

# IASI L1 Radiance Monitoring and Comparison with HIRS, for Metop-A and Metop-B

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## Introduction

The Infrared Atmospheric Sounding Interferometer (IASI) is currently flying on Metop-A since October 2006. Since the reception of the first calibrated spectra, IASI L1 NRT radiance monitoring is done at EUMETSAT, based on the comparison of measured and modelled IASI L1C spectra generated by the radiative transfer model RTTOV v9.3 using ECMWF forecast files, and on comparison between the co-located measurements of IASI and HIRS flying on the same platform. With the launch of Metop-B in September 2012, IASI L1 radiance monitoring is done in parallel for the two instruments, providing a self-consistency checks and interesting inter-comparisons in the framework of the IASI-B CalVal activities, using double differences or direct comparisons done on a large number of spectra.

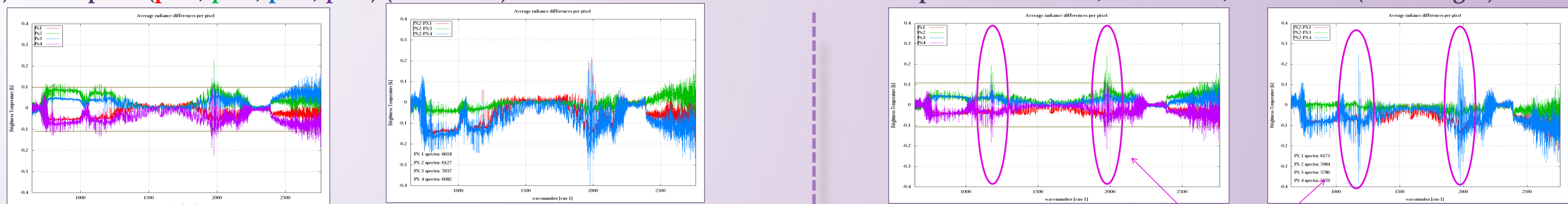
IASI-A

IASI monitoring

IASI-B

## IASI Radiance monitoring

The radiance monitoring, generated every day at EUMETSAT, allows a quick view on IASI L1 processing and IASI L1c products quality. Larger statistics gives more information on the noise, and also consistency between the 4 IASI pixels. The following figures show for each IASI, the differences between the Mean (4 pixels) – each pixel (pix1, pix2, pix3, pix4) (on the left) and the radiance differences between pixels: Pix1 -Pix2, Pix3 - Pix2, Pix4 - Pix2 (on the right) for both IASI:

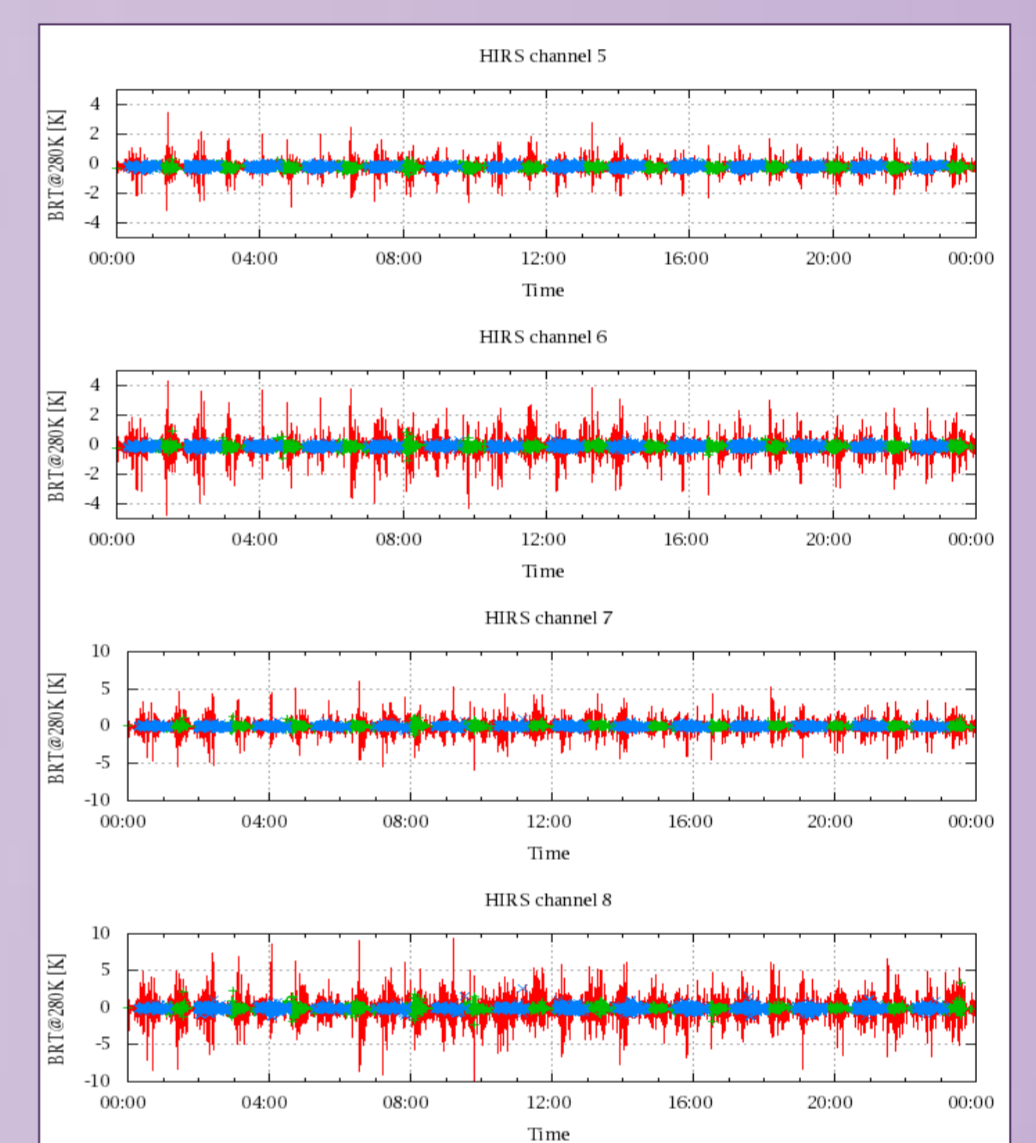
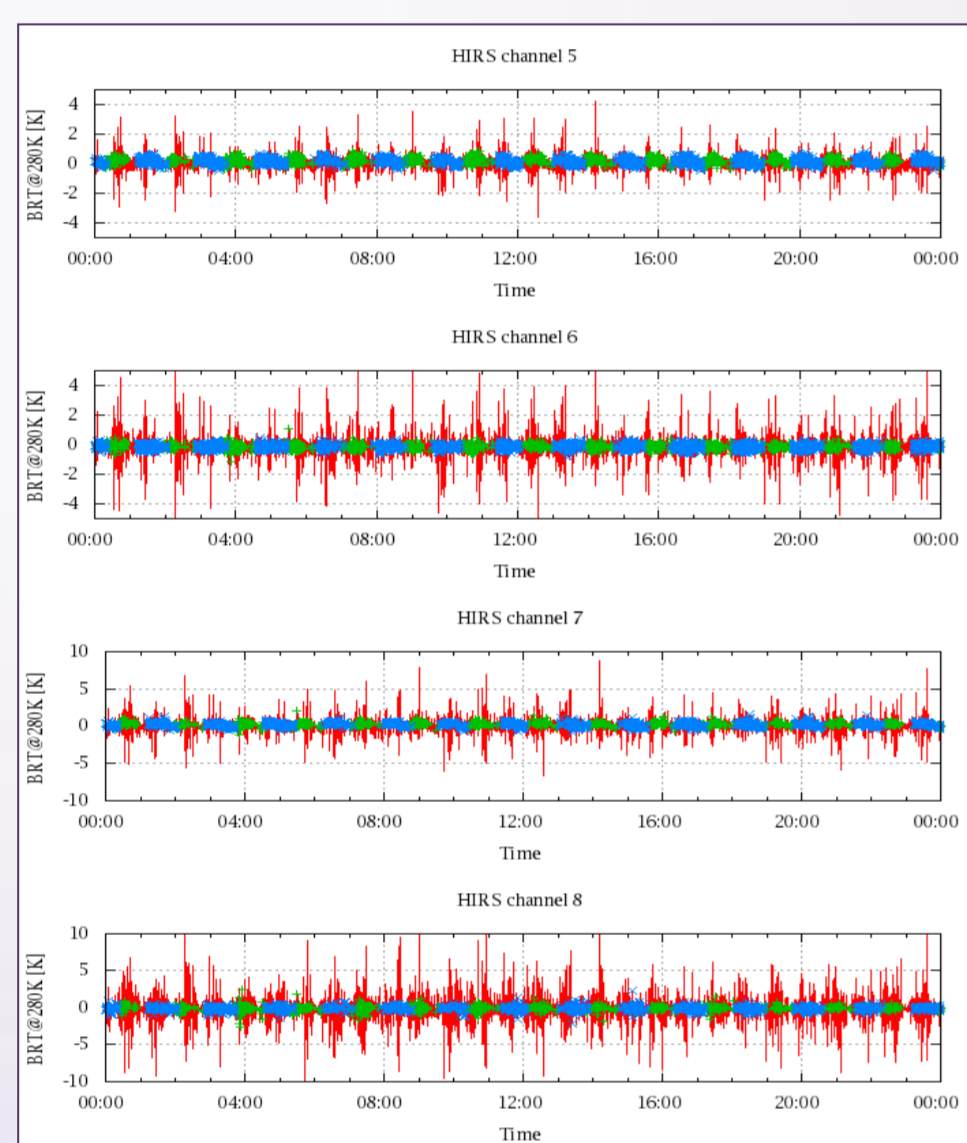


The quality of the IASI-B product is already very good (within the spec 0.1K), minus some slight adjustment, like the interband limits.

## IASI - HIRS Comparison

The radiance comparison of IASI and HIRS on-board Metop is performed on all pixels with a distance smaller than 3 km between IASI and HIRS. All sky conditions are covered. The radiance differences IASI - HIRS are given in brightness temperatures at 280K reference temperature. All conditions (clear, cloudy, day and night) are given in red in the following figures. The clear sky conditions at night are given in green and the clear sky cases during daylight are displayed in blue. The figures show the example of the HIRS channels 5 to 8 but this is done every day with all HIRS channels.

The comparison between HIRS and IASI-B are comparable to the one done with IASI-A. For some other HIRS channels, the differences are slightly larger, possibly due to the degradation of HIRS on Metop-B which is observed at the moment. This is under investigation by NOAA/EUMETSAT

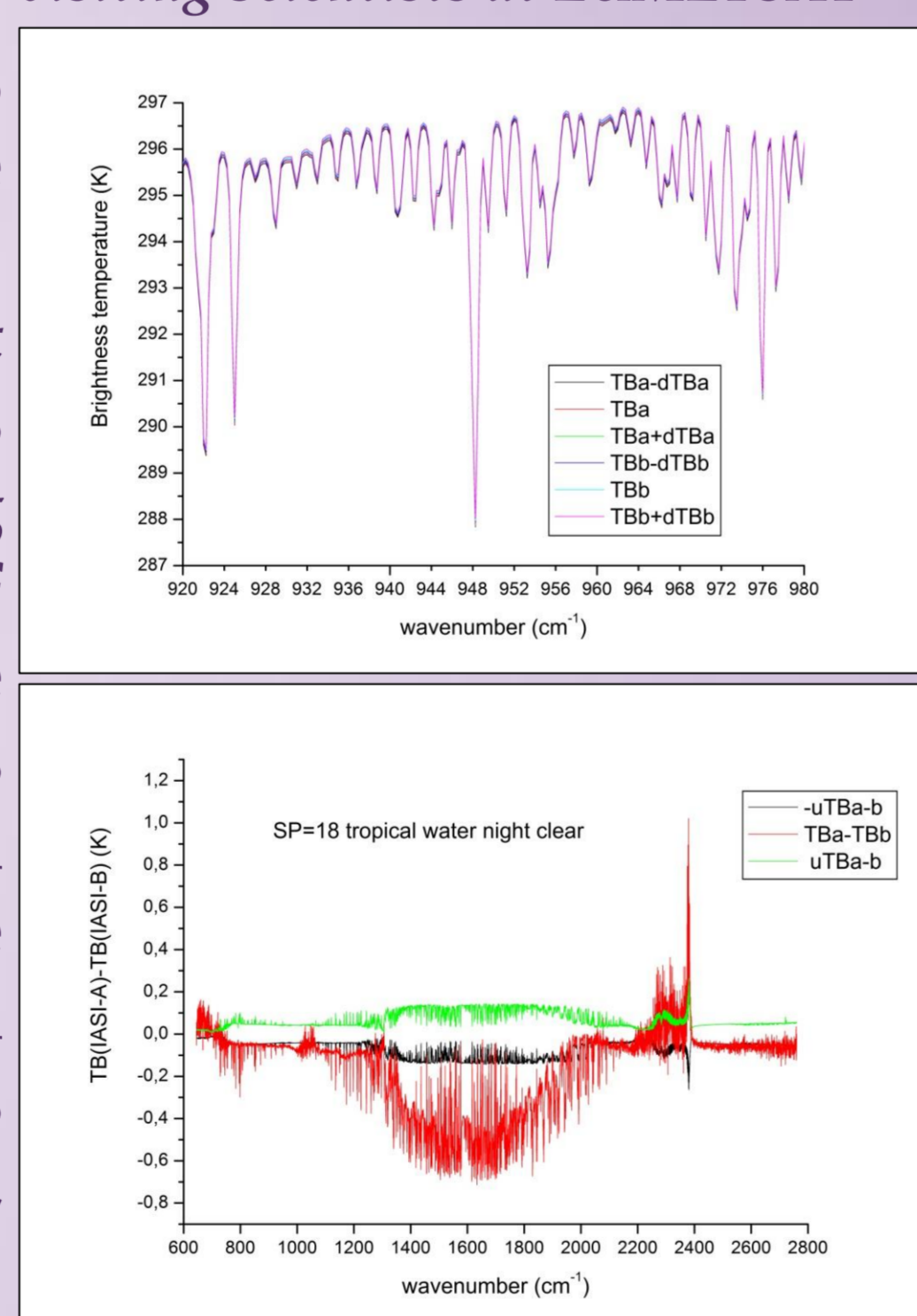


## IASI-A/IASI-B Intercomparison

### Direct comparison of radiances and BT

Thanks to Claude Camy-Peyret, Jérôme Bureau (LATMOS), two visiting Scientists at EUMETSAT

The use of large numbers of spectra hypothesis that the difference between averages should be very close to the average of the differences,  $\langle \text{IASI-A-IASI-B} \rangle = \langle \text{IASI-A} \rangle - \langle \text{IASI-B} \rangle$ , provided that the sampling is done over homogeneous geographical/geophysical conditions and during the same period, minimizing then the effect of ~50 min differences between the two Metop. The average for both IASI for the relevant categories have been calculated « in stream » for the period 18/01/2013 to 25/01/2013 with 3650 and 3640 native EPS files respectively (~ 2 million Pixel (PN) each for  $10 \leq \text{Scan Position (SP)} \leq 20$ ). The results presented here are for the category tropical, water, clear, night (See fig. 1 and 2)



The number of such channels (index i) ranges from 3206 to 4835 (over 8461) for all (PN,SP). The number of spectra used of each PN is 1400 and 4 times these numbers when looking at FOR (Field Of Regard of 4 PN). The table shows the uncertainty on  $\Delta \text{TB}$  which are the standard deviations around the mean. These statistics are done for all pixels sampled in clear sky over water at night, latitude in [20S,20N], all longitudes.

The differences (including a small geophysical variability) are well below the expected nominal accuracy in brightness temperature of IASI (0.5 K) demonstrating the very good consistency of the 2 models presently in orbit.

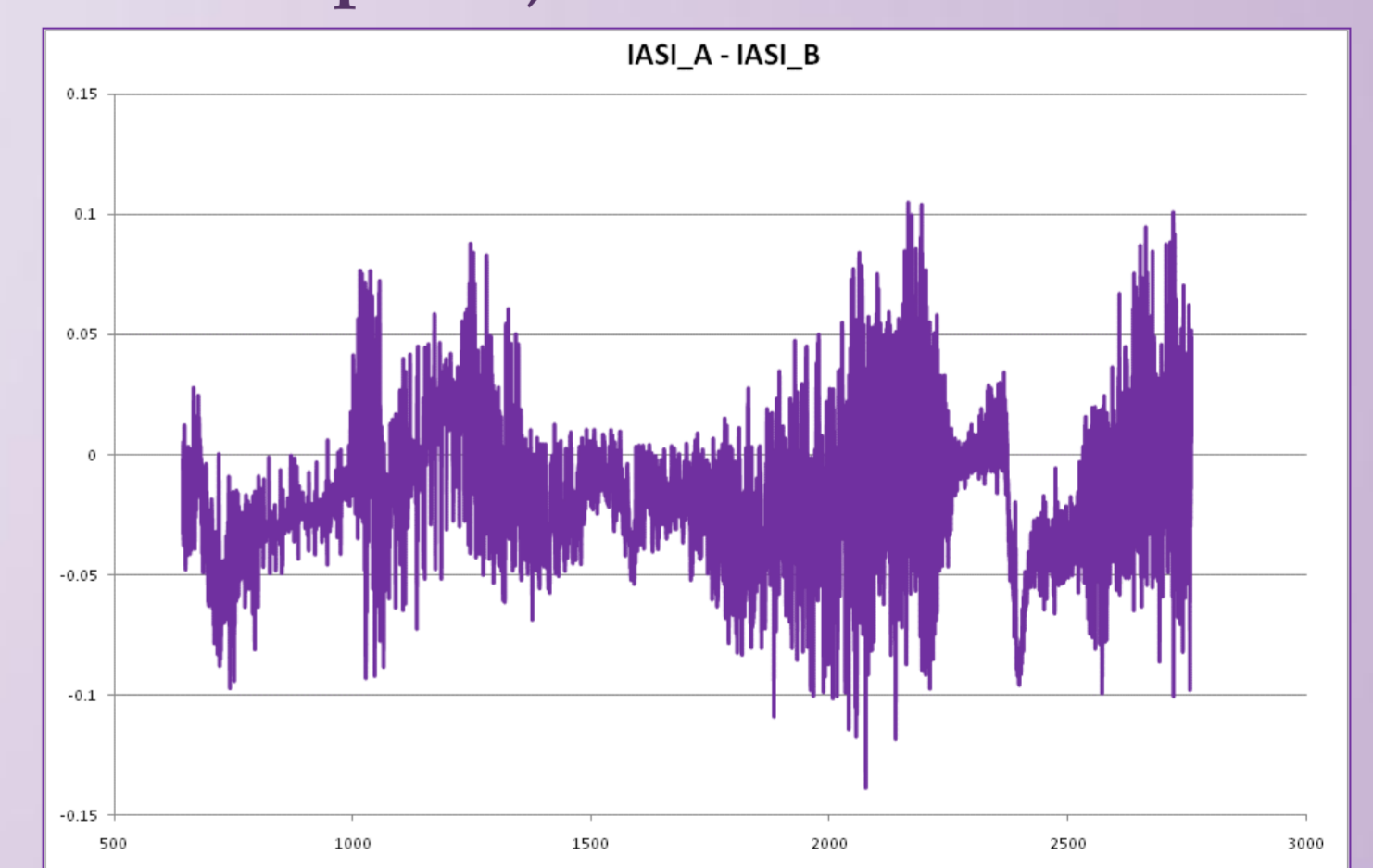
$\Delta \text{TB}(K)$	SP10	SP11	SP12	SP13	SP14	SP15	SP16	SP17	SP18	SP19	SP20
PN1	0.0153 ±0.0019	0.0214 ±0.0021	0.0076 ±0.0025	-0.0151 ±0.0019	-0.0653 ±0.0028	-0.1112 ±0.0032	-0.0665 ±0.0032	-0.0990 ±0.0038	-0.1604 ±0.0034	-0.0515 ±0.0031	-0.0643 ±0.0025
PN2	0.0354 ±0.0014	0.0899 ±0.0019	-0.0084 ±0.0026	-0.0510 ±0.0021	-0.0716 ±0.0031	-0.0817 ±0.0034	-0.0611 ±0.0034	-0.1184 ±0.0032	-0.1678 ±0.0041	-0.1119 ±0.0037	-0.1110 ±0.0031
PN3	0.0300 ±0.0015	0.0437 ±0.0017	0.0346 ±0.0017	0.0417 ±0.0016	-0.0454 ±0.0018	-0.0666 ±0.0032	-0.0920 ±0.0036	-0.0991 ±0.0036	-0.1002 ±0.0028	-0.0638 ±0.0027	-0.0761 ±0.0030
PN4	-0.0040 ±0.0020	0.0411 ±0.0017	-0.0004 ±0.0025	-0.0588 ±0.0028	-0.0444 ±0.0027	-0.0589 ±0.0026	-0.0937 ±0.0034	-0.1511 ±0.0038	-0.1345 ±0.0036	-0.0954 ±0.0029	-0.1031 ±0.0033
FOR	0.0220 ±0.0015	0.0504 ±0.0018	0.0143 ±0.0022	-0.0206 ±0.0020	-0.0527 ±0.0025	-0.0756 ±0.0030	-0.0606 ±0.0033	-0.1126 ±0.0035	-0.1361 ±0.0034	-0.0684 ±0.0029	-0.0785 ±0.0028

Average brightness temperature differences  $\Delta \text{TB}(\text{PN}, \text{SP}) = \text{TB}(\text{IASI-B}, i) - \text{TB}(\text{IASI-A}, i)$  over common Gaussian channels (using skewness and kurtosis criteria).

### Comparison using double differences

The following figure shows the difference between IASI-A (Obs-Cal) and IASI-B (Obs-Cal) over 20 days (24000 clear spectra compared).

The spectra have been taken by night, over sea, without the polar regions. The figure shows that the difference in NedT at 280K is between 0.1K (which is the specification for Obs-Cal at 280K), which shows a good radiometric consistency between the two IASI.



## Conclusion/Perspectives

The comparison between IASI with modelled radiances using ECMWF forecast files, with HIRS and now with the second instrument gives a complete every day monitoring. Comparison between the two IASI, using double differences or direct comparison over a large number of spectra, gives different information and interesting comparison, showing in general a very good consistency of the 2 IASI.

These results lead to some future comparison with other instruments, as it is foreseen to do in the next months with CrIS/NPP, including also direct comparison at SNOs (Simultaneous Nadir Observations) which can be done for few observations, allowing punctual checks. It is planned to extend the IASI monitoring to the IASI-CrIS inter-calibration using double differences with the forecasts files, giving meaningful daily statistics and interesting long term inter-comparisons.