IASI FM2 on METOP A
Performances after 1.5 year in orbit

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Outline

■ First decontamination

■ Stability of the instrument

■ Spectra rejections
  ♦ Day 2 improvements of processing

■ Intercalibration IASI / AIRS

see IASI performances assessment at the 1st IASI Conference
  • http://smsc.cnres.fr/IASI
Evolution of contamination effect (ice) 2007-2008

IASI FM2 Instrument Noise (pixel 1)

Wave Number (cm\(^{-1}\))

NeDT at 280 K (K)

Spec

Dec 2006

Apr 2007

Sept 2007

Feb 2008
After first IASI decontamination

First IASI decontamination end of March 2008 (1.5 year after launch)
Evolution of the measured transmission loss

- First IASI decontamination
  - end of March 2008 (1.5 year after launch)

- Successful
  - recovery of the initial radiometric noise IASI
    - Initially measured beginning of December 2006

- Contamination rate
  - Now 1/4 of the initial rate
  - No need for new decontamination before 2 years
Fixed Cube Corner Offset

- **Accurate determination**
  - Std < 0.2 µm

- **Stability over 16 months**
  - Small drift
  - 1 µm

- **Period of analysis**
  - 4th Dec 2006
  - 31th Mar 2008
**Interferometric Axis Position**

- **Stability over 12 months**
  - Negligible drift
  - Results provided at Anglet conference confirmed
    - Obtained at that time from 5.5 months of data

- **Period of analysis**
  - 16th Apr 2007
  - 1th Mar 2008

- **Small evolution 11 July 2007**
  - Cause by parameter updating (spectral database)
  - Amplitude 30 µrad
  - Equivalent to $\Delta \nu / \nu = 5 \times 10^{-7}$
Long term evolution of other parameters

- **Temperatures**
  - Optical Bench (BIMS_OPBT): mean
  - Black Body Temperature (BIMSBBT): mean

- **Long term evolution over 1 year**
  - 1 point per orbit
  - Average over 1 orbit

- **Period of analysis**
  - 16th Apr 2007
  - 1st Apr 2008

- **Reminder**: Orbital stability verified during Cal/Val
Regulation margin of the detectors temperature

CBS power regulation (mW)
observation of 2 orbits every 2 months

- Stable on the long term
  - Small seasonal effect, small orbital variation
- Very good indicator that the temperature of the detectors will be kept low
  - Strong impact on the radiometric noise for long wavelength
Fraction of Spectra rejected by on-board processing

% of BBofFlagSpectNonQual raised per day
(without some days in External Calibration)

End of Cal/Val

% of ZPD raised per day
(without some days in External Calibration)
Fraction of Spectra rejected by on-ground processing

- % of GQisFlagQual raised per day (without some days in External Calibration)
- % of FlagOverUnderFlow raised per day (without some days in External Calibration)
98.5 % of earth views (groups of 4 soundings) not affected by spikes

Among the 1.5 % of earth views affected by spikes
  - E.g. over the South Atlantic Anomaly (SAA)
  - 82.2 % have more than 3 spectra available
  - 97.9 % have more than 2 spectra available
  - 99.8 % have more than 1 spectrum

If the 4 IASI pixels of each Earth View are not assimilated
  - Dynamic selection of the selected sounding increase availability of the measurements

On the long term
  - Proposal for Day 2 evolution of IASI processing
Spectra not computed because of NZPD error

- Small fraction of spectra not available because not computed by on-board processing
  - Between 0.15% (Pixel 1&4) and 0.3% (Pixel 2)
  - Stable over 9 months

- Geographic repartition
  - 1 or 2 occurrences max per month per bin of 0.5 x 0.5 deg²
Spectra not computed because of NZPD error

- **Brightness Temperatures from the IIS imager**
  - Black curve: Histogram of BT in the vicinity of rejected spectra
    - 1/4 of the IIS image
  - Red curve: Histogram of BT in the IASI footprint for rejected spectra

- **Conclusion**
  - Affected pixels: 0.3%
  - Histogram of rejected pixels
    FWHM = 25 K
  - Close shape of the 2 histograms
Proposed evolutions of IASI processing for the day 2

- Add more detailed information for the cause of rejected spectra
  - Spike reason,
  - NZPD reason,
  - OverFlows,
  - Other

- In case of a spike occurrence, provide B1 and B2 spectra when available
  - With proper flagging

- Add AVHRR L1B cloud mask information in the L1C product

- Add IIS image Brightness Temperature average and variance in L1C prod
  - For easy spatially uniform scenes detection

- Add minor modifications for improving (or easing) the monitoring of IASI performance by the TEC
  - No impact on the L1C products
Intercalibration IASI-AIRS (GSICS)

- **Method:** for intercomparison at high spectral resolution
  - Precompute TF of each AIRS Spectral Response Function \( \rightarrow Ak, k=1..2378 \)
  - IASI calibrated spectra (L1B or L1C TBC) \( \rightarrow \) interferogram I0
  - For each k, \( Sk=TF^{-1}(I0/Af*Ak) \), … AIRS like spectrum, interpolated at nuk
    - \( \rightarrow \) SAIRS_like (k)
    - \( Af \) is IASI apodisation function
      (G if L1C spectrum, self-apodisation if L1B spectrum)

- **Validation**
  - Over 2000 spectra from the TIGR dataset

- **On-going activities**
  1. Intercomparison with GCC/GSICS results
  2. Increase the number of comparison opportunities
     (generalization of the SNO concept)
Conclusions

■ After more than 17 months in orbit
  ♦ IASI is performing very well
    • all mission requirements are met
    • both instrument and processing

■ All performances very stable in the long term
  ♦ Radiometry, spectral, geometry

■ During the routine phase, IASI Technical Expertise Center (IASI TEC) located in CNES/Toulouse takes care of
  ♦ In-depth Performance monitoring
  ♦ Processing parameters updating

■ In parallel with the operational monitoring performed by the EUMETSAT EPS/CGS teams
  ♦ Near Real Time
  ♦ Radiances monitoring (wrt Radiative Transfer)
Spares
## IASI outages : SEU/SET anomalies

<table>
<thead>
<tr>
<th>Date</th>
<th>Mission outage</th>
<th>Origine</th>
<th>Sub-system</th>
<th>Détails</th>
</tr>
</thead>
<tbody>
<tr>
<td>15/05/2007</td>
<td>~ 1day 5h</td>
<td>SEU</td>
<td>LAS</td>
<td>Target LAS T° correlation, due to an SEU on CCE or LAS</td>
</tr>
<tr>
<td>13/06/2007</td>
<td>~ 1day 7h</td>
<td>SEU</td>
<td>DPS</td>
<td>DMC checksum error</td>
</tr>
<tr>
<td>20/07/2007</td>
<td>~ 1day 9h</td>
<td>SEU</td>
<td>DPS</td>
<td>DPC pixel 3A checksum error</td>
</tr>
<tr>
<td>01/11/2007</td>
<td>~ 10h</td>
<td>SEU</td>
<td>DPS</td>
<td>DPC pixel 4A checksum error</td>
</tr>
<tr>
<td>08/11/2007</td>
<td>~ 11h</td>
<td>SEU</td>
<td>DPS</td>
<td>DMC checksum error</td>
</tr>
<tr>
<td>18/11/2007</td>
<td>~ 4days 9h</td>
<td>SET</td>
<td>DPS</td>
<td>Communication error IMS-DPS with OOLs on DPS voltages due to SET on DMC converter</td>
</tr>
<tr>
<td>04/02/2008</td>
<td>7h 50min</td>
<td>SEU</td>
<td>CCM</td>
<td>Overflow on ALU computation. Error disappear after reset which confirms SEU, probably on CCE RAM</td>
</tr>
<tr>
<td>09/02/2008</td>
<td>3h 45min</td>
<td>SEU</td>
<td>DPS</td>
<td>DPC pixel 3B checksum error</td>
</tr>
<tr>
<td>5 occurrences</td>
<td></td>
<td>SEU</td>
<td>OBDH</td>
<td>OBDH corruption zone OBDH (EDAC counter anomaly) without mission outage</td>
</tr>
</tbody>
</table>

- **Proton or Heavy ion events caused IASI to go into safe mode (1 or 2)**
- **long outage due to detectors temperature stabilization after safe mode 2**
### IASI availability in Operational modes

<table>
<thead>
<tr>
<th>Operational Modes</th>
<th>% in each mode between 07/05/07 and 03/31/08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal OP</td>
<td>90 %</td>
</tr>
<tr>
<td>External Calibration</td>
<td>1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non Operational Modes</th>
<th>% in each mode between 07/05/07 and 03/31/08</th>
</tr>
</thead>
<tbody>
<tr>
<td>decontamination, IASI anomalies and platform anomalies</td>
<td>10 %</td>
</tr>
</tbody>
</table>

- EUMETSAT / CNES / ALCATEL Working group has proposed recommendations for diminishing impact of SEU anomalies (on-board)
- Before these recommendations are implemented
  - Strong involvement of the EUMETSAT and CNES operational teams to reduce the duration of unavailability periods
  - E.g. IASI decontamination implemented consecutively to a plate-form anomaly to save 2 days in non operational modes