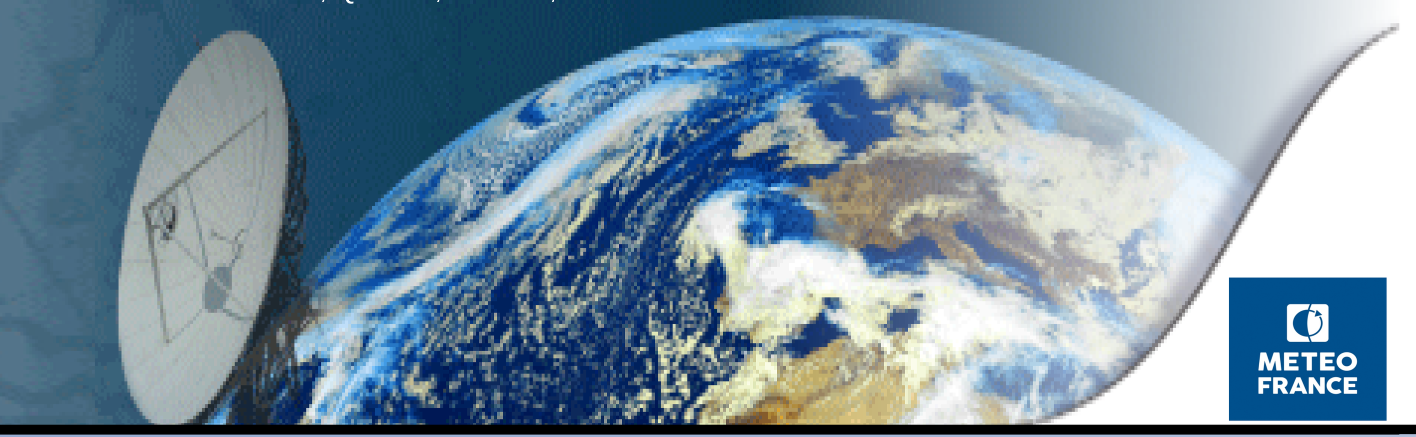
ITSC-22. Saint-Sauveur, Quebec, Canada, 31 October – 6 Novembre 2019



Global vs local IASI processing, Cloud mask and L1C comparison

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Motivation

- The IASI instrument, carried by METOP satellites, provides radiance data that are essential in NWP models.
- diffGlobal is an application developed by the Satellite Meteorology Research Center (CEMS) in Lannion to monitor the local versus global IASI processing, in the NWPSAF context, after applying the cloud mask made (MAIA 4) and the cloud mask made by EUMETSAT. The difference between the results shows the influence of each mask on the cloud fraction (CF) and the brightness temperature (BT).
- The results are synthesized as maps (IASI pixel display), graphs (BT) or histograms (statistics).
- Monthly statistics are performed to highlight the bias produced by one mask or the other in a medium term.

Comparison of the cloud fraction got with MAIA and EUMETSAT masks.

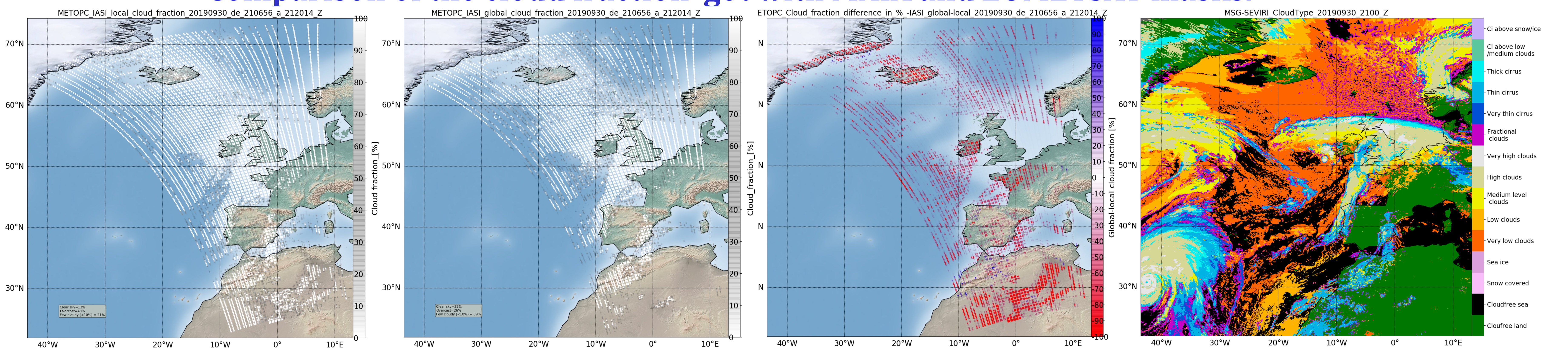

Figure 1. from left to right : IASI cloud fraction with MAIA mask; IASI cloud fraction with EUMETSAT mask; cloud fraction difference global-local; cloud type with SEVIRI mask (the nearest 1/4h).

- The two first maps are the projection of the cloud fraction in the IASI pixels (4 IFOV) locations after process of the AVHRR data with MAIA mask and the EUMETSAT mask. The third map is the difference of the two first and helps to deduce which processing produces the cloudiest sky and where the main differences are located.

- A study is lead to compare the CF difference map with other masks, like the SEVIRI mask. It helps to detect what type of cloud can be associated to the main differences between MAIA and EUMETSAT masks. The date of September 30, 2019 was chosen for the study. Three types of results are depicted, from the most to the least satisfactory:
  - The good: The higher clouds, like cirrus (blue) and disturbances clouds (white and green-grey) are associated to no CF difference between the results of the two processings.
  - The bad: Very low and fractional clouds like stratus, stratocumulus or cumulus (orange and pink) in rear sky are located on the areas containing the most of CF's differences.
  - The ugly: An other disparity is detected over ice surface (greenland) where MAIA gives a more cloudy sky.

- The figure.2 shows statistics of global and local processing differences for a full month of data, on the whole period and area, but also for given day/night conditions and surface types, that helps to target areas or periods which occur these differences.

- The main blue histogram shows the CF differences :
  - Most of CF pixels are identical. The two cloud masks are globally close.
  - However a bias is produced by the MAIA mask.

- The left small histogram depicts, for daytime, nightime and twilight, the contribution for each mask in the strongest CF differences [-100% ; -5%[and]+5% ; +100%]:
  - About 40% of the CF differences is a MAIA overestimation at any time of the day.
  - About 10% is a EUMETSAT mask only during the twilight period.

- The right small histogram depicts this contribution over land, sea and coast/lakes.
  - MAIA is responsible for 30% to 40% of the CF differences above any kind of soil.
  - EUMETSAT produces 10%, only over land and coast/lakes.

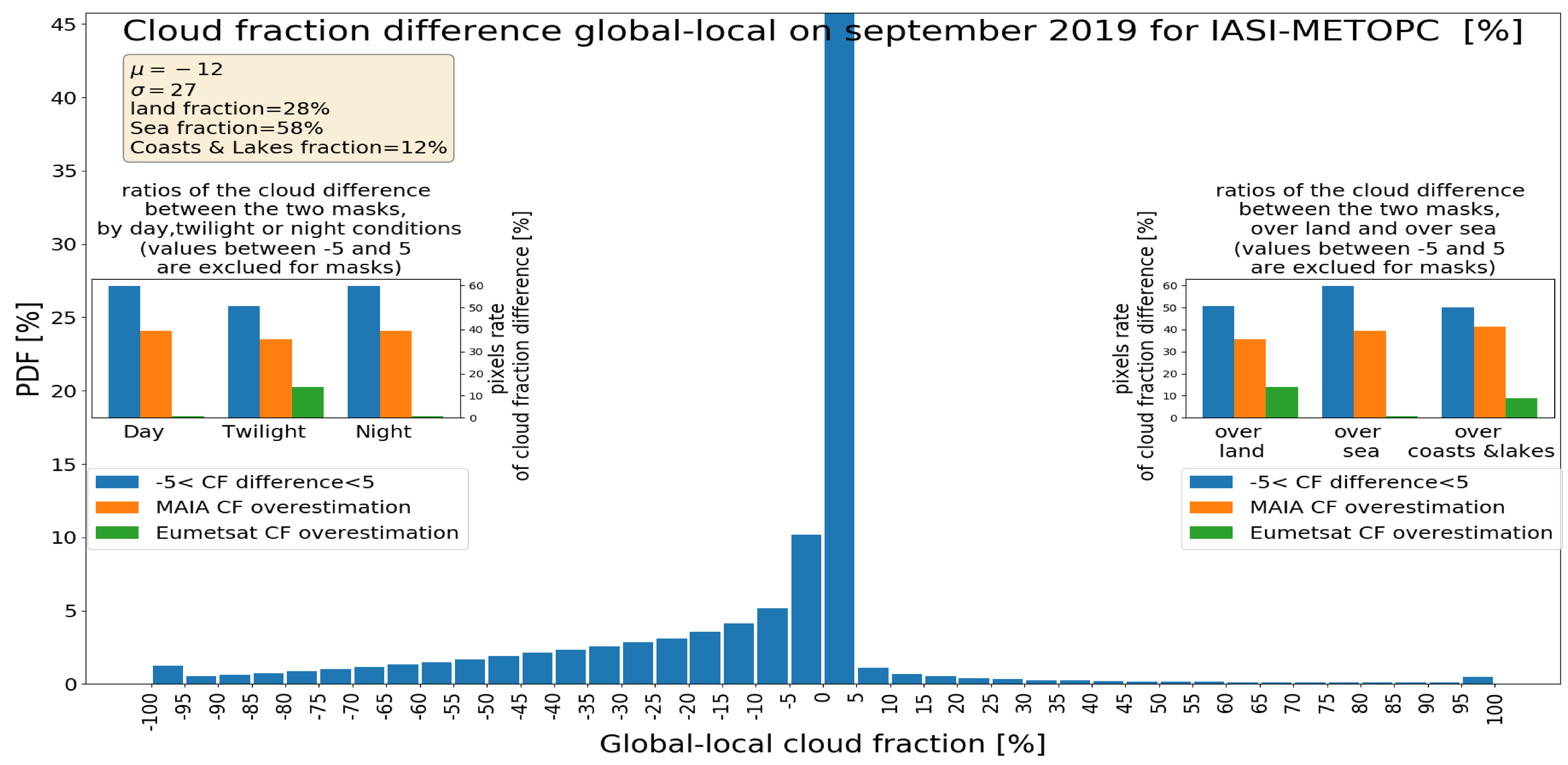

Figure 2. monthly statistics of global-local CF (main graph); ratio of CF difference for each mask depending on luminosity (small left graph) or depending on soil type (small right graph)

- 3 conclusions:
  - The results of local and global IASI processing are strongly similar.
  - But the MAIA mask greatly overestimates the cloud fraction compared to the EUMETSAT mask in any circumstance.
  - Sometimes the second one overestimates also: in twilight situation, or in presence of land, which can implicate the relief in the mask's algorithms.

Visualization of Brightness Temperature's difference local-global

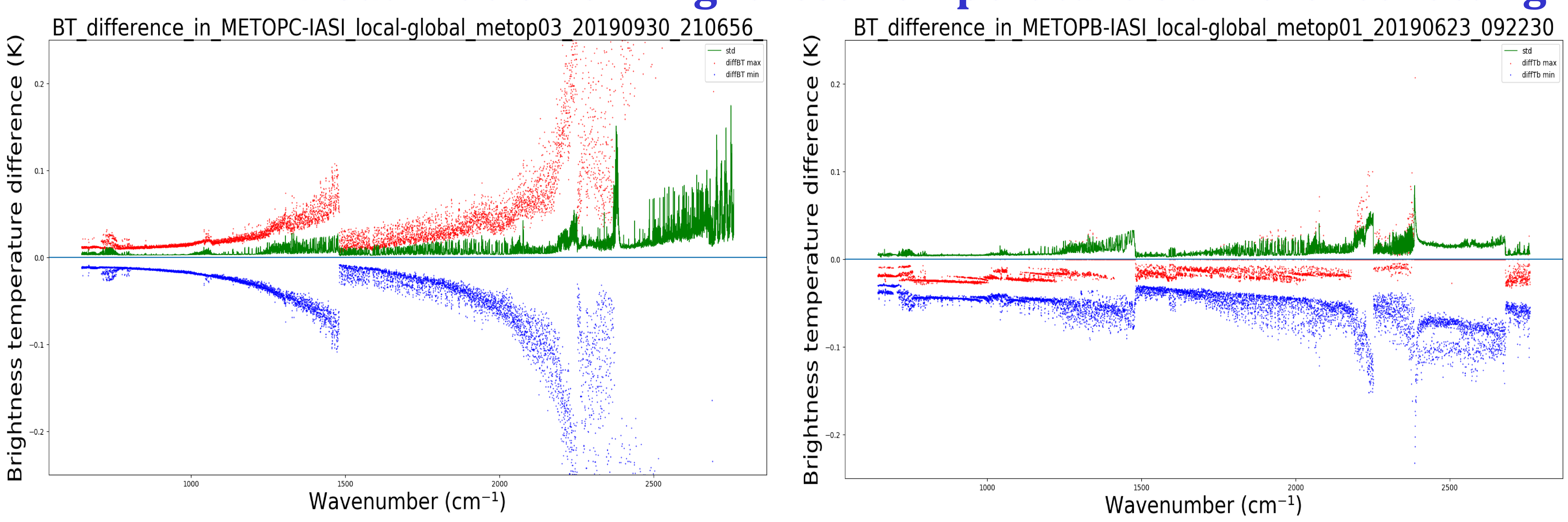

Figure 3. BT difference local-global extremes for each wavenumbrer. The left graph is an usual case. The right graph shows an anomaly on a single IASI scan

- The local and the global IASI processings give different BT. These differences are plotted on on graphics for all fields of view and for all the 8461 wavenumbers. More particularly it is the biggest differences in BT that are plotted for each wavenumber. The standard deviation is also represented and a scale factor is applied.

- Theses graphics help to detect eventual anomalies on lines of the IASI scan. For instance the right's graphics shows a shift of the 3 curves in negatives values in the scan of IASI-B. A more accurate study permitted to isolate the line responsible of this shift.

Conclusion and future plans

- The comparison of the CF obtained with MAIA and with EUMETSAT masks shows some differences, mainly with very low clouds and fractional clouds but also above land, ice soil and in twilight conditions.
- A new statistical study will be lead to determine the ratio of each cloud type associated with CF differences. Then these results will be used to compare the differences in the IASI pixel with the Clouds from AVHRR Extended (CLAVR-x) processing system which is a full-fledged mask, using NOAA algorithms, and with the SEVIRI mask for MSG data.
- The visualization of the biggest differences in BT helps in the detection of inconsistencies in the IASI scan.
- These graphs and maps will be soon available on a web site developed by the CEMS and replace what is currently done in the NWPSAF context.

References:
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