IASI L0/ L1 NRT Monitoring at EUMETSAT: Comparison of Level 1 Products from IASI and HIRS on Metop-A

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1. Introduction
2. IASI L1 product quality
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4. IASI – HIRS radiance monitoring set-up
5. Results from IASI and HIRS L1 radiance comparison
6. Summary and Conclusions
IASI (Infrared Atmospheric Sounding Interferometer):

- Covering the range 645 cm\(^{-1}\) to 2760 cm\(^{-1}\)
- with 8461 spectral samples and
- 4 instantaneous field of view (IFOV)
- a spectral resolution 0.5 cm\(^{-1}\) of the IASI L1C product
- On-board the Metop-A satellite in sun-synchronous 09:30 morning orbit
1. Introduction

IASI L0/L1 NRT monitoring:

- IASI L0/L1 NRT product quality monitoring was started in April 2007 at EUMETSAT headquarter during IASI Cal/Val phase
- Near real time reports on data quality are used to support of decisions on product dissemination

The monitoring consists of the combination of:
- IASI quality and processing parameters and the
- Radiance monitoring based on forecast data and AVHRR L1B data and the
- Comparison of HIRS L1B with IASI based pseudo HIRS channels using HIRS spectral response functions

ITSC-17 April 2010
2. IASI L1C product quality since July 2007 (OPE)

Daily average of L0/L1 data quality [%]

- EXT. CAL Moon avoidance
- Over Flows

IASI Operational Phase
2. IASI L1C product quality: geographical distribution

![Map showing geographical distribution of IASI L1C product quality with a South Atlantic Anomaly highlighted.](image-url)
3. Average double differences between the 4 IASI pixel (IFOV)

\[(\text{Obs-Cal})_{\text{PX2}} - (\text{Obs-Cal})_{\text{PXi}}\]

Average radiance differences per pixel

- PX2 - PX1 red
- PX2 - PX3 green
- PX2 - PX4 blue

wavenumber [cm\(^{-1}\)]
4. IASI - HIRS radiance monitoring set up

- IASI and HIRS co-location criteria is 3 km distance
- All situations (land, sea, day, night, etc.) are collected
- HIRS spectral response function convolved with IASI L1C provide the HIRS pseudo channels
- Cloud cover of IASI FOV based of co-located AVHRR L1B cloud flag
- IASI versus HIRS NRT monitoring started end of May 2008
5. Results of IASI and HIRS L1 radiance comparison

Brightness Temperature at 280K

- IASI B1
- IASI B2
- IASI B3
- HIRS INSB
- HIRS MCT
5. IASI - HIRS: 24 h average channels 1 to 19

Radiance Difference in BRT at 280K [K]

Drop of Cold Space Counts of HIRS

IASI L1 PPF related
5. IASI - HIRS: 24 h average channels 1 to 19

Radiance Difference in BRT at 280K [K]

Jan 2008  Jan 2009  Jan 2010
5. HIRS MCT detector channels 2 to 12

Radiance Difference in BRT at 280K [K]
5. HIRS MCT detector channels 2 to 7 (CO$_2$ band)
5. HIRS MCT detector channels 8 to 12 (SURF, O3, H2O)
5. HIRS INSB detector: channels 13 - 19

Radiance Difference in BRT at 280K [K]

CH 13
CH 14
CH 15
CH 16
CH 17
CH 18
CH 19
5. Results from linear Regression: Channel 1-19

Correlation coefficient of lin. Reg.\[\]

Slope of lin. Reg. \([K/\text{day}]\)
6. Summary and Conclusions: IASI L1

- IASI L1 product quality is stable and above 99%

- Systematic radiance bias changes in the operational phase were not related to the IASI instrument.

- The excellent instrument stability and accuracy of the spectral calibration reveals a small radiance differences between the 4 IASI pixel on a few number of IASI channels mainly in Band 3.
  - A on-ground parameter update is scheduled for April 2010.

- Degradation of IASI L1 products for few minutes on the 19/20th Sept. 2008, 10/11th Aug. 2009, 4/5th Jan. 2010, and on 20th Feb. 2010 were related to IASI L1 PPF.
  - A software patch is in preparation for May 2010 (part of Day-2 IASI L1 PPF upgrade).
6. Summary and Conclusions: IASI-HIRS comparison

- IASI – HIRS L1 product comparison shows very good agreement all differences are well within specifications.
  - Very stable in-orbit performance is observed with HIRS Ch: 8, 10, 14, 19 bias changes less than 10 mK over 2.5 years.
  - HIRS CO₂ channels show seasonal variation of radiance bias (only channel 6 and 14 are stable).
  - HIRS Ch. 4 bias with 50 mK amplitude for 24h and 0.5 K for individual IASI-HIRS measurements.
  - HIRS WV channels 11 and 12 both compared to IASI Band 2 show linear trend with opposite sign.
  - The IASI decontamination in March 2008 had no impact on radiance bias.

- The annual radiance bias variation is related to the imperfect knowledge of the HIRS spectral response function of Channel 2-5, and 15-18.

- A general non-linear response of the HIRS instrument/detectors has not been concluded due very stable behaviour of ch. 8, 10 and 14.

- The behaviour of channel 11, 12 and 13 required further investigations
HIRS spectral response functions: Channel 1 to 19

BRT at 280K [K]

Wavenumber [cm⁻¹]

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