximum spectral calibration relative error of 2.10$^{-6}$**
=> Need an accurate Instrument Spectral Response Function (ISRF) model
ISRF are pre-calculated in a spectral database, L1 processing determines the most relevant ISRF to be used with respect to current values of a set of parameters (interferometric axis, cube corner offset…).
We monitor time variable input parameters of this ISRF model. As long as they remain stable, there is no problem with IASI spectral calibration.



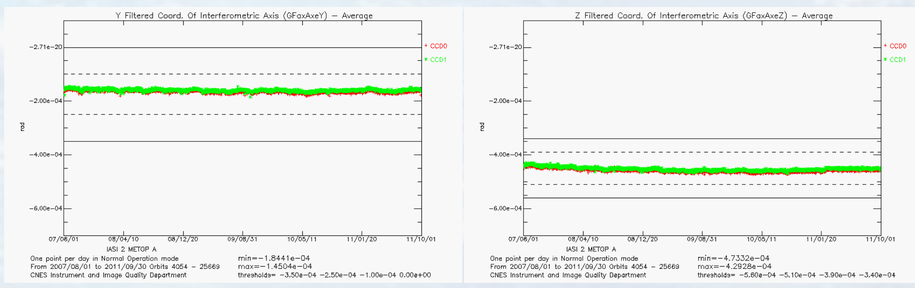

- Instrument ghost amplitude
- Position: cube corner constant offset

Drift < 1.2 µm in 4 years => No spectral database configuration update needed (up to 4 µm)




- Interferometric axis position:

Total drift with respect to reference position ($Y_0$, $Z_0$) in the spectral database: (+32 µrad,-84 µrad)
As soon as |Total Drift| < 300 µrad => No spectral database configuration update needed




**The instrument is extremely stable**

## Conclusion

As the 1st European hyper-spectral infrared sounder, the IASI instrument has demonstrated its operational capability and its adequacy to user needs, with highly meaningful contributions to meteorology, climate and atmospheric chemistry. The in-flight performance of IASI is fully satisfactory (instrument and processing). In particular, the system shows a very stable behaviour.

In addition, MetOp-B IASI PFM-R Cal/Val plan has been defined and pre-launch activities carried out.

## See also …

Poster session:

[1] ***"IASI Technical Expertise Centre",*** *J. Chinaud et al.*

[2] ***"Long-term radiometric inter-comparison of IASI-A / AIRS and preparation for IASI-A / IASI-B",*** *D. Jouglet et al.*