How we ensure the quality of the EUMETSAT IASI L2 products

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Introduction

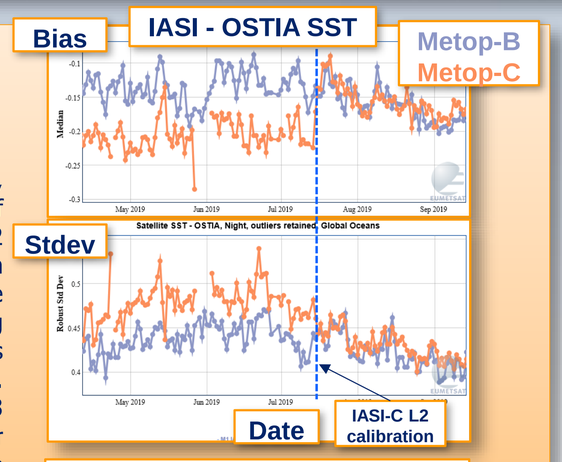
Geophysical parameters from the IASI instruments on Metop-A and Metop-B are provided from EUMETSAT's Central Facility in near real time since 2007 for Metop-A and since 2013 for Metop B. Metop-C, which was launched in 2018, joint the IASI Level 2 (L2) collection in 2019 after a several months long commissioning period. The EUMETSAT IASI Level 2 suite [1] includes vertical profiles of temperature and humidity, related cloud information, surface skin temperature and emissivity, and atmospheric composition parameters (e.g. CO, O3, SO2, CH4).

The number of IASI L2 products and their associated uncertainties or flags is high, and improvements, anomaly corrections or new algorithms are regularly added to the IASI L2 Products Processing Facility (PPF). In order to ensure the quality of the retrievals, every step of the products lifetime is covered by processes dedicated to verify and validate the generation of the IASI L2 data. Some processes are common to the whole EPS system, like the operational products generation monitoring, when some others are specific to the scientific aspects of the IASI L2.

We present in this poster an overview of the processes, tools and activities that are implemented at EUMETSAT to ensure the quality of the IASI L2 products generation.

Metop-C commissioning: providing high quality products in a limited amount of time

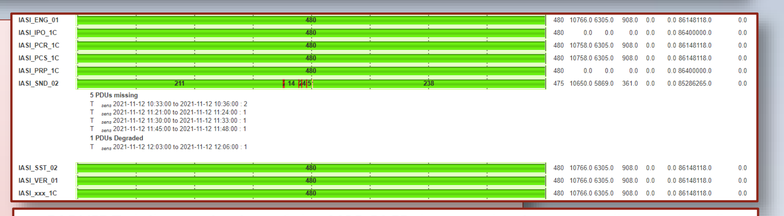
For the commissioning of the last IASI instrument, EUMETSAT was able to rely on a long history of validation inherited from 14 years of IASI L2 operations (examples: [2],[3],[4],[5]). The validation strategy was based on two types of activities: (i) the use of the routine IASI L2 scientific monitoring running at EUMETSAT and (ii) the validation studies resulting from an important number of collaborations. This strategy has made it possible to produce M03 IASI L2 products of the same quality as the two other platforms less than 9 months after the launch despite the long calibration period required for the IASI instrument and the high number of products generated.



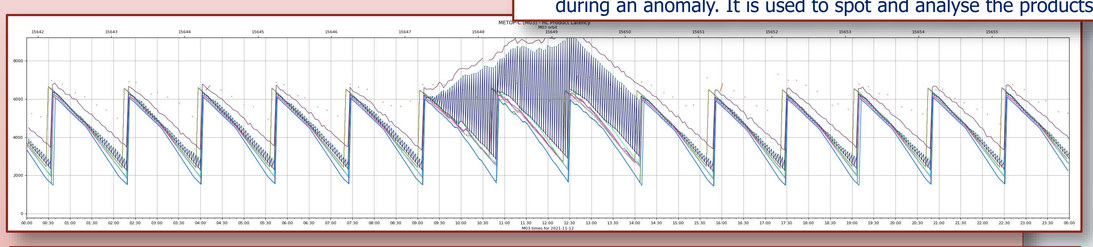
Use of the **METIS** monitoring tool for the IASI L2 M03 commissioning: timeseries of the IASI L2 OEM SST compared to the OSTIA model [5]

EPS Operational Monitoring

The EUMETSAT EPS Ground Segment is monitored through the SAPHIRE tool. It generates real-time reports about the data production and the status of the Metop products processing.



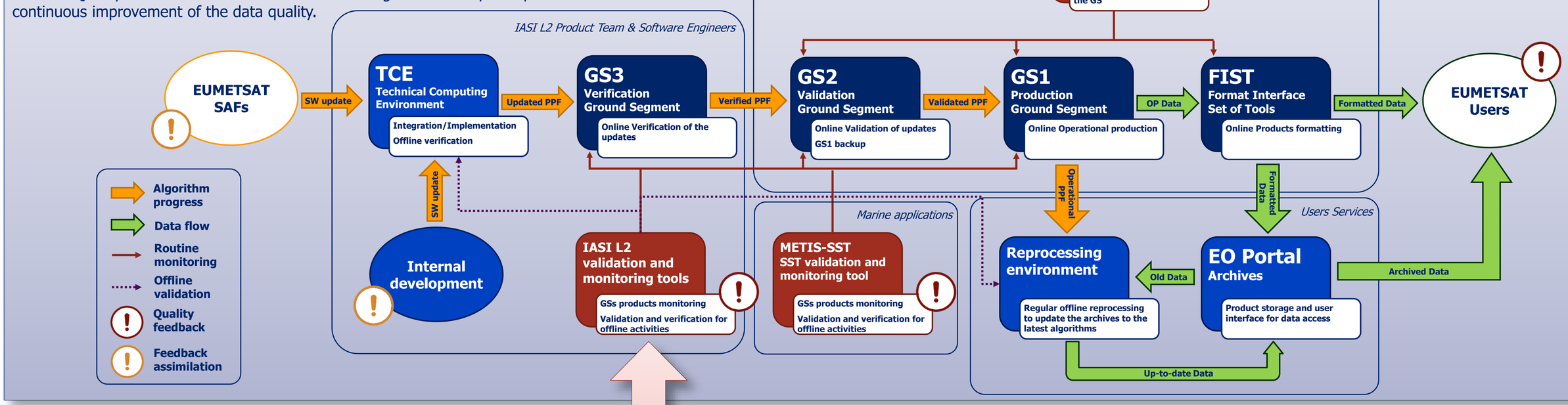
SAPHIRE daily monitoring of the M03 IASI data production, a.k.a. "green bars", during an anomaly. It is used to spot and analyse the products degradations.



SAPHIRE daily overview of the M03 products latency during an anomaly. It is used to monitor the time elapsed from the platform acquisition to the near real time (NRT) data production.

The EUMETSAT quality control and improvement processes: from the development to the routine monitoring of a IASI L2 algorithm update

When an improvement needs to be implemented in the IASI L2 Products Processing Facility (PPF), the update has to pass several quality gates before it gets to operational production and reaches the users. It will then be monitored and later applied to the past data to ensure an homogeneous and up-to-date archive. Quality feedback from users and monitoring are used by the product teams to ensure the continuous improvement of the data quality.

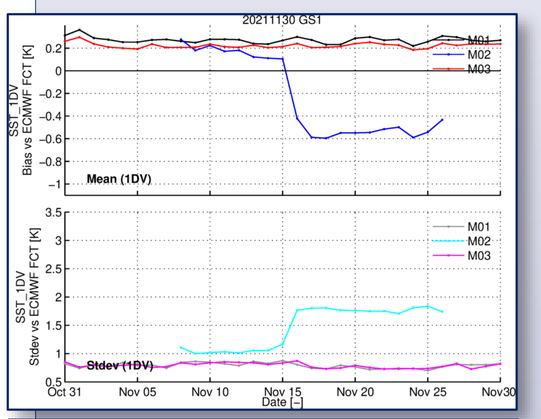


IASI L2 validation and monitoring tools

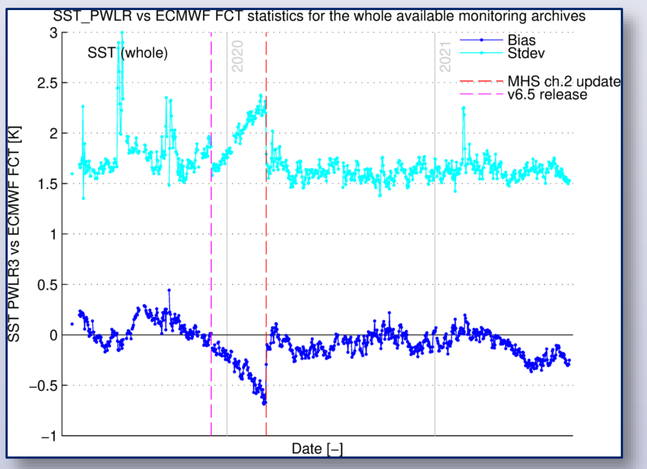
To ensure the quality and the stability of the retrievals, several tools have been developed to manipulate, validate and monitor the IASI L2 products. An example of the use of the EUMETSAT SST monitoring tool **METIS-SST** applied to the commissioning of the M03 IASI L2 is presented above. We show below some examples of uses of two other tools dedicated to the handling of IASI L2 products : **IMOEN** and **MONALiSA/MAP_GII**.

IMOEN

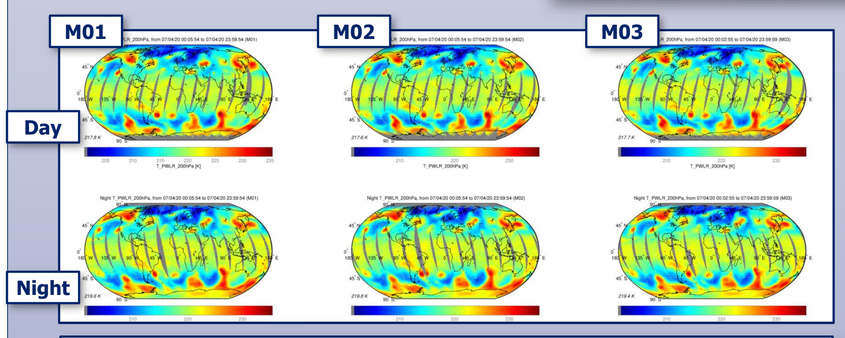
The IMOEN Matlab toolbox provides generic functions for the manipulation and the validation of the IASI data. It is the basis of the IASI L2 Processing Daily Monitoring that performs everyday an extensive overview of the products self-consistencies and behaviors against numerical models. It is also used in all the IASI L2 development and commissioning activities, as well as in support to operations.



IMOEN monitoring of IASI L2 OEM SST vs ECMWF FCT during the last M02 end-of-life activities. Bias (top) and stdev (bottom) timeseries, for M01 (black), M02 (blue) and M03 (red)



M02 IASI L2 full-sky SST timeseries: degradation, then recovery from the loss of the MHS channel 2. Degradation started end 2020 and the IASI L2 had to be patched in March 2021 (red line) to exclude it.



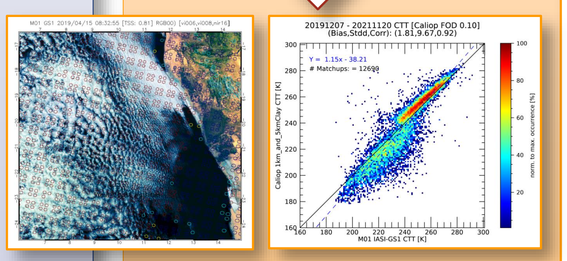
IMOEN daily map of the full-sky temperature at 200 hPa for the three Metop platforms (M01 to M03 from left to right), for day (top) and night (bottom), illustrating the stability of the three IASI instruments across the platforms

You have questions about the IASI L2 products or the way to access them?
⇒ Contact *ops@eumetsat.int*

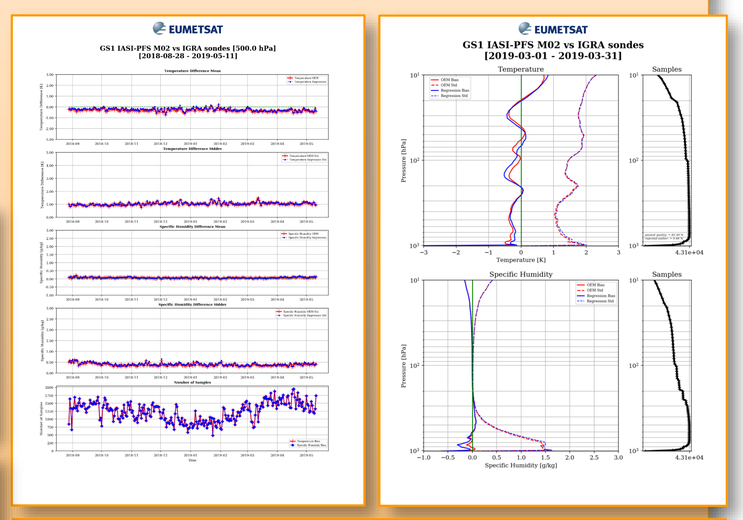
MONALiSA/MAP_GII

The MONALiSA/MAP_GII is a Python/IDL toolbox that provides an environment for the inter-comparison of IASI L2 data with reference measurements (*in situ*, ground-base or satellite). It is used for the assessment of the processors and the automatic daily monitoring of the products. MONALiSA/MAP_GII handles colocation and comparison of measurements from radiosondes (IGRA [6], WOUDC [7]), brewer spectrophotometer (EUBREWNET [8]), GPS receiver (SuomiNet [4], EUMETNET [9]) and satellite data (CALIOP [10], SEVERI [11]).

More on that topic : Friday 9:45, Stefan Stapelberg
"Validation and operational monitoring of cloud products derived from IASI measurements."



MAP_GII validation of M01 IASI L2 cloud products
Left: IASI L2 cloud cover over AHVRR composite image
Right: IASI L2 vs CALIOP cloud top temperature



MONALiSA monitoring of IASI L2 temperature and humidity against IGRA sondes
Left: nine-months timeseries (2018/09-2019/05, M02)
Right: one-month accumulated vertical statistics (2019/03, M02)

Summary

The quality and the stability of the EUMETSAT IASI L2 products is ensured by processes and activities that are common to all the EPS products for some and specific the IASI L2 processing for others. After 14 years of operations, the wide range of available tools and the large number of collaborations that have been established will also support the short and long term evolutions of the EUMETSAT IASI L2 processing (see T. August and T. Hultberg presentations). They will also be the basis of the validation and the quality assessment of the next generation of EUMETSAT HSIR instruments, IASI-NG and MTG-IRS.

References:
[1] August, T. *et al.*, "IASI on Metop-A: Operational Level 2 retrievals after five years in orbit", *2012*
[2] "IASI L2 Metop-B – Validation report", EUM/TSS/REP/13/684650, *2013*
[3] "IASI L2 v6.2 Validation Report", EUM/RSP/REP/16/857500, *2016*
[4] Roman, J. *et al.*, "A global assessment of NASA AIRS v6 and EUMETSAT IASI v6 precipitable water vapor using ground-based GPS SuomiNet stations", *2016*
[5] Donlon, C. J. *et al.*, "The Operational Sea Surface Temperature and Sea Ice analysis (OSTIA)", *2011*
[6] Durre, I. *et al.* «Overview of the Integrated Global Radiosonde Archive». *Journal of Climate, vol. 19 pp 53-68*, 2006
[7] https://woudc.org/
[8] Rimmer, J. S. *et al.*, "EuBrewNet – A European Brewer network (COST Action ES1207), an overview", *2017*
[9] Guerova, G. *et al.*, "Review of the state of the art and future prospects of the ground-based GNSS meteorology in Europe", *2016*
[10] Karlsson, K.G. *et al.*, "On the optimal method for evaluating cloud products from passive satellite imagery using CALIPSO-CALIOP data" *2013*
[11] Ermida, S.L *et al.*, "Assessing the potential of parametric models to correct directional effects on local to global remotely sensed LST", *2018*