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

E. Péquignot\textsuperscript{1}, L. Buffet\textsuperscript{1}, J. Chinaud\textsuperscript{1}, S. Gaugain\textsuperscript{1}, E. Jacquette\textsuperscript{1}, D. Jouglès\textsuperscript{1}, V. Lonjou\textsuperscript{1}, C. Larigaudière\textsuperscript{1}, C. Villaret\textsuperscript{1}, J. Donnadille\textsuperscript{2}, B. Tournier\textsuperscript{2}, C. Baque\textsuperscript{3}

\textsuperscript{1}Centre National d'Etudes Spatiales (CNES)
\textsuperscript{2}Noveltis (Toulouse)
\textsuperscript{3}AKKA (Toulouse)

3\textsuperscript{rd} IASI conference, 4-8 February 2013, Hyères, France
Introduction

Instrumental artifacts removal

Sounder performances

Intercalibration

Conclusions
Key dates

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

First IASI/METOP-B spectrum 24/10/2012 at 03:04 PM

Main Atmospheric Chemical Signatures

Legend:
- H₂O
- N₂O
- CO₂
- CO
- CH₄
- O₃
IASI: 2 operational modes

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

- **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 Chinaire’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

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

<table>
<thead>
<tr>
<th></th>
<th>Bande 1</th>
<th>Bande 2</th>
<th>Bande 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>IASI</td>
<td>Limits (cm⁻¹)</td>
<td>645</td>
<td>1180</td>
</tr>
<tr>
<td></td>
<td>Echantillonnage (cm⁻¹)</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Xres (cm)</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Bande 1</th>
<th>Bande 2</th>
<th>Bande 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRIS</td>
<td>Limits (cm⁻¹)</td>
<td>648.75</td>
<td>1096.25</td>
</tr>
<tr>
<td></td>
<td>Echantillonnage (cm⁻¹)</td>
<td>0.625</td>
<td>1.25</td>
</tr>
<tr>
<td></td>
<td>Xres (cm)</td>
<td>0.8</td>
<td>0.4</td>
</tr>
</tbody>
</table>
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\textsubscript{max} and apodisation functions)

<table>
<thead>
<tr>
<th>IASI CrIS\textsubscript{like} / IASI (overestimation factor of IASI noise in the raw comparison)</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.5</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>
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)

- 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,Crls)
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)