



# EUMETSAT activities for IASI-C Commissioning

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31/10/2019

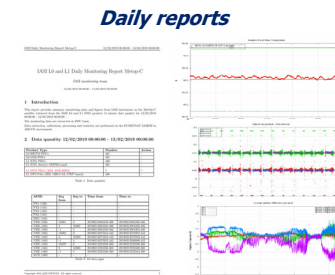


# Context

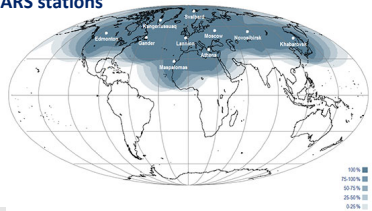
## Infrared Atmospheric Sounding Interferometer on Metop-C

### The role of IASI L1 science team during the commissioning of IASI-C:

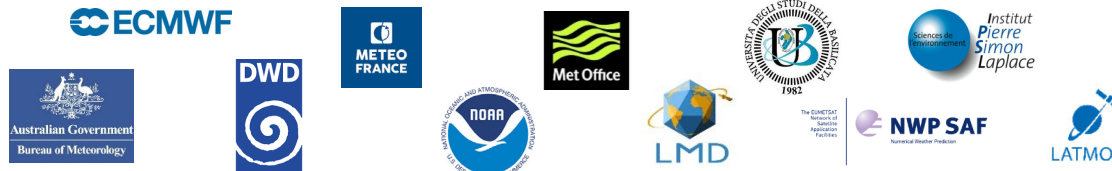
- Support CNES activities
  - Weekly Teleconf meeting with the TEC
  - coordinate/verify install of Aux Files + impact studies
- Daily Monitoring full check of IASI-C quality data
  - Daily reports (flags, obs-calc)
  - Additional Monitoring tools (IRMA ...)
- Support the operations
  - ⇒ Anomalies, manoeuvres, dissemination ...
- Support the users and IASI EARS (regional processing)
  - Inform and deliver updates (info, files ...)
  - Examine and rationalize users' Feedbacks (after the dissemination start)



EARS stations



Users

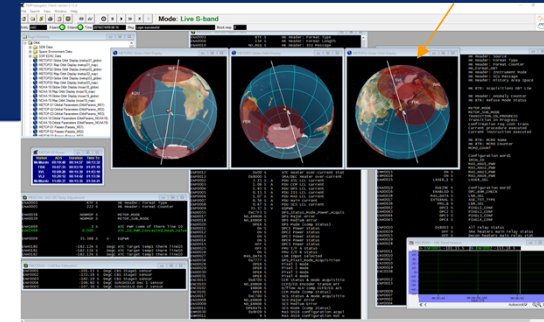


# First heart beats of IASI-C

## Interferogram & spectra



Metop-C



IASI-C is operated by EUMETSAT, from Darmstadt (Germany)

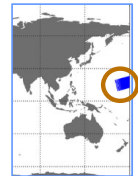
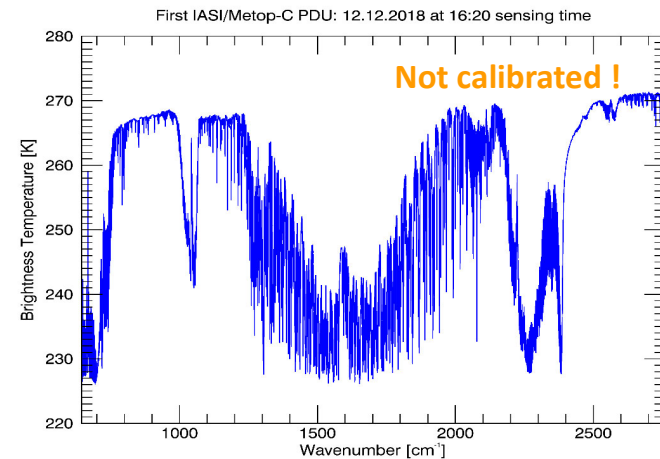
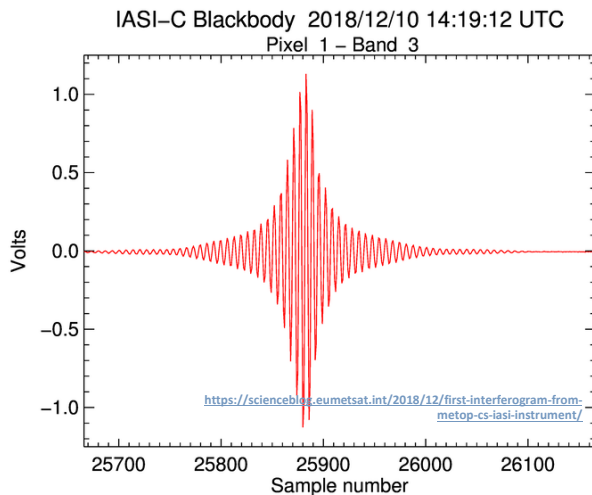
From the Ground Segment (GS):

After several weeks of decontamination/outgasing ...

IASI-C has been switched on - 10/12/2019 😊 => 1<sup>st</sup> Interferogram

Processing has been started - 12/12/2019 😊 => 1<sup>st</sup> spectra

First IASI-C data processed at EUMETSAT:



# IASI-C commissioning

## Key dates

From 10/10/2019 to 01/07/2019:

13 updates => 9 TOP upload + 4 on ground install along the Cal/Val period

- 10/12: 1<sup>st</sup> Interferogram (without on-board processing)
- 12/12: 1<sup>st</sup> Spectra (with on-board processing)
- 14/12: CD Stop
- 17/12: On-board update → Coding Tables (Moon + EW + SM)

*Christmas Break*

- 4/01: On-board update → Reduced Spectra for radiometric calibration
- 8/01: Instrument anomaly
- 18/01: ARB#4 → IASI to be switched to Redundant Side B
- 25/01: Back to Normal Op and full Check
- 01/02: On-board update → Full update for Side B
- 05-07/02: First special EW External Calibration
- 25/02: On-board update → Reduced spectra for radiometric calibration

### Dissemination:

- Special Trial Dissemination (to partners) → 8 April 2019
- Pre-Operational Trial Dissemination (all users) → 10 May 2019
- Full Dissemination & end of Cal/Val → 1 July 2019

December 2018

January 2019

February 2019

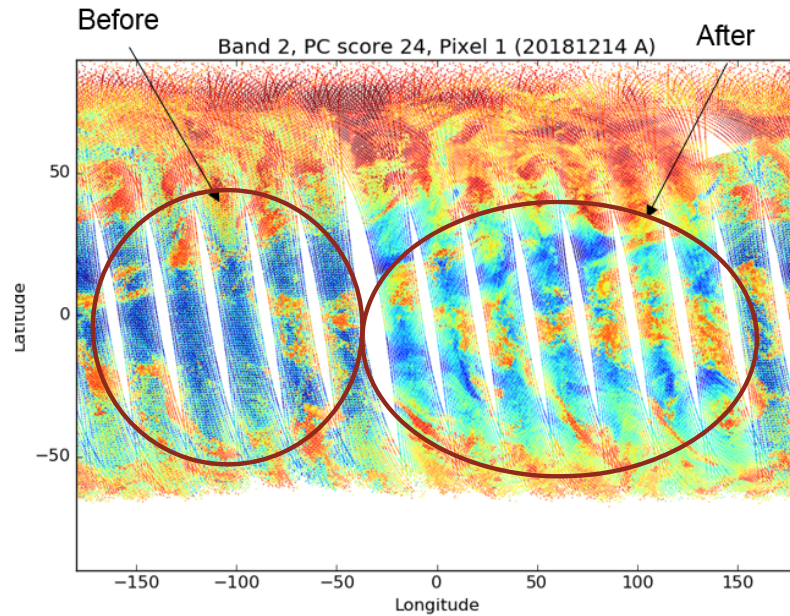
April/May/June  
2019

# IASI Operations & monitoring

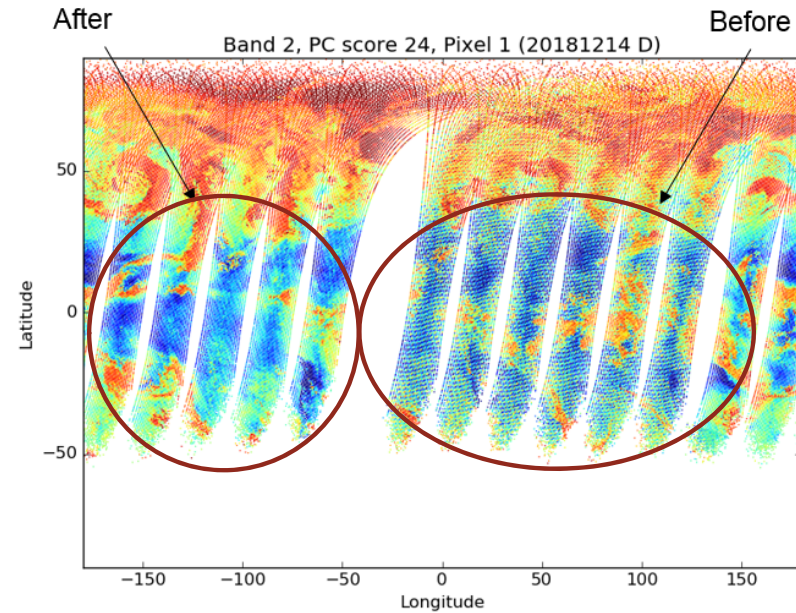
## Impact of CD stop

17/12/2018: CD stop => Reduction of the ghost effect visible on PC scores

Ascending orbits



Descending orbits



# IASI Operations & monitoring

## Uploads and GS install

Example: Impact of BRD#8, GRD#2 and ODB#2 (after the switch Side B)

### 1) CNES is delivering Aux Files

Dear all

Please note that we have just sent all the requests corresponding to the delivery of the ground parameters.

This delivery includes the BRD, GRD and ODB files:  
 IASI\_BRD\_xx\_M03\_20190131180000Z\_xxxxxxxxxxxxxxZ\_20190131170359Z\_IAS\_T\_0000000000  
 (IDeFIDConf = 7)  
 IASI\_GRD\_xx\_M03\_20190131180000Z\_xxxxxxxxxxxxxxZ\_20190131170624Z\_IAS\_T\_0000000000  
 (IDeFStableParamID = 2)  
 IASI\_ODB\_xx\_M03\_20190131180000Z\_xxxxxxxxxxxxxxZ\_20190131170407Z\_IAS\_T\_0000000000 (IDeFSDB = 2)  
 IASI\_CHR\_xx\_M03\_20190131180000Z\_xxxxxxxxxxxxxxZ\_20190131170359Z\_IAS\_T\_0000000000

Content of the TOP files is:  
 Quality threshold for the complex radiometric calibration,  
 IIS/AVHRR offset guess, sounder/ISS offsets,  
 Scan mirror reflectivity coefficients, Y/Z filtered interferometric axe guess, NZpd inter-pixel,  
 Parameters linked to IPSF (Instrument Point Spread Functions) and natural phases, grid for ODB function computation,  
 thresholds for admissible spectral shifts.

Best regards  
 IASI TEC Team

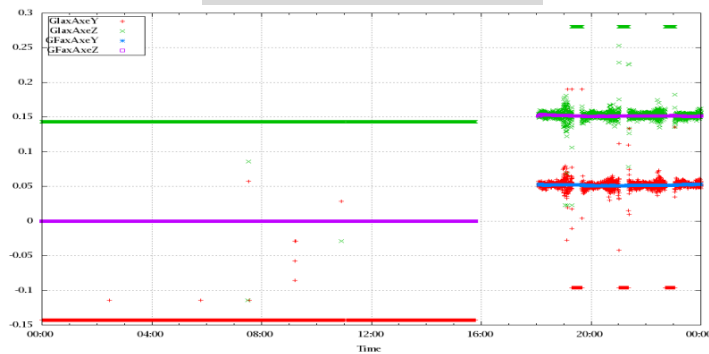
### 2) Top Upload from the GS

Time	Transition from	Transition to
01/02/2019 00:00:13	-	Normal operation
01/02/2019 11:02:37	Normal operation	Auxiliary ASE synchronised
01/02/2019 11:04:29	Auxiliary ASE synchronised	External calibration
01/02/2019 15:48:13	External calibration	Auxiliary ASE synchronised
01/02/2019 15:49:17	Auxiliary ASE synchronised	Heater 2
01/02/2019 15:50:21	Heater 2	Heater 1 warm up
01/02/2019 15:51:09	Heater 1 warm up	Heater 2
01/02/2019 16:24:29	Heater 2	Auxiliary ASE synchronised
01/02/2019 16:57:33	Auxiliary ASE synchronised	Normal operation

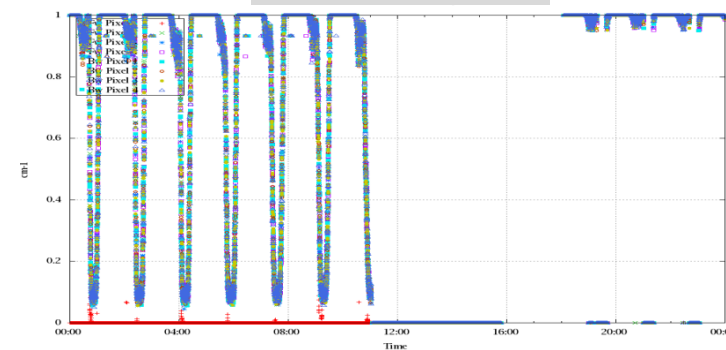
Table 3: Instrument modes

### 3) Monitoring the impact

Optical axis position – Fw scan



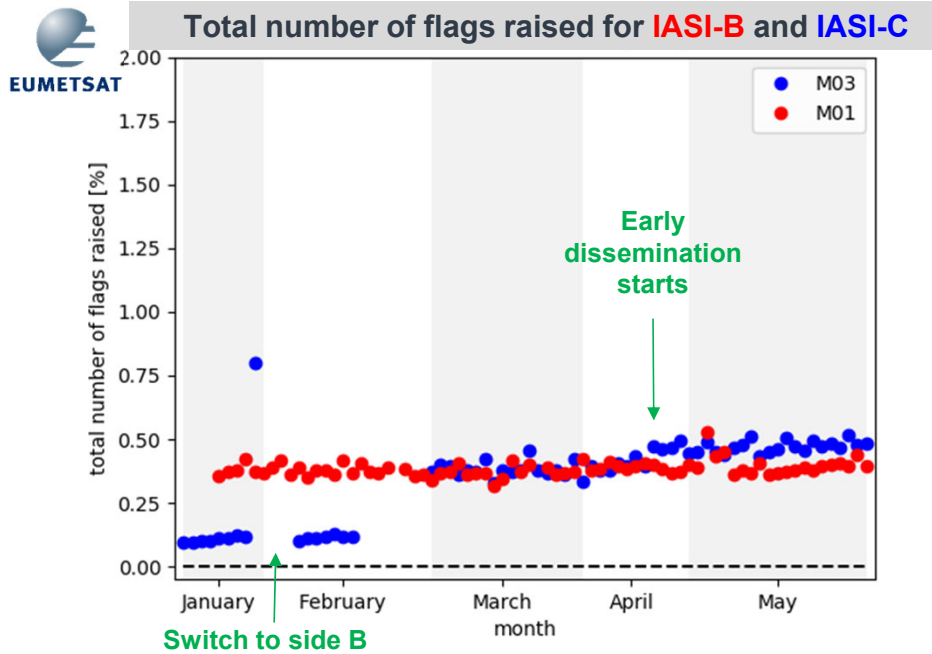
Mean spectral shift quality



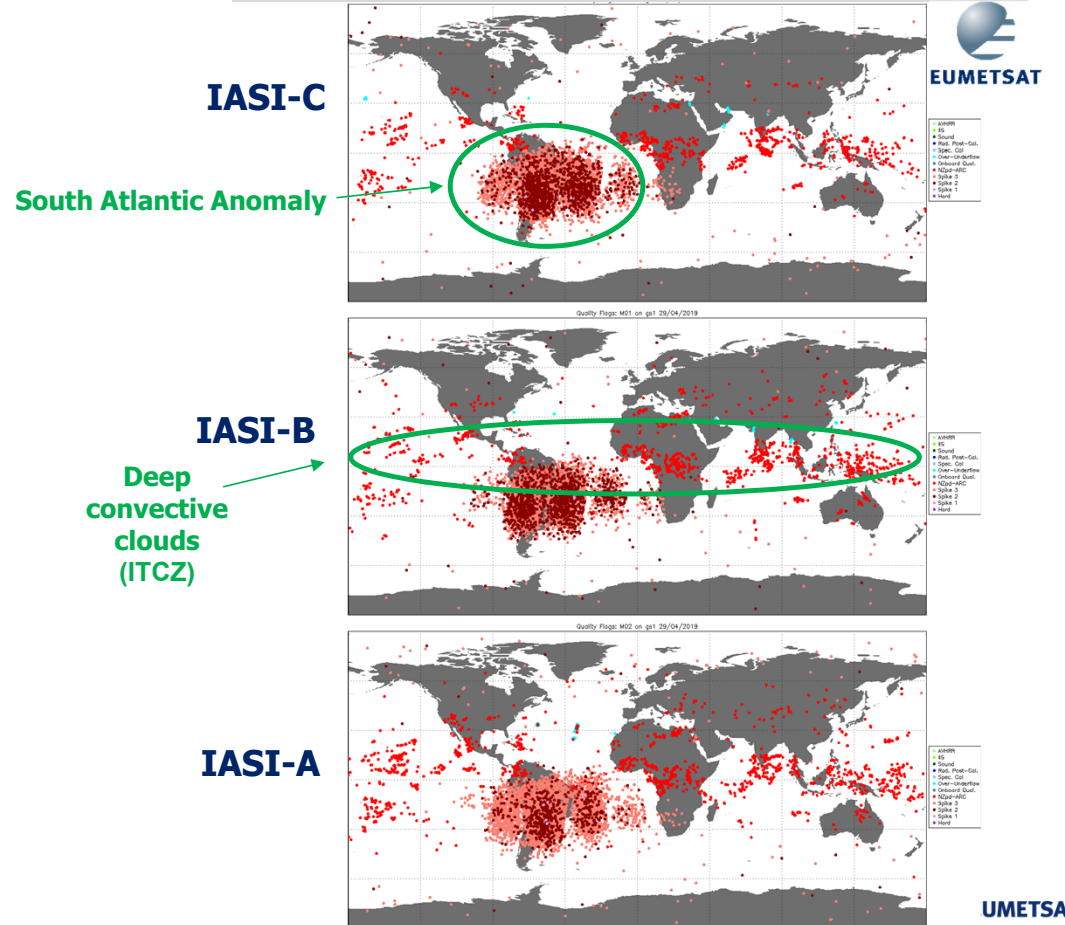
# IASI Operations & monitoring

## Onboard & on-ground quality flags checks

### Daily monitoring of flags during the cal/Val



Maps of flags raised for IASI-B and IASI-C  
29/04/2019



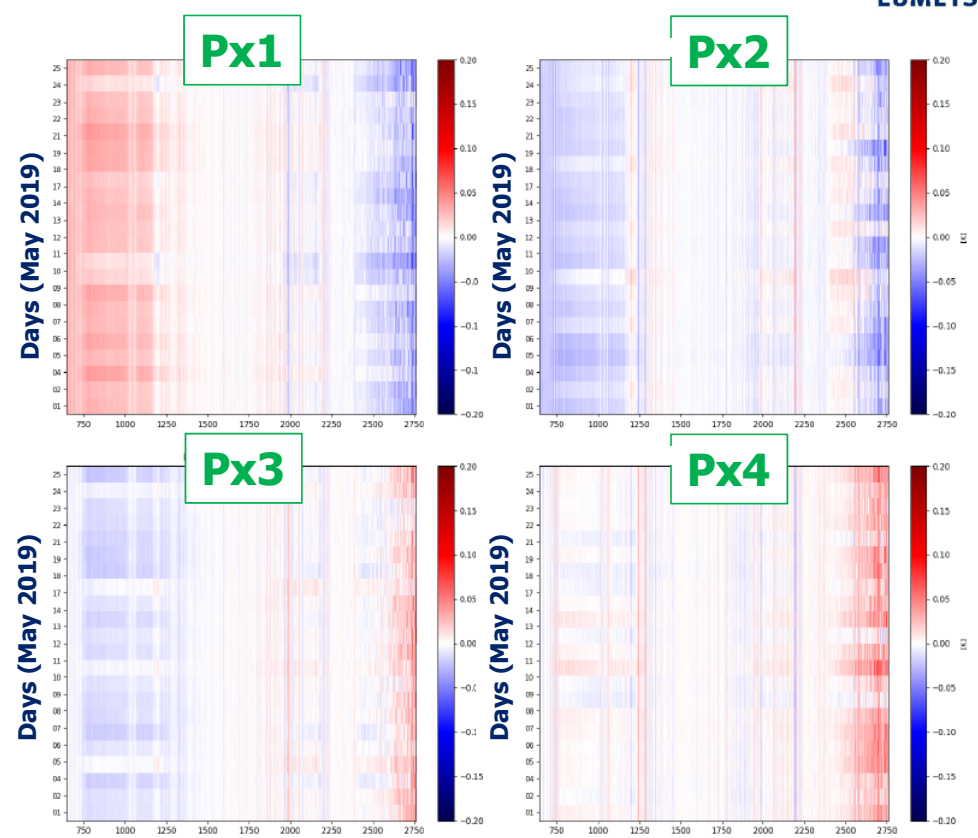
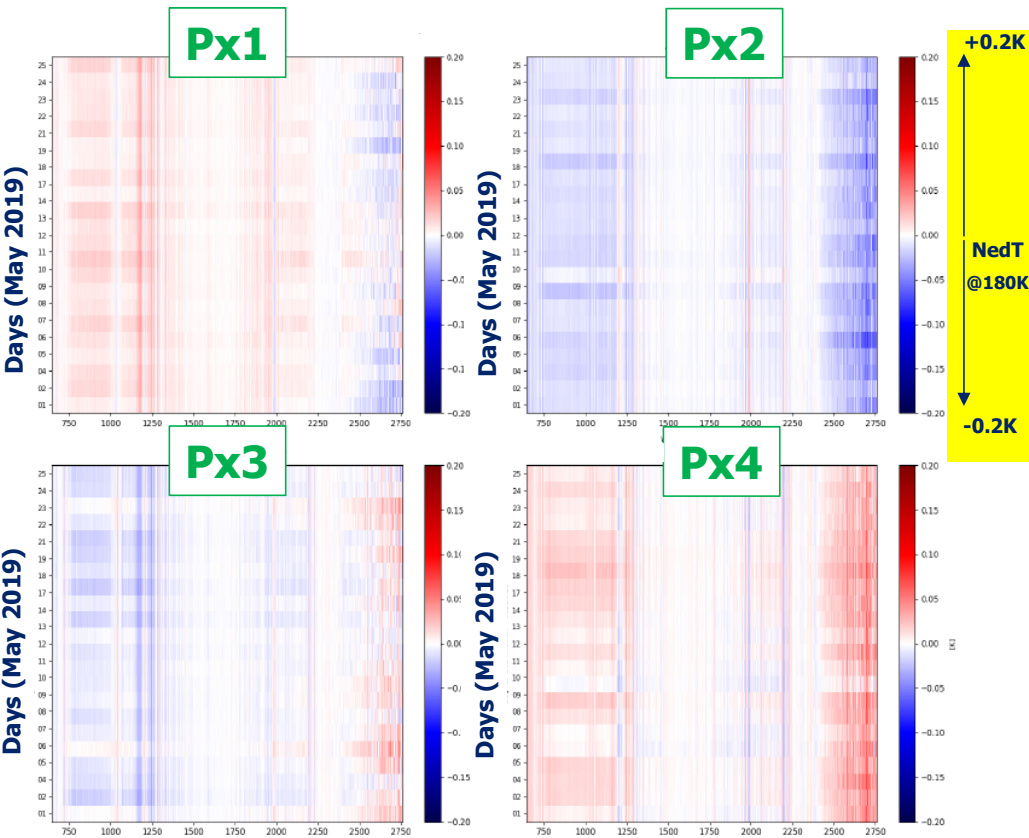
# Additional studies

## Pixel difference monitoring

Metop-B

$$Px_i - \overline{Px_{all}}$$

Metop-C



8 Wavenumber (cm-1) Canada, 31 October 20 Wavenumber (cm-1)

Wavenumber (cm-1)

Wavenumber (cm-1) IMETSAT



# Additional studies

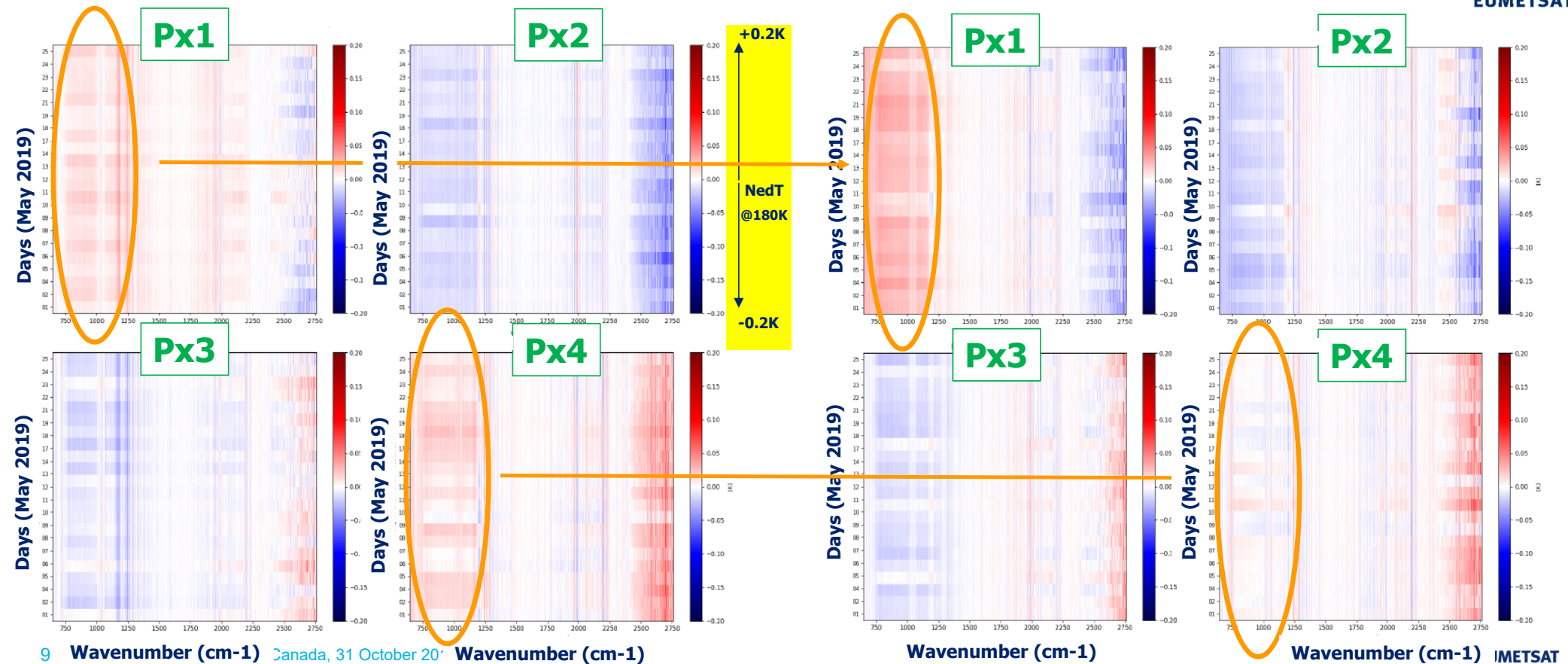
## Pixel difference monitoring



Metop-B

$$Px_i - \overline{Px_{all}}$$

Metop-C



9 Wavenumber (cm-1) Canada, 31 October 20 Wavenumber (cm-1)

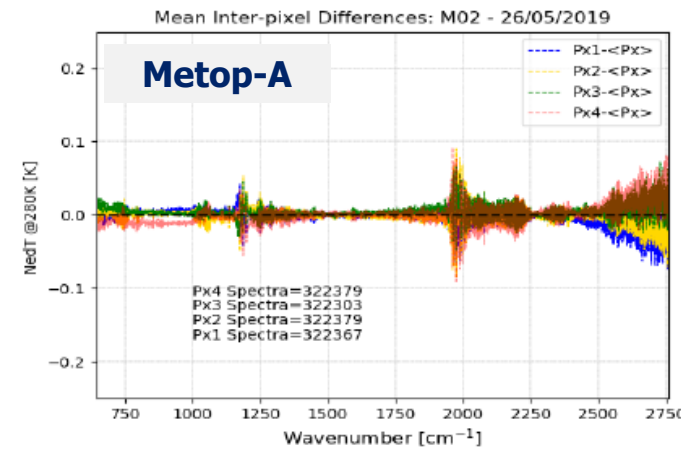
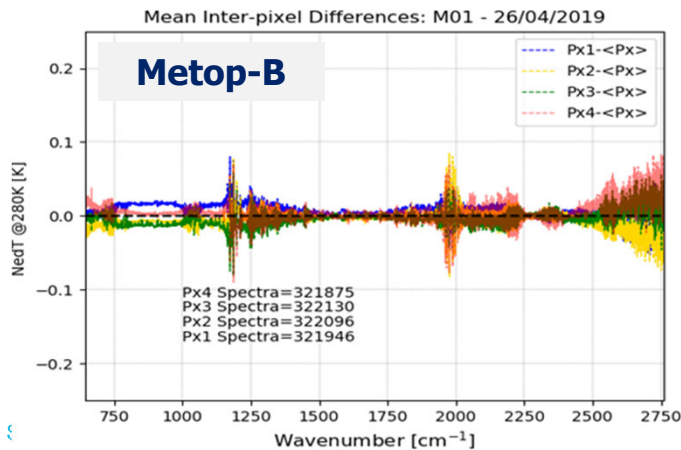
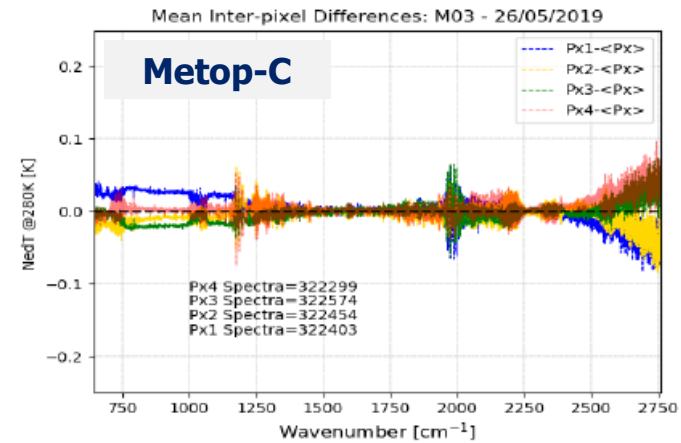
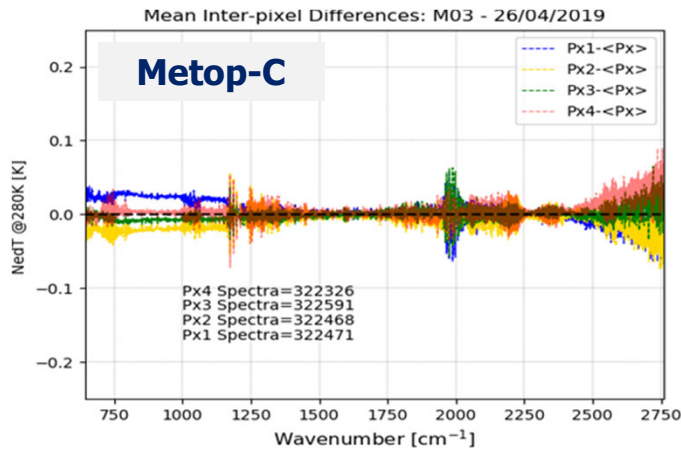
Wavenumber (cm-1)

Wavenumber (cm-1) EUMETSAT

# Additional studies

## Pixel difference monitoring

### Daily Mean IASI-C NedT by pixel vs Avg All pixels

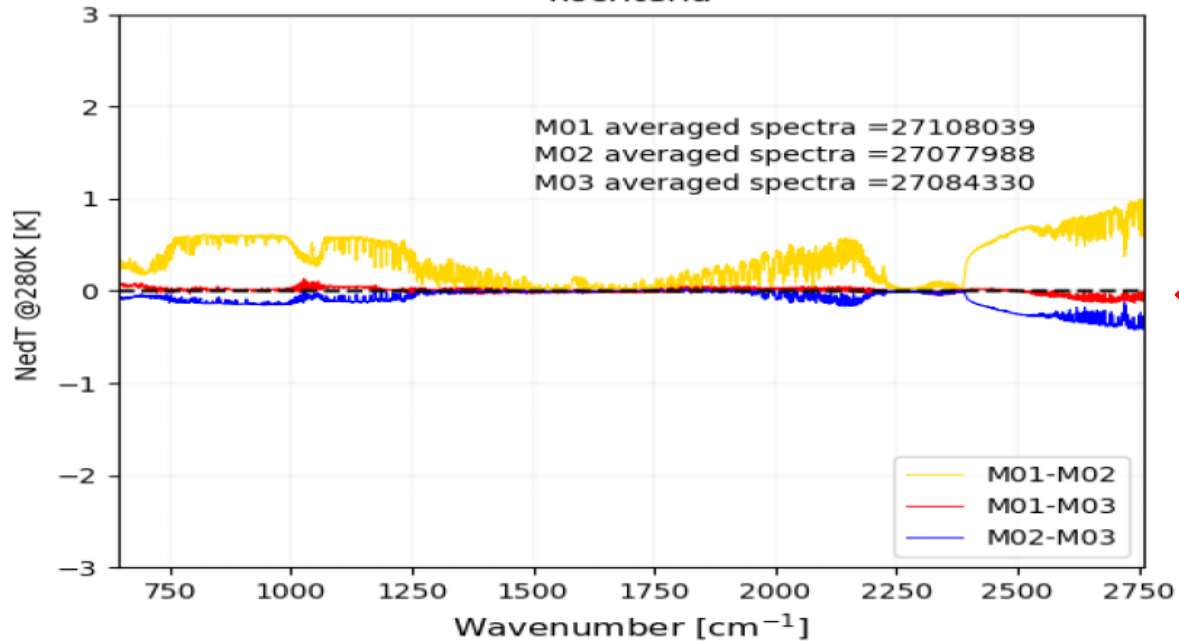


# Additional studies

## Massive averages

Averaged radiance difference between IASI-A, IASI-B and IASI-C

Average Radiance Differences Between Platforms: from 01 to 26/05/2019  
nocriteria



**Very good agreement between IASI-C and IASI-B!**

**May 2019**

# Additional studies

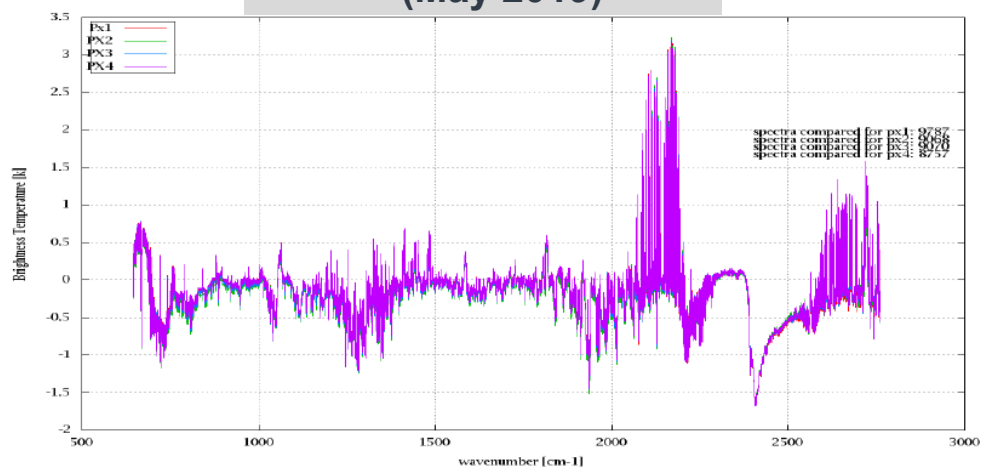
## OBS-CALC

### Evaluation of OBS-CALC

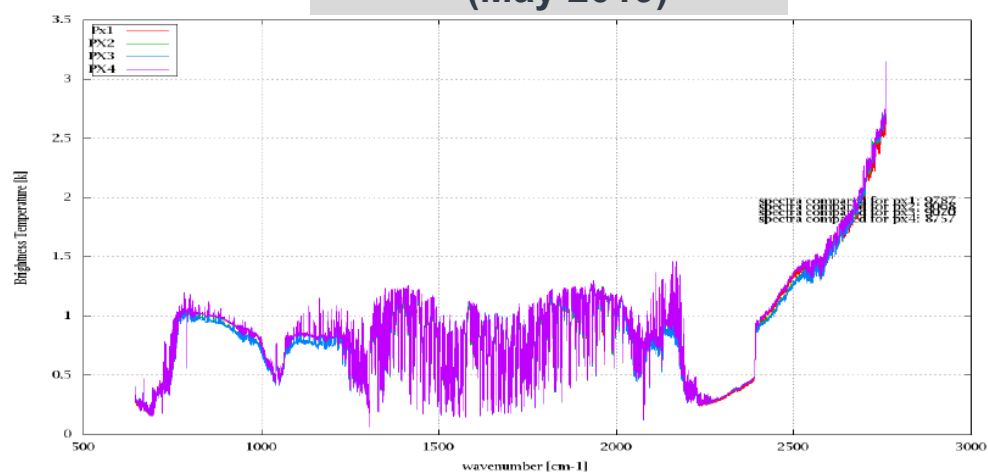
**OBS:** IASI observed radiances

**CALC:** IASI calculated radiances (NWP atmo profiles + RT model)

Mean OBS-CALC  
(May 2019)



Stdev OBS-CALC  
(May 2019)



# User Feedback

## Cal/Val partners

- Early dissemination started on the 8<sup>th</sup> of April 2019
- Cal/Val Partner and contribution:

Partner	Subject of support	POC	Status	Products	Expected Feedback	Service Network
<b>ECMWF</b>	Monitoring and assimilation	<a href="mailto:Tony.McNally@ecmwf.int">Tony.McNally@ecmwf.int</a> <a href="mailto:Reima.Eresmaa@ecmwf.int">Reima.Eresmaa@ecmwf.int</a>	Agreed	IASI L1C data with collocated AVHRR	Monitor radiance residuals (OBS-GUESS) RT model RTTOV Global	TERR
<b>MetOffice UK</b>	Monitoring and assimilation	<a href="mailto:Fiona.Smith@bom.gov.au">Fiona.Smith@bom.gov.au</a> <a href="mailto:chawn.harlow@metoffice.gov.uk">chawn.harlow@metoffice.gov.uk</a>	Agreed	IASI L1C	Monitor radiance residuals (OBS-CALC) RT model RTTOV Global + Regional ?	EUMETCast
<b>Météo-France</b>	Monitoring and assimilation	<a href="mailto:francois.mahfouf@meteo.fr">francois.mahfouf@meteo.fr</a> <a href="mailto:Vincent.Guidard@meteo.fr">Vincent.Guidard@meteo.fr</a>	Agreed	IASI L1C	Monitor radiance residuals (OBS-CALC) Global + Regional RT model RTTOV	EUMETCast
<b>DWD</b>	Monitoring and assimilation	<a href="mailto:Christina.Koepken@dwd.de">Christina.Koepken@dwd.de</a> <a href="mailto:Harald.Anlauf@dwd.de">Harald.Anlauf@dwd.de</a>	Agreed	IASI L1C	Monitor radiance residuals (OBS-CALC) RT model RTTOV Global	EUMETCast
<b>NOAA</b>	Monitoring and assimilation	<a href="mailto:jim.silva@noaa.gov">jim.silva@noaa.gov</a> <a href="mailto:Andrew.Collard@noaa.gov">Andrew.Collard@noaa.gov</a> <a href="mailto:Antonia.Gambacorta@noaa.gov">Antonia.Gambacorta@noaa.gov</a> <a href="mailto:lettia.soulliard@noaa.gov">lettia.soulliard@noaa.gov</a>	As partner	IASI L1C	Monitor radiance residuals (OBS-GUESS) RT model CRTM Use L1C product to run the NOAA L2 processor	TERR FTP (1day)
<b>Univ. Basilica</b>	Monitoring	<a href="mailto:carmine.serio@unibas.it">carmine.serio@unibas.it</a>	Agreed	IASI L1C	Inspect Observation error covariance matrix and potential drift check if NeDT stay within specifications	FTP (1day)
<b>IPSL</b>	Monitoring and statistics	<a href="mailto:Cathy.Clerboux@latmos.ipsl.fr">Cathy.Clerboux@latmos.ipsl.fr</a> <a href="mailto:claupe.camy-peyret@upmc.fr">claupe.camy-peyret@upmc.fr</a>	Agreed	IASI L1C	Metop-A/-B/-C intercomparison through massive averaging (over 1 month of data) and stratified against latitude band, pixel, SN, clear/cloudy/mix. RT model 4A	EUMETCast <a href="mailto:Cathy.Boonne@ipsl.jussieu.fr">Cathy.Boonne@ipsl.jussieu.fr</a> Yes
<b>LMD</b>	Monitoring	<a href="mailto:cyril.crevoisier@lmd.polytechnique.fr">cyril.crevoisier@lmd.polytechnique.fr</a>	Agreed	IASI L1C	Comparison of OBS-CALC to sondes (ARSA) Inspect residuals against viewing angles, pixel number etc, comparison between the 3 IASI. will apply the normal science algorithms and work on fluxes	
<b>LATMOS</b>		<a href="mailto:Sarah.Safieddine@latmos.ipsl.fr">Sarah.Safieddine@latmos.ipsl.fr</a>	Agreed	IASI L1C		
<b>University Wisconsin–Madison</b>	Monitoring	<a href="mailto:robert.knuteson@ssec.wisc.edu">robert.knuteson@ssec.wisc.edu</a>	Agreed	IASI L1C		TERR
<b>Univ. Libre de Bruxelles</b>	Monitoring	<a href="mailto:Daniel.Hurtmans@ulb.ac.be">Daniel.Hurtmans@ulb.ac.be</a> <a href="mailto:pfcocheur@ulb.ac.be">pfcocheur@ulb.ac.be</a>	Agreed	IASI L1C	development of Forli products (which are part of the L2) => starting and testing the processing of IASI-C data. Feedback on L2.	EUMETCast

+ Contribution from EUMETSAT IASI teams (HSL1 and HSL2)

# User Feedback

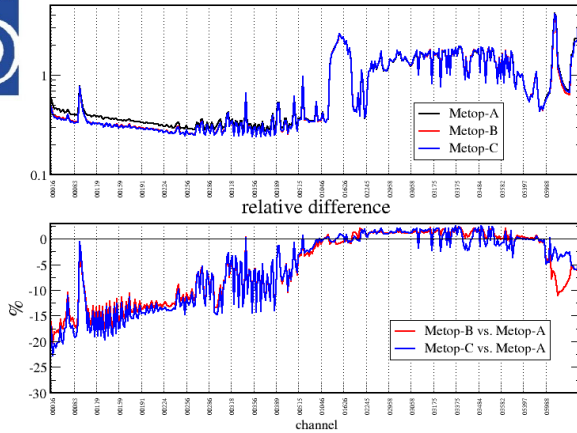
## From NWP centres

### Stdev OBS-CALC for selected channels



obs-fg std.dev. (bias corrected)

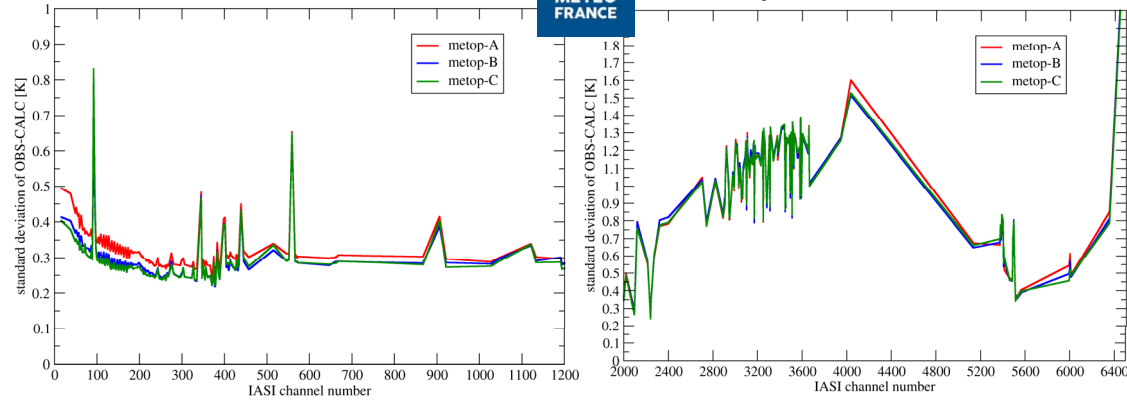
2019040809-2019051318



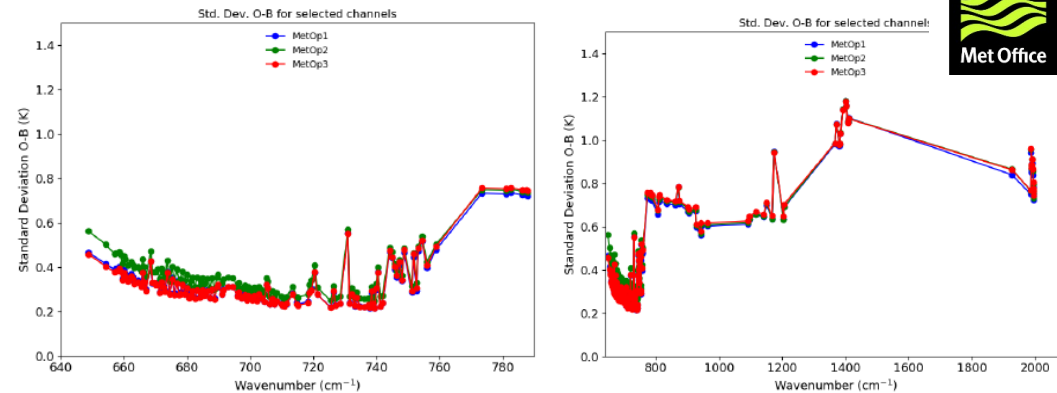
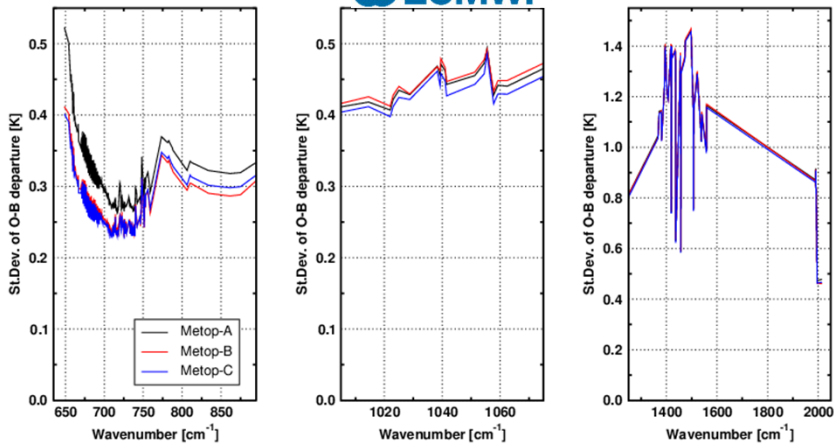
global statistics - 17 05 2019 - ARPEGE



global statistics - 17 05 2019 - ARPEGE



- IASI-A has higher stdev than IASI-B and -C, especially in band 1
- IASI-C performs slightly better IASI-B

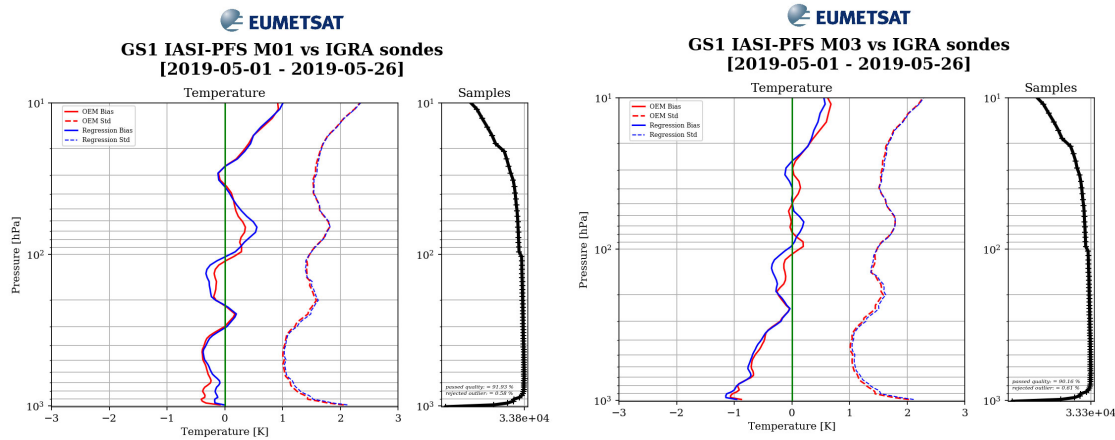


# User Feedback

## From the L2 community

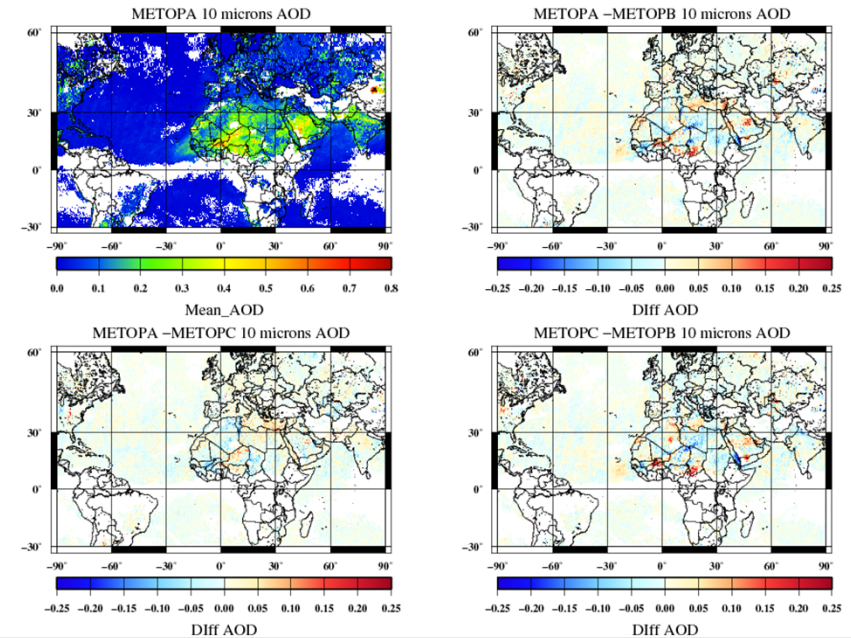
### L1C products are used to retrieve geophysical parameters

#### Comparison of T retrievals from IASI-B and IASI-C with radiosondes data



- First L2 retrievals are very promising
- Bias in Temperature related to the use of M01 config
- Metop A and Metop C compare well in term of dust AOD retrieval

#### Maps of mean and differences in Atmospheric Optical Depth retrievals



# Summary and conclusion

- EUM supported CNES activities during the Cal/Val :
  - Daily routine monitoring (flags ...)
  - Install and Check related to Aux Files deliveries and upload
  - Additional studies to complement CNES results
- Main results
  - IASI-C performs as well as Metop-B IASI and better than IASI-A
  - Inter-pixel differences show that pixel 1 is slightly biased (vs the average)
  - Inter-platform comparison highlight the need for IASI-A non-linearity correction update
    - ⇒ On-board non-linearity update done in September 30<sup>th</sup>, 2019

The operational dissemination of IASI-C started on the 1<sup>st</sup> July ☺

## **Acknowledgments**

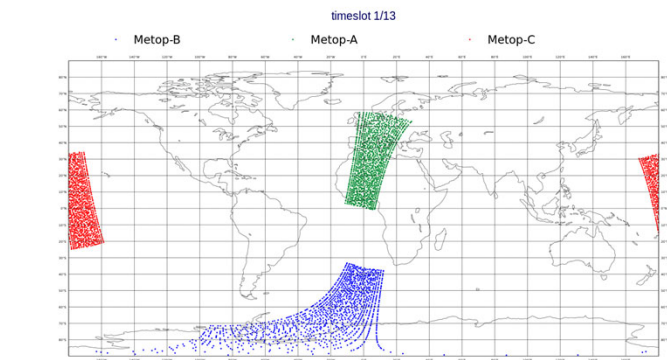
EUMETSAT and CNES would like to acknowledge all the partners that have contributed to this study. Feedback were essential to finalize the Cal/Val exercise and insure the good quality of IASI L1c as well as PC products before the operational dissemination.



# Thank you



# IASI



TMProppagator Client version 2.12.4

Mode: Live S-band

Page Directory

- DIR SEM Data
- Space Environment Data
- SUR Data
- IASI Data
  - METOP01 Globe Obs Display (metop01\_globe)
  - METOP01 Map Obs Display (metop01\_map)
  - METOP02 Globe Obs Display (metop02\_globe)
  - METOP02 Map Obs Display (metop02\_map)
  - METOP03 Globe Obs Display (metop03\_globe)
  - METOP03 Map Obs Display (metop03\_map)
  - NOAA-18 Globe Obs Display (noaa18\_globe)
  - NOAA-18 Map Obs Display (noaa18\_map)
  - NOAA-19 Globe Obs Display (noaa19\_globe)
  - NOAA-19 Map Obs Display (noaa19\_map)
  - METOP-01 Obs Parameters (ObsParams\_M01)
  - METOP-02 Obs Parameters (ObsParams\_M02)
  - METOP-03 Obs Parameters (ObsParams\_M03)
  - NOAA-18 Obs Parameters (ObsParams\_NOAA18)
  - NOAA-19 Obs Parameters (ObsParams\_NOAA19)
  - METOP-01 Passes (Passes\_M01)
  - METOP-02 Passes (Passes\_M02)
  - METOP-03 Passes (Passes\_M03)
  - METOP-18 Passes (Passes\_M18)
  - METOP-19 Passes (Passes\_M19)

Global maps showing satellite coverage for VLZ, KOU, SVE, WAL, PER, and McMurdo.

Time	Alt	Division	Time to
McMurdo	09:19:48	00:14:32	09:13:32
FKU	10:20:28	00:03:39	09:59:59
SVL	10:29:28	00:15:30	09:03:30
VLZ	10:20:10	00:16:42	09:13:36
McMurdo	11:00:37	00:15:26	09:15:43

Log entries:

```
0x0003 RTT S HK Header: Format Type
0x0004 RTT S HK Header: Format Length
0x0010 RTT S HK Header: ICU Message
0x0002 0x000 S ATC Heater over-current stat
0x0003 0x000 S SHV/DC Heater over-current
0x0004 1.25 A PDU ATC LCL current
0x0005 1.06 A PDU CCM LCL current
0x0006 0.15 A PDU IIS LCL current
0x0007 1.07 A PDU MAS LCL current
0x0008 6.47 A PDU main current
0x0009 35.37 V EOPW
0x0010 0x000 S OPS_Status_Mode_Power_Acquis
0x0011 NO_ERROR S OPS_Major error
0x0012 NO_ERROR S OPS_Minor error
0x0013 OPS Mode (Comp status)
0x0014 ON S OPS1 Power status
0x0015 ON S OPS2 Power status
0x0016 ON S OPS3 Power status
0x0017 OFF S OPS4 Power status
0x0018 OFF S OPS5 Power status
0x0019 PHU I/F A status
0x0020 PHU I/F B status
0x0021 MAS_DATA S LNR Input selected
0x0022 0x777 S OPS_P163 Mode_Acquisition
0x0023 OPS1 mode
0x0024 OPS2 mode
0x0025 OPS3 mode
0x0026 OPS4 mode
0x0027 OPS5 mode
0x0028 CCR status & mode acquisitio
0x0029 CCR/CD Encoder trans err
0x0030 0x000 S Off/Flow ALL comp CCR/CD act
0x0031 NO_ERROR S CCR Mode (Comp status)
0x0032 0x000 S SCS status & mode acquisitio
0x0033 NO_ERROR S SCS Mode (Comp status)
0x0034 NO_ERROR S SCS Medium Error
0x0035 OPERATE S SCS Mode (Comp status)
0x0036 NO_ERROR S MAS DS16 Conf (uration acqui
0x0037 0 S MAS DS16 Conf (uration net u
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