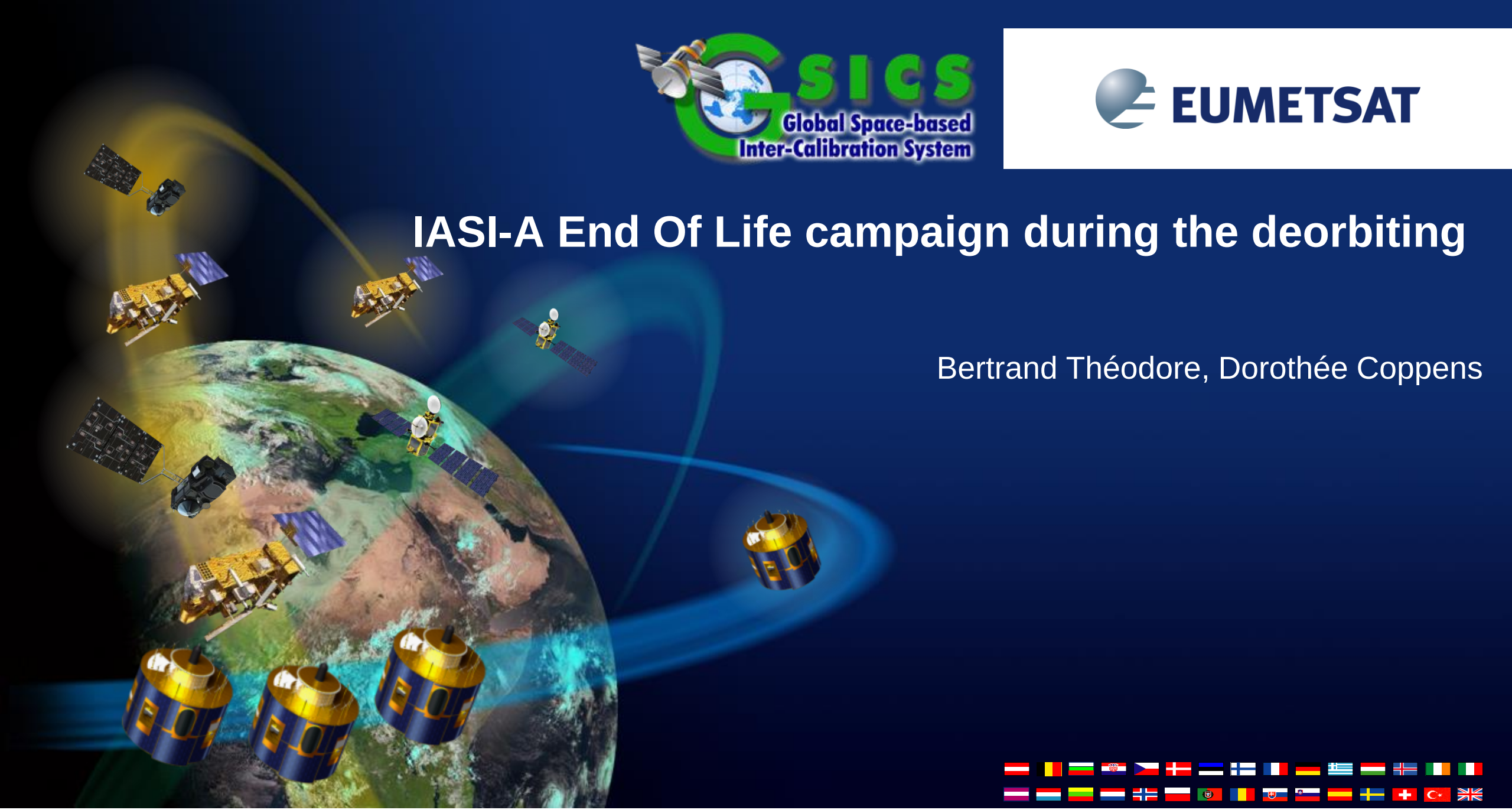


IASI-A End Of Life campaign during the deorbiting

Bertrand Théodore, Dorothée Coppens

IASI End Of Life Activities

Campaign #3
Tests with prolonged data outage
The instruments are well functioning

Campaign #4
Tests potentially risky for the instrument or the quality of the data
Products are not disseminated to the users

6 Sept	7-13 Sept	16 Sept-15 Oct	25-29 Oct	1-10 Nov	11-14 Nov	16-26 Nov	27 Nov
IASI-EOL-13 IASI redundancy Test the instrument redundancies: Instrument side B / Laser 2 and Instrument side B / DPC 5 Instr/Level-1 analyses	IASI-EOL-16 CSQ investigation To characterize more finely the CSQ anomalies ~~on nominal side and /or~~ redundant side, via modifications of CSQ thresholds Instr/Level-1 analyses	IASI-EOL-15 IASI supersampled mode Reduction of swath and increase of spatial sampling by modification of scan alpha law Level-1/Level-2 analyses	IASI-EOL-18 NedT improvement Reduce the dissipation of the detector for 1 pixel only, which would reduce the temperature and then the NedT Only CNES analyses	IASI-EOL-01 LFD release Release of the LFDs, reactivate the CD and assess the impact on IASI data quality Instr/Level-1 analyses	IASI-EOL-02 CD stop After IASI-EOL-01 (LFD released and CD active), stop again the CD and check the ghost effect and check data quality Instr/Level-1 analyses	IASI-EOL-03 Inter calibration Acquire Simultaneous Nadir Observations of IASI-A, B and C for data post-evaluation Level-1/Level-2 analyses	IASI-EOL-17 Deep space acquisition Perform an External Calibration during the Back-flip manoeuvre to acquire limb view measurements Instr and Level-1/Level-2 analyses

IASI end of mission

De-orbiting

EOL-03: Inter-calibration using SNOs

Purpose:

- **Take advantage of the Metop-A de-orbiting manoeuvres to acquire Simultaneous Nadir Observations of IASI-A, B and C**
- **Allowed for the first time direct IASI inter-comparisons that was impossible in routine operations due to the time separation (50 minutes) of the spacecrafts**

Inter-comparisons can be performed by:

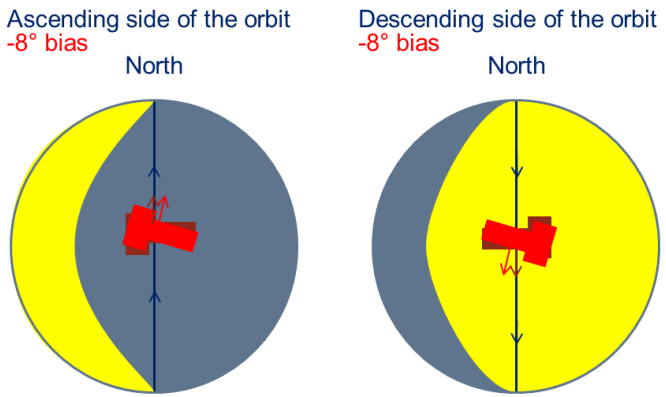
- **1 to 1 comparisons of the closest acquisitions. However**
  - **Limited number of overlapping pixels**
  - **Limited number of uniform pixels**
- **Averages over the region where the orbits cross**
  - **Large (>1000) number of pixel**
  - **Implies that <IASI-A – IASI-B/C> = <IASI-A> - <IASI-B/C> is valid**

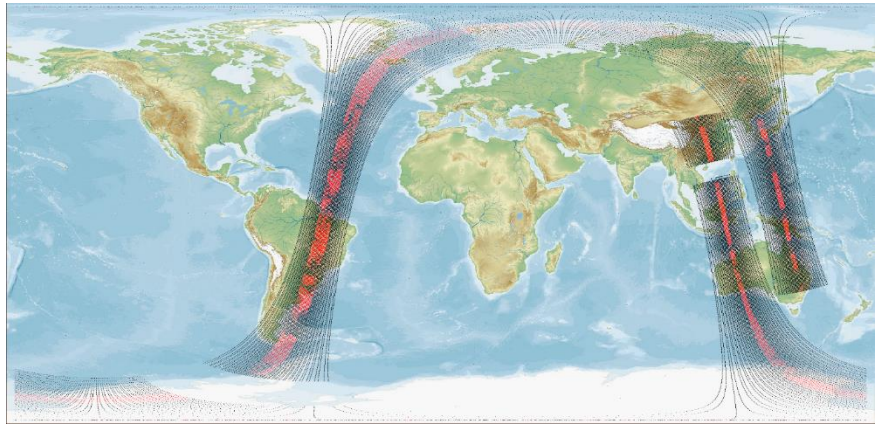
EOL-03: Inter-calibration using SNOs

- **Five IASI-A/IASI-B and three IASI-A/IASI-C SNOs occurred between the 19th and the 25th November 2021 both both the Artic and the Antartic**

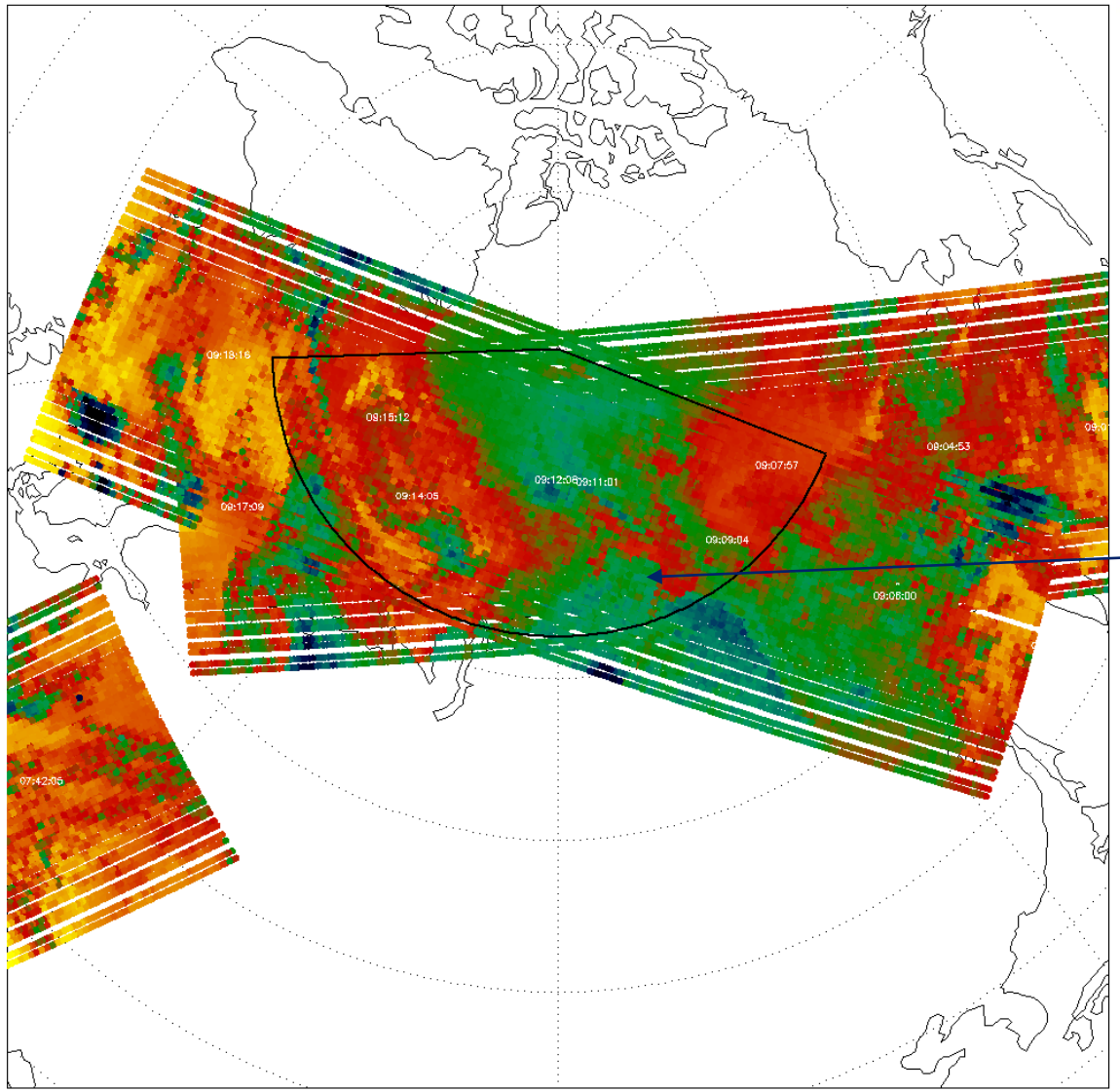
- **For the de-orbiting manoeuvre, the platform was biased in yaw. This means that:**

  - **the Doppler effect was not compensated for anymore**
  - **the co-registration IASI/AVHRR failed at the edges of the swath ➔ impact on the cloud fraction estimation**





EOL-03: Inter-calibration using SNOs



IASI-B

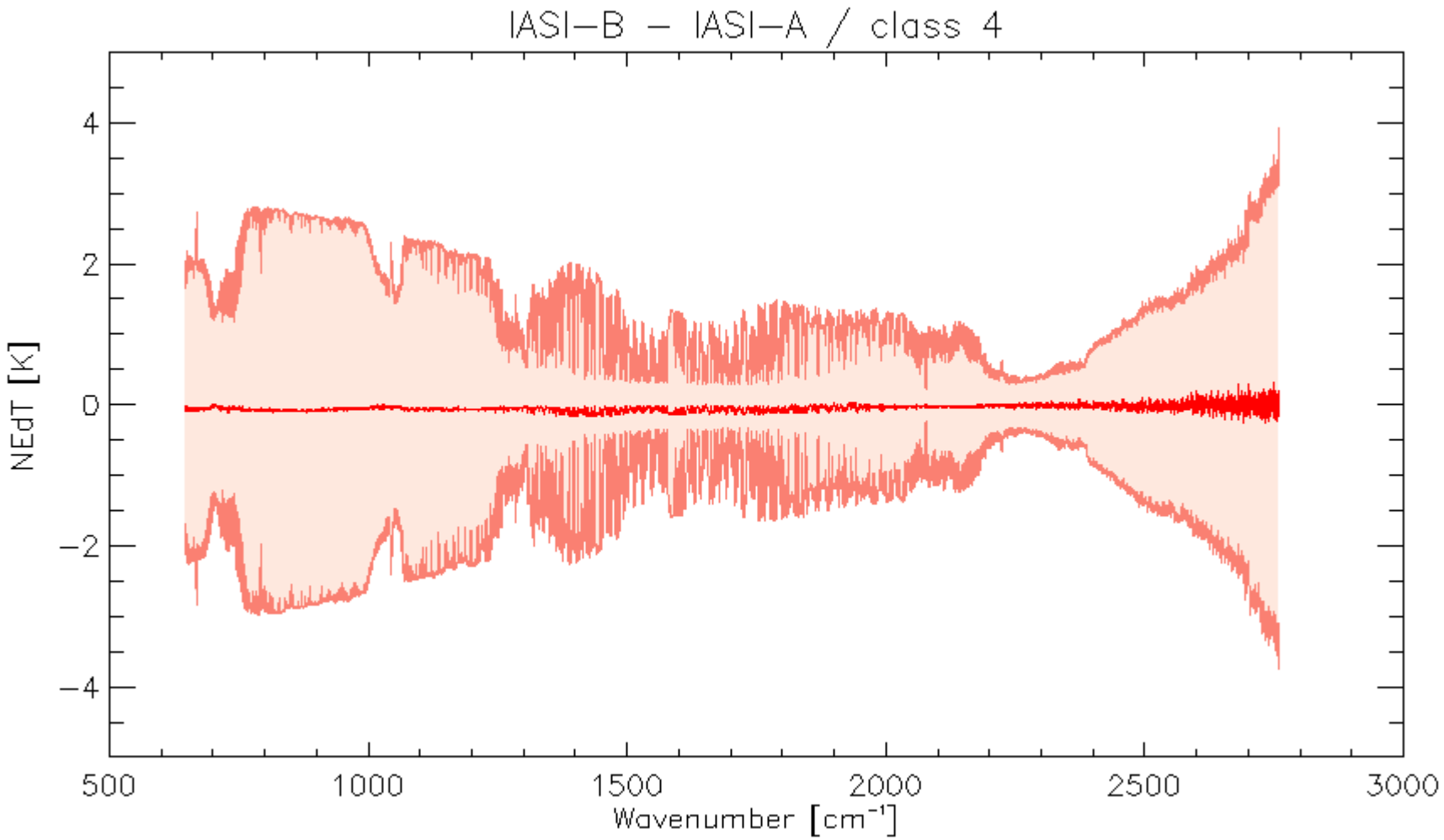
ROI

IASI-A

The case of the SNO IASI-A/IASI-B on 19th Nov. 09:11 UTC

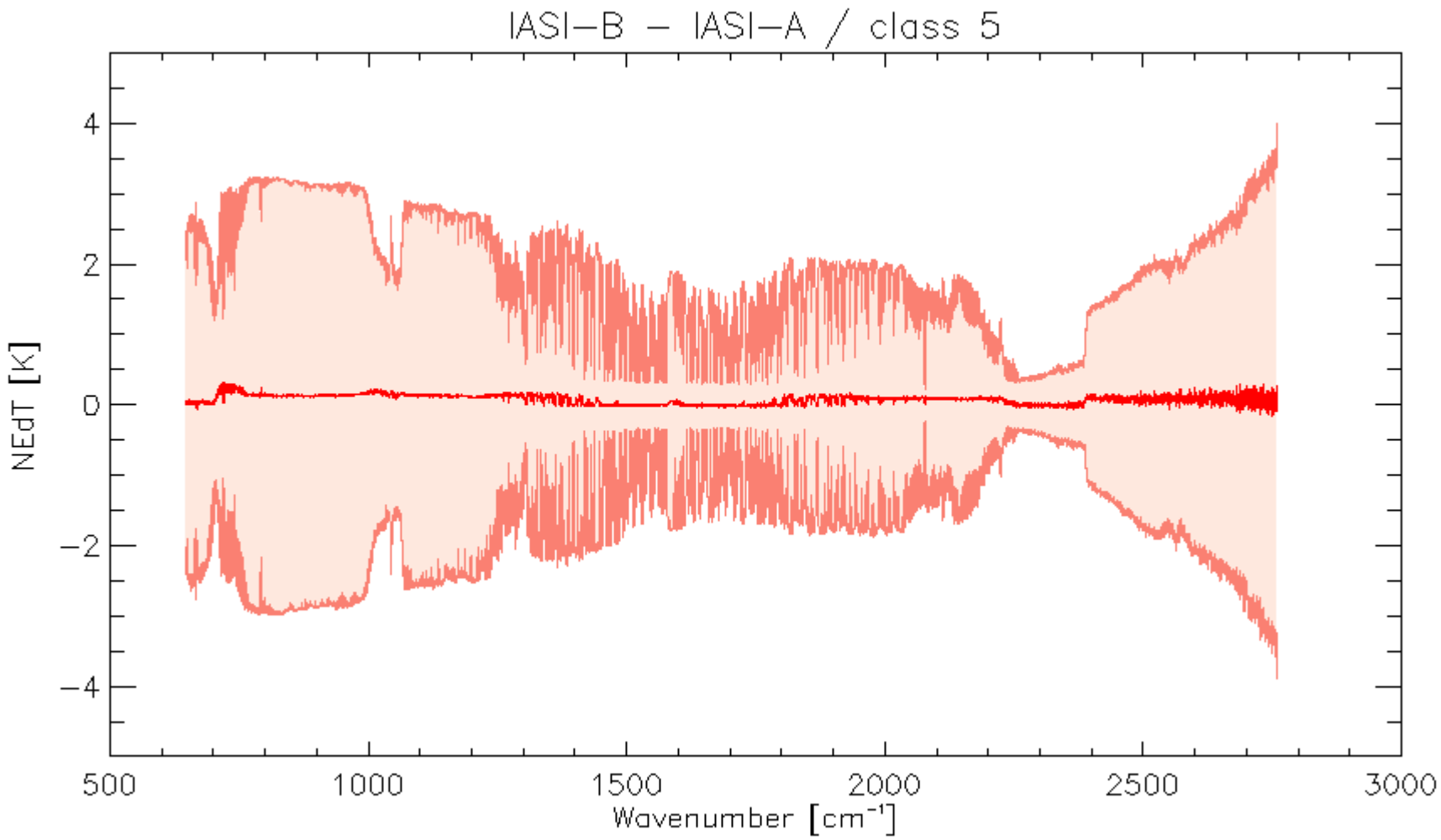
The radiances of all pixels within the ROI are averaged depending on the scene temperature

EOL-03: Inter-calibration using SNOs



Temperature class: 240-250K

EOL-03: Inter-calibration using SNOs



Temperature class: 250-260K

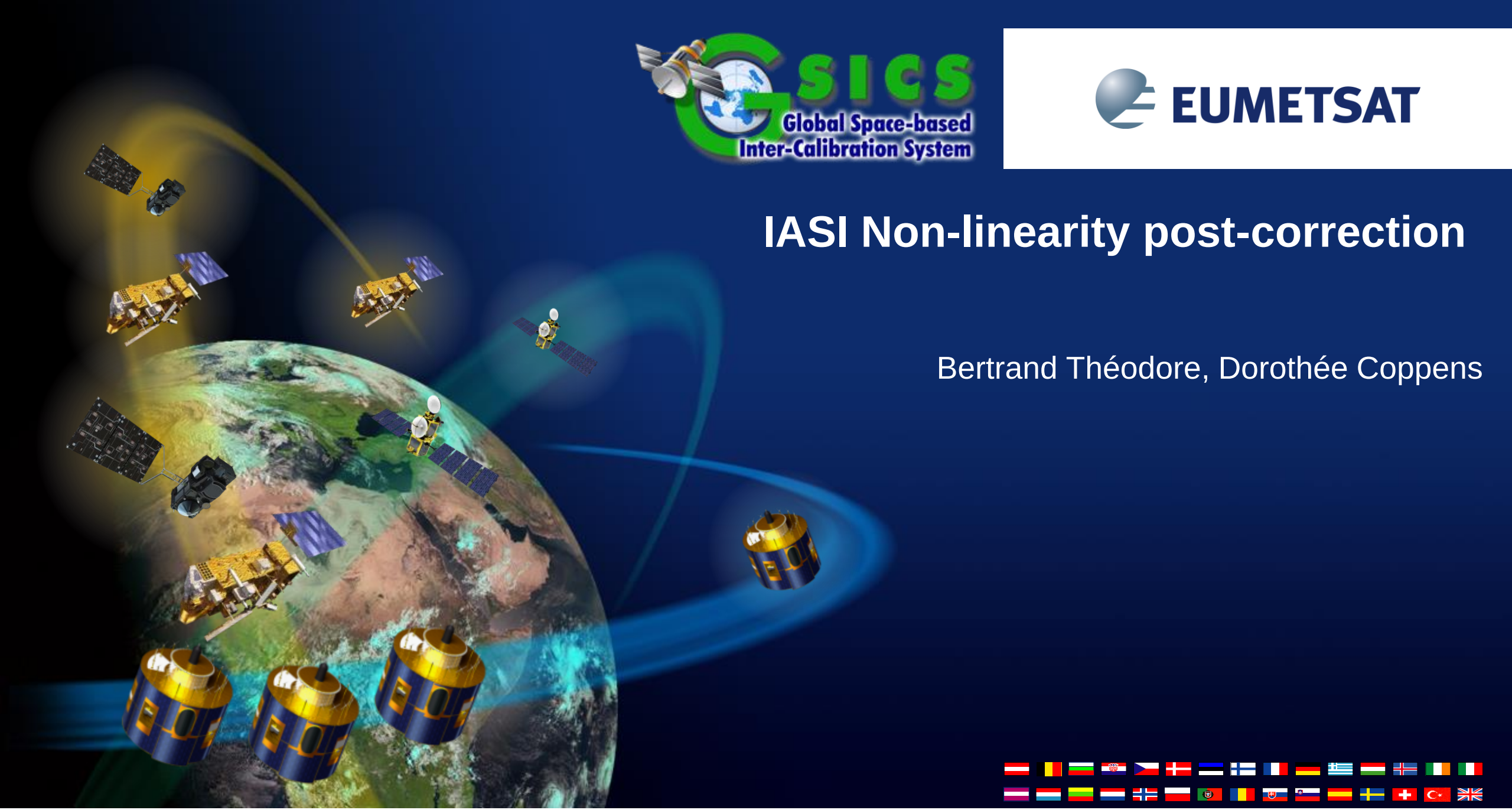
Conclusion

Already very promising results!

All end-of-life analysis will be completed by the end of June 2022

The data were not disseminated. If you want to access the data, please send a request to: ops@eumetsat.int

Thank you for the attention!



IASI Non-linearity post-correction

Bertrand Théodore, Dorothée Coppens

Introduction

Rationale:

- **The design of hyperspectral IR instruments implies different calibration and correction processes**

- **But some features are common to all instruments, such as:**
  - ✓ **The non-linearity of the detectors that depends on the type of the detector material**
  - ✓ **The etalon effect which can occur in the optical system in many hyperspectral IR instruments and be seen in their measurements**

→ **Developing corrections for both instrument effects would improve data quality and be beneficial to users**

Non-linearity correction

Status:

- ✓ For all hyperspectral instruments, the non-linearity correction is done in the on-board processing on raw interferograms
- ✓ The on-ground processing does not have access to the raw interferograms ➔ this makes an exact correction impossible
- ✓ Reprocessing of the non-linearity correction is not possible

Open questions:

- ✓ Is it possible to remove *a posteriori* the residual non-linearity in the ground processing (i.e. when the information on the original signal has been lost)?
- ✓ If yes, it would then be possible to post-process or reprocess any L1 hyperspectral radiance products, including aspects related to non-linearity

Non-linearity correction

Under a contract with EUMETSAT, SPASCIA has proposed a correction algorithm:

$$S\_corr\ (\nu) = S(\nu)\cdot(1-(2\cdot\varepsilon(A2)\cdot(V\_EW-V\_BB\ ))-(3\cdot\varepsilon(A3)\cdot([\![V\_EW]\!]\text{^}2-[\![V\_BB]\!]\text{^}2\ )))$$

$\varepsilon(A2)$= Estimation error of the quadratic term of the non-linearity correction.
$\varepsilon(A3)$= Estimation error of the cubic term of the non-linearity correction.
V_EW= Earth view interferograms base line.
V_BB= Black body interferograms base line.

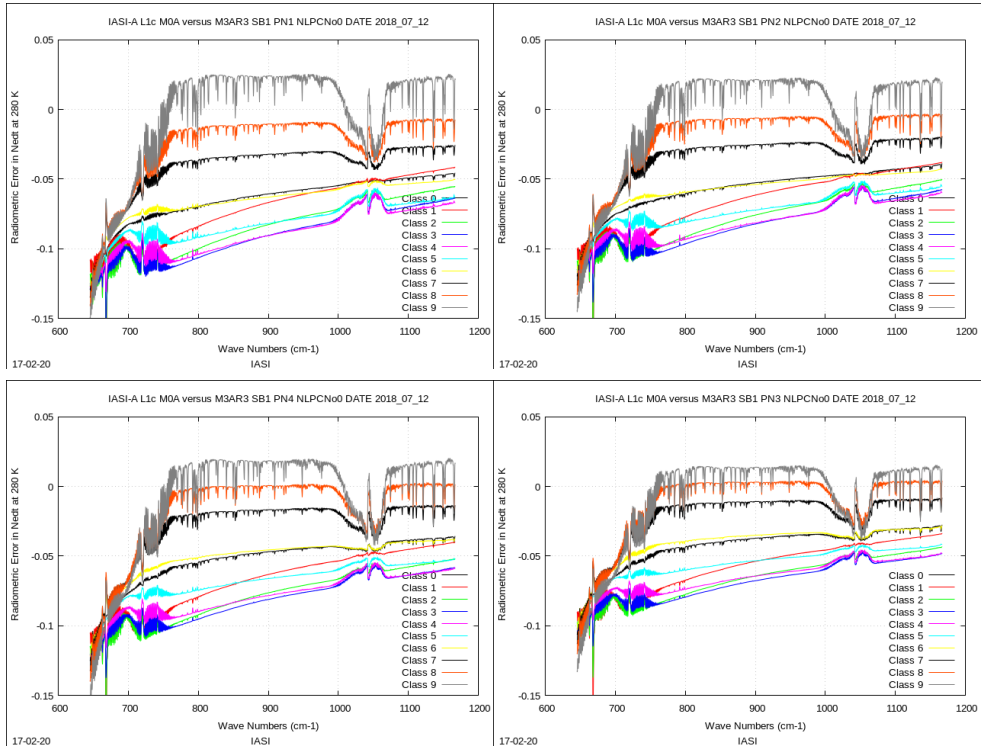
It means:

- ✓ **The correction is post-processing, using calibrated spectra**
- ✓ **The correction requires the knowledge of the interferogram baseline**
- ✓ **The BB temperature is needed to compute the BB spectrum**

Non-linearity correction – validation using IASI

IASI-A: Average error per class:

Before correction



Scene temp. [K]

T < 220

225 K

235 K

245 K

255 K

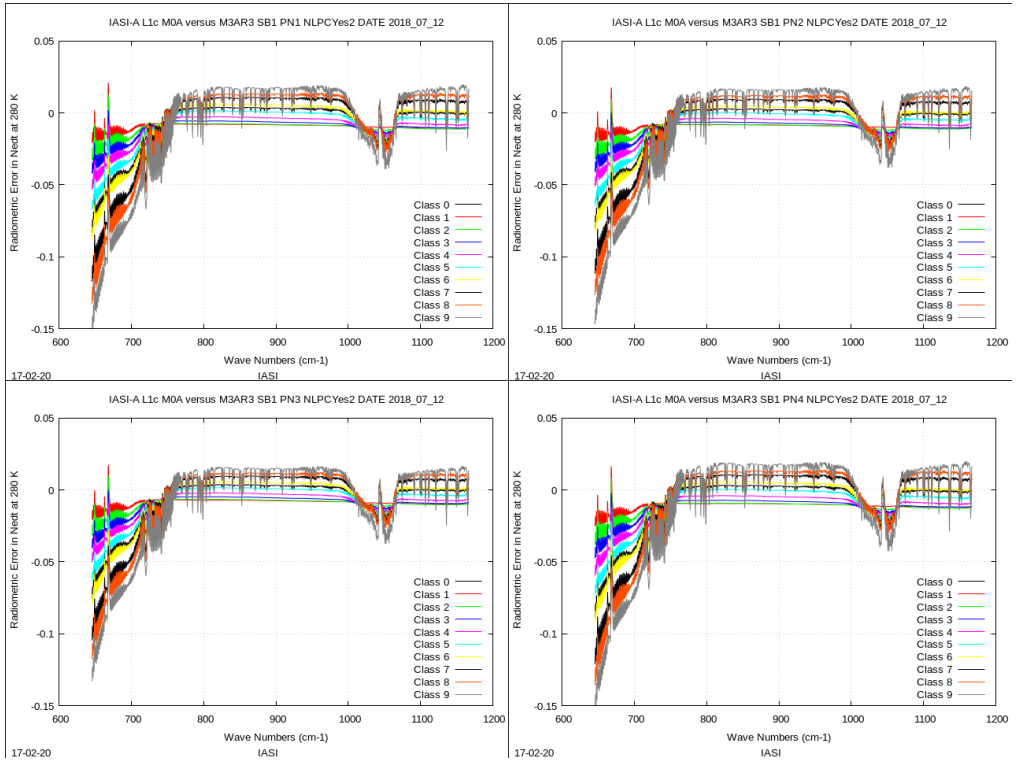
265 K

275 K

285 K

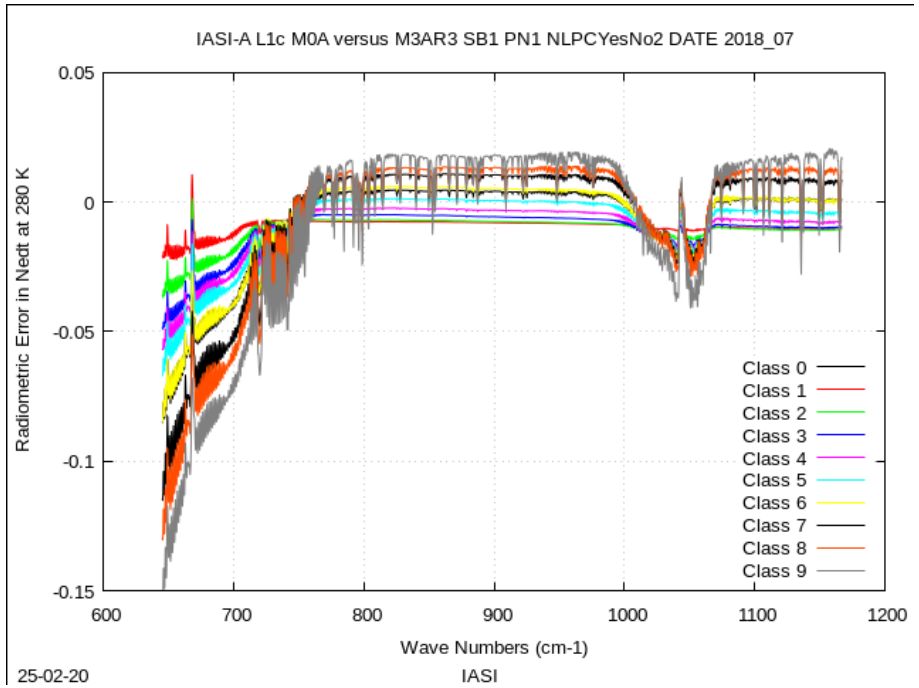
T > 290 K

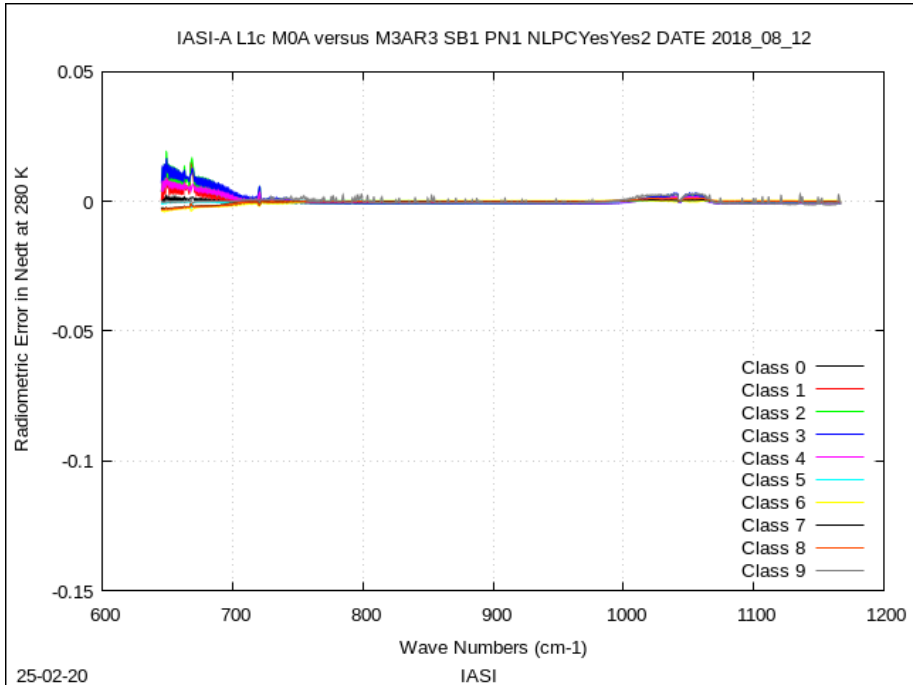
After correction



Non-linearity correction – validation using IASI

- ✓ **Residual Errors can be interpreted as a bias**
- ✓ **Each spectrum is bias corrected with respect to its atmospheric class**



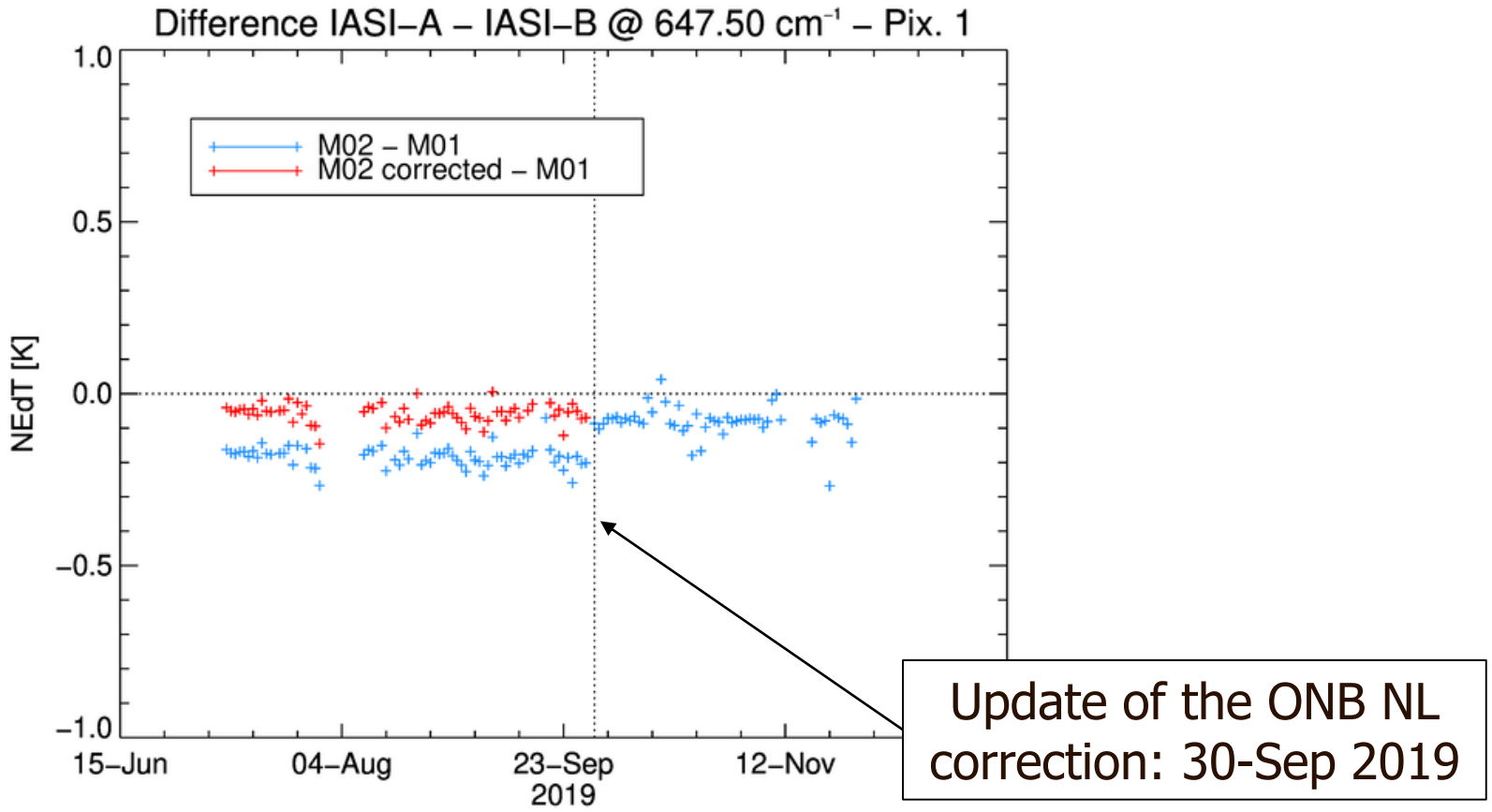


Scene temp. [K]

- T < 220 K
- 225 K
- 235 K
- 245 K
- 255 K
- 265 K
- 275 K
- 285 K
- T > 290 K

Non-linearity correction – validation using IASI

Checking the consistency IASI-A/IASI-B using IASI spectra averages:



Conclusion

- ✓ **The post-correction + the bias removal works almost perfectly and allows a time-consistent dataset over the whole instrument lifetime**
- ✓ **This method is being tested to see if this can be used in the reprocessing of IASI L1c on both Metop-A and Metop-B**
- ✓ **If all good, the IASI L1c reprocessed products will be made available by the end of 2022/beginning 2023.**