IASI New Generation
Program status, System overview and scientific objectives

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CNES
IASI - New Generation

- IASI-NG and the EPS-SG program
- From IASI to IASI-NG: scientific objectives
- Innovations and new challenges
- Status of the IASI-NG performances at Level 1C
- Planning and next steps
IASI-NG: continuation of the IASI program

- **IASI**: part of EPS program
- **EPS** ➔ **EPS-SG, IASI** ➔ **IASI-NG**
- **IASI-NG**: one of the main payloads of the future METOP-SG satellites

- **For both IASI and IASI-NG, CNES is in charge of:**
  - The development of the instrument
  - The definition of the Level1 processing algorithms
  - The development of the L1 operational chain (L1CPOP)
  - The commissioning phase and the monitoring of the performances during the mission

*Level 2 products are under EUMETSAT responsibility*
*CNES supports the development of the retrievals algorithms in the laboratories*
FROM IASI to IASI-NG

Applications are the same:

- Temperature
- Water Vapor
- Aerosol
- Pollutants
- Volcanic Plumes
- Greenhouse Gases

Main detected molecules:

- $\text{H}_2\text{O}$ - Water
- $\text{CO}_2$ - Carbon dioxide
- $\text{O}_3$ - Ozone
- $\text{N}_2\text{O}$ - Nitrous oxide
- $\text{CO}$ - Carbon monoxide
- $\text{CH}_4$ - Methane
The use of IASI data for the atmospheric composition

- Estimation of CO total column using IASI data (from LATMOS/ULB)
- Other Essential Climate Variables retrievals (from LMD/LA/LOA/LATMOS)
The new challenges of IASI-NG

IASI-NG Level 1 main characteristics

<table>
<thead>
<tr>
<th>Main figures</th>
<th>IASI</th>
<th>IASI-NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiometric Resolution (NeDT)</td>
<td>0.5 cm⁻¹</td>
<td>IASI/2 (0.25 cm⁻¹@L1C)</td>
</tr>
<tr>
<td>Spectral resolution</td>
<td>0.5 cm⁻¹</td>
<td>IASI/2 (&lt;0.25K@280K)</td>
</tr>
<tr>
<td>Absolute Radiometric Calibration</td>
<td>&lt; 0.5K</td>
<td>IASI/2 (&lt;0.25K@280K)</td>
</tr>
<tr>
<td>Spectral bands</td>
<td>3 bands</td>
<td>4 bands</td>
</tr>
<tr>
<td>Number of sounder pixels per acquisition</td>
<td>4 pixels</td>
<td>16 pixels</td>
</tr>
<tr>
<td>Ground Pixel diameter</td>
<td>12 km</td>
<td>12 km</td>
</tr>
<tr>
<td>Ground sampling</td>
<td>25 km</td>
<td>25 km</td>
</tr>
</tbody>
</table>

IASI  
IASI-NG
The better spectral resolution of IASI-NG (combined with a lower noise) aims at enabling better retrievals in the lower atmospheric layers.

Example of the CO$_2$ retrieval:

<table>
<thead>
<tr>
<th></th>
<th>1 % CO$_2$</th>
<th>1 K Temp.</th>
<th>Noise</th>
<th>Other species</th>
</tr>
</thead>
<tbody>
<tr>
<td>IASI</td>
<td>0.1 K</td>
<td>1 K</td>
<td>0.2 K</td>
<td>O$_3$, H$_2$O</td>
</tr>
<tr>
<td>IASI-NG</td>
<td>0.15 K</td>
<td>1 K</td>
<td>0.1 K</td>
<td>Less interferences</td>
</tr>
</tbody>
</table>

Courtesy: LMD
To deal with the stronger requirements in terms of performances, a new instrumental concept has been proposed:

- The Mertz interferometer allows a field compensation (self-apodisation correction)
- Field compensation is achieved by introducing optics with correct optical index
- A single ‘dual swing” mechanism translates two pairs of prisms proportionally and creates simultaneously the OPD change and the self-apodisation compensation

- The level 1 processing has been modified consequently, especially to estimate the Instrument Spectral Response Function (ISRF)
Hard challenges but encouraging performances budgets

- Overview of the L1 processing

  - INSTR
  - Raw Images
    - OBP Image
    - Sum of raw images
    - OGP Image

  On-board

  - OBP Science
  - L0 Spectra $\epsilon \mathbb{C}$
  - Conventional Compression
  - Compressed L0 spectra $\epsilon \mathbb{C}$

  On-ground

  - Conventional decompression
  - Uncompressed L0 spectra $\epsilon \mathbb{C}$
  - OGP ISRFEM
  - OGP Science

- L1C atmospheric spectra
  - Spectrally and radiometrically calibrated
  - SRF removal (shift and shape) and Gaussian apodisation

- OBP Image
  - Sum of raw images

- OGP Image
  - Uncompressed L0 spectra $\epsilon \mathbb{C}$

- Geolocation of pixel center
- LOS geometry
- Radiance Classification within FOV
- Cloud, land/sea, ice fraction within FOV
Hard challenges but encouraging performances budgets

• The first system budget shows very encouraging results in terms of
  ✓ Geometric performances
  ✓ Spectral performances
  ✓ Radiometric performances
EPS-SG planning

- **EM INSTRUMENT**
  - EPS-SG System Development
  - MetOp-SG A Satellite Development

- **PFM**
  - EUMETSAT
  - EPS-SG PAYLOAD DATA ACQUISITION AND PROCESSING VALIDATION

- **Level 1C Operational Processor**
  - LIC POP V1
  - LIC POP V2
  - LIC POP V3

- **Science Data Algorithms**
Thank you ...