Status of IASI instruments onboard Metop-A and Metop-B satellites

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2 operational instruments

- IASI-A since July 2007 (launched October 2006)
- IASI-B since April 2013 (launched September 2012)

Mission extended for IASI-A: specified lifetime was 5 years

Both instruments deliver very good performances, similar between each other and with a very good stability in time. We also aim at maintaining a maximal operational availability for both instruments.

► Performance status: poster S1-03 (Claire Maraldi)

A constant quality of distributed data is guaranteed via an accurate monitoring of instrument performance indicators done by IASI TEC at CNES on L1 products. In addition, all the instrument housekeeping telemetries are ground monitored by EUMETSAT.
Interferometer stability (1/2)

Reference laser: temperature loop stability

Example of optics area temperature monitoring sensor
Interferometer stability (2/2)

- **Stability of Corner cube mechanical performance**
  ➢ Stable speed profile in both directions

- **Stability of Corner cube alignment**
  ➢ Very low drift for both IASIs

Cube corner offset variation for IASI-A

- **< 2µm in 8 years**

**Average speed**

- **132.45mm/s**
CBS: 3 stages passive cryo-cooler

3rd stage regulated temperature (=detector location stage): perfectly stable at the target (close to 90K)

2nd and 1st stages unregulated temperature (decoupling stages): stable (evolution <+0.2°C per year)

Detectors temperature stability

Example of IASI-B

Power (3rd stage)

Temperature (3rd stage)

Cryogenic regulation temperature (1 LSB accurate ΔT < 50mK)
Instrument availability

Instrument in **Normal Operation mode**
\[ \approx 97\% \] for each IASI

**Main outage contributors**
- Decontamination
- Anomalies
- Routine calibration
- External events

**Quality of L0 spectra**: usually \[ \leq 0.5\% \] rejected spectra (mainly due to spikes in B3)

- « Cube speed quality » flags raised by the Cube Corner Electronics. Flagged spectra were rejected.

- Root cause of these flags still under investigation.

- It was decided to switch to redundant side of instrument to recover usual availability.
Main changes onboard since 3rd IASI conference (2013)

IASI-A switched to redundant side (April 2015)

- Availability much improved: almost no more CSQ flags, availability restored to its maximum.
  - First time IASI-A was operated on redundant side
    - Redundant thermal control
    - Redundant electronics
  - Performance identical on redundant side
    - Detectors regulation target adjusted in order to have the same physical temperature to maintain B1 radiometric performance. Regulation power adjusted close to minimum margin (~6mW) as it was on nominal side.
    - Small effect on IASI Line Of Sight because of use of redundant position encoder for scan mechanism: taken into account for geolocation via IIS/AVHRR offset guess update
Main changes onboard since 3\textsuperscript{rd} IASI conference (2013)

Compensation Device stopped permanently for both IASI’s since October 2015

\begin{itemize}
\item Effect on IASI performance: poster S1-08 (Elsa Jacquette)
\item Compensation Device mechanism was designed to compensate for Cube Corner mechanism exported efforts towards the satellite, in a configuration with LFD released (which is not the case for both IASI’s)
\item CD stop was not an option in original IASI design. A bypass solution was found to make the CD stop.
\item CD stop configuration was tested first on IASI-A in November 2014 and found to have a \textbf{positive impact on IASI performance} (suppression of « ghost » effect due to separating blade microvibration in the interferometer), and an \textbf{acceptable effect on Metop satellite AOCS}. Thus a \textbf{permanent stop} was decided and \textbf{performed in October 2015}.
\item Visible via instrument telemetries
  \begin{itemize}
  \item small local decrease of CD temperature
  \item no side effect on CCFD and optical bench thanks to thermal regulation
\end{itemize}
\end{itemize}
Some proposals for IASI-A End of Life test preparation

**Acquisition of Moon** in Cold Space view (to be studied)

- Possibility to test **new calibration methods for TIR** already used in VIS and SWIR.
- Could be extended to **inter-compare IASI-A and IASI-B** calibration using the Moon (relative calibration).
- Derive IR spectra of the Moon and thus **scientific information about the Moon** (surface temperature and composition). Proposal to characterize Moon in TIR domain is supported by GSICS.

**Example of Moon transit in IASI pixels** (taken from IASI-B Cal/Val)
Some proposals for IASI-A End of Life test preparation

Local improvement of spatial sampling and possibly spatial resolution (to be studied)

- Reduction of swath and increase of spatial sampling by scan parameter modification.
- Final objective: possibility of improvement of spatial resolution by ground processing of overlapping acquisitions ("supermode" like)

- Concept to be analysed in detail
  - Need of sufficient accuracy of pointing and geolocation
  - Need of sufficient knowledge of instrument IPSF
- A first study could be done on available data from nadir acquisitions during monthly External Calibration (oversampling along satellite velocity)

Current definition:
Spacing between views = 58 mrad

Proposed modification:
Spacing between views = 7.3 mrad equivalent to 0.5 pixel (6 km)
Third IASI model to be delivered

• IASI FM3 retrofit: replacement of old NdFeB magnets inside scan and corner cube mechanisms, by new magnets less sensitive to corrosion

• Delicate intervention on corner cube mechanism implied interferometer realignment: successfully performed

• Instrument acceptance campaign achieved at TAS. Instrument final performance validated by Optical Vacuum Test in January 2016.
  
• Very good radiometric and spectral results, not affected by the retrofit operation

IASI FM3R will be ready for reintegration on Metop-C PLM in September 2016, followed by satellite AIT campaign then launch in October 2018