CGMS-XXX EUM-WP-16
Prepared by EUMETSAT
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RESULTS FROM EUMETSAT IR AND WV SATELLITE INTERCALIBRATION ACTIVITIES

A cross calibration to compare the IR-window and WV channels of Meteosat-7 and Meteosat-5 (at 63° E) with channels 8 and 12 of the HIRS instrument on NOAA-14 is routinely performed. The main results are that the IR window cross-calibration gives biases (Meteosat-HIRS) of about –1 to –2 K for both spacecraft. The WV cross-calibration gives biases (Meteosat-HIRS) of about +3 K for both spacecraft.

There are several potential sources of the observed bias. These include errors in the operational calibration and uncertainties in the instrument characterisation, especially in the spectral response functions. In order to improve the calibration further investigations on the potential error sources are ongoing with the aim to have a better understanding of all elements impacting the image calibration.

RESULTS FROM EUMETSAT IR AND WV SATELLITE INTERCALIBRATION ACTIVITIES

1 INTRODUCTION

This paper responds to Action 29.26 of CGMS XXIX requesting satellite operators to regularly perform satellite cross-calibration.

Previous papers from EUMETSAT to CGMS have reported on satellite intercalibration. Specifically, CGMS XXIX EUM-WP-16 described the intercalibration method used at EUMETSAT and listed comparisons of Meteosat to HIRS.

In this paper, recent results of comparisons between both Meteosat-5 and Meteosat-7 to the respective IR and WV channel of the HIRS instrument (onboard NOAA-14) are presented. It should be noted that since 31 May 2001, the EUMETSAT operational calibration of Meteosat-5 is performed via an intercalibration with Meteosat-7 (for both the IR and the WV channel). This implies that there is no bias between the two Meteosat satellites, which is also reflected in the comparisons to HIRS. The EUMETSAT operational calibration of Meteosat-7 relies entirely on the internal blackbody. The Meteosat calibration coefficient is of unit $W/m^2/ster/count$.

2 RESULTS FOR METEOSAT-7

The satellite intercalibration has been performed on a regular basis for more than a year. The Figures 1 and 2 show the results of the satellite intercalibration for the IR and WV channels of Meteosat-7. Both the IR and the WV operational coefficients are very stable in time. The operational calibration of the IR channel has a cold bias of about 1.5 % to 2.5 % in spring 2002 with respect to the coefficient derived from the intercalibration. This cold bias results in a brightness temperature difference between 1 and 2 K.

The large jumps in December 2001 for both the IR and the WV channel and in June 2002 for the WV channel are due to different radiometric gain settings onboard the satellite.

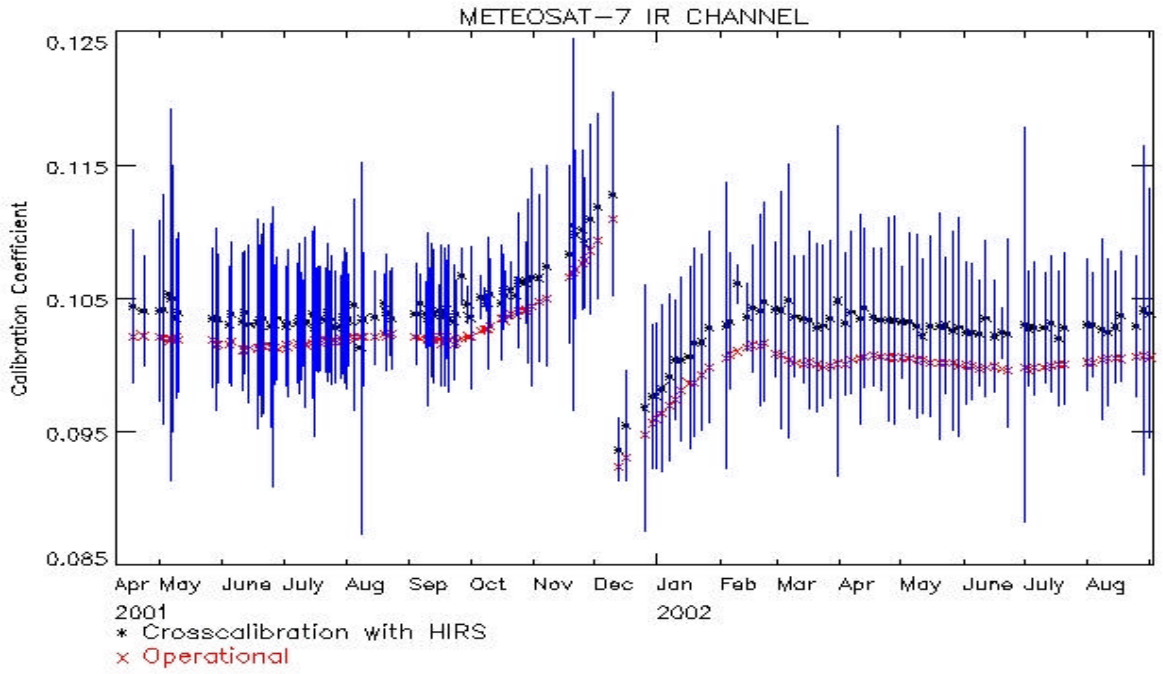

Figure 1: Comparison of the operational calibration coefficient of the Meteosat-7 IR channel (crosses) with results from an intercalibration with channel 8 of HIRS (asterisks) onboard NOAA-14. Error bars show the standard deviation due to scatter of individual cross-calibration targets.

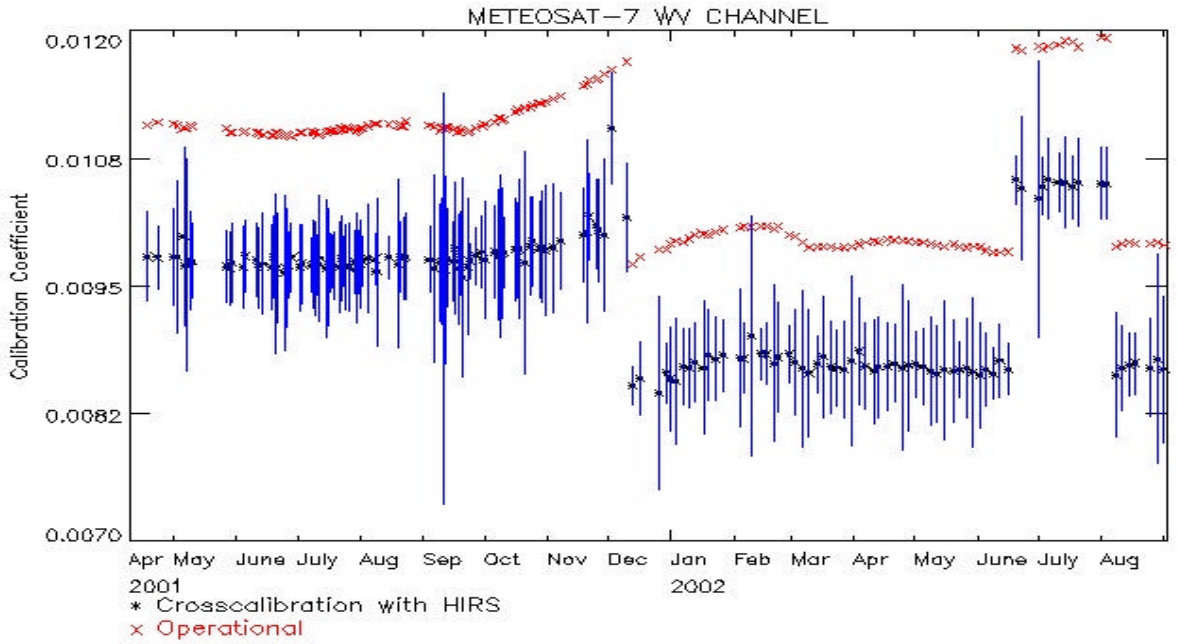

Figure 2: As Figure 1, but for the Meteosat-7 WV channel (crosses) and channel 12 of HIRS (asterisks) onboard NOAA-14.

3 RESULTS FOR METEOSAT-5

The intercalibration results for Meteosat-5 show a cold bias of almost 3 % for the IR channel, and a 14 % warm bias for the WV channel. The intercalibration results for Meteosat-5 are presented in Figures 3 and 4.

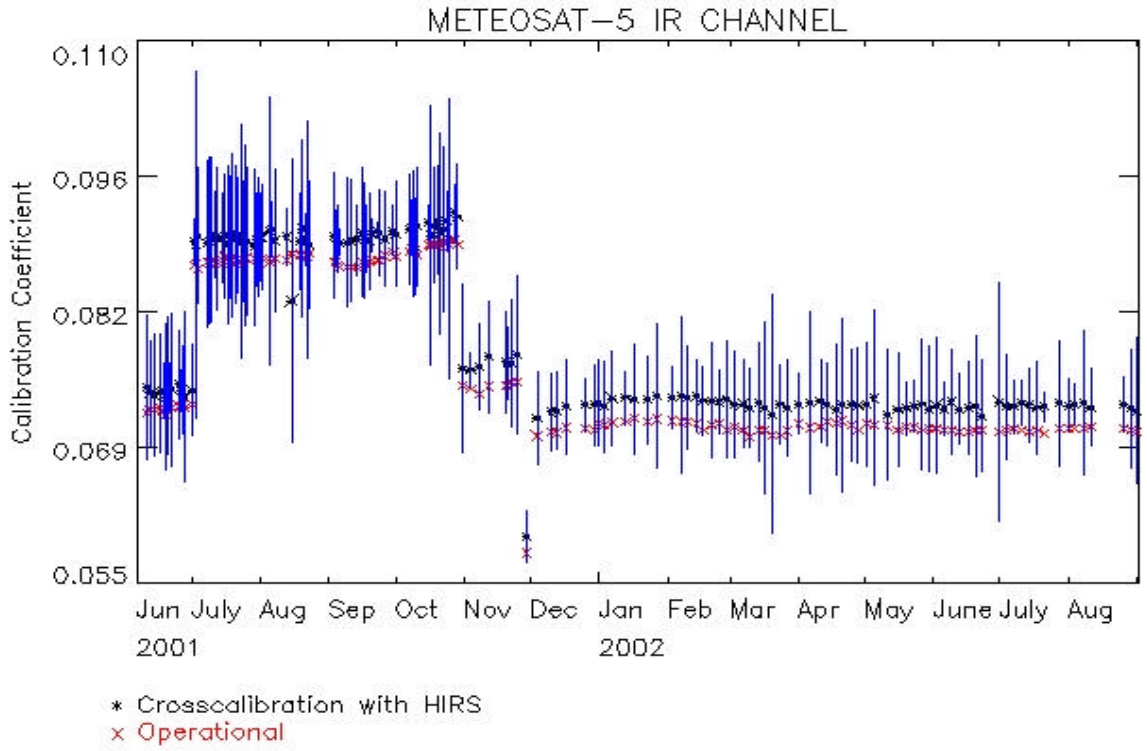

Figure 3: Comparison of the operational calibration coefficient of the Meteosat-5 IR channel (crosses) with results from an intercalibration with channel 8 of HIRS (asterisks) onboard NOAA-14. Error bars show the standard deviation due to scatter of individual cross-calibration targets..

The large jumps in July and October 2001 for both the IR and the WV channel and in February 2002 for the WV channel are due to different radiometric gain settings onboard the satellite. The somewhat smaller jump end of November 2001 is caused by a decontamination of the detectors of Meteosat-5.

4 BIAS DISCUSSION

The results from the previous sections show a persistent bias between the Meteosat IR and WV channels and the relevant channels from HIRS. As the reason for such bias can be manifold, an internal project at EUMETSAT has been initiated to identify potential sources and to estimate their impact on calibration. This project involves the whole calibration suite, starting with an error budget analysis for the involved spacecraft components, such as the detectors (spectral response functions), black body source (emissivity), and the front optics (lens transmissivities and reflecitivities). Additionally the complete calibration code will be reviewed, from the acceptance of numerical forecasts (for determination of atomospheric

corrections) to the radiative transfer code used. A more detailed analysis of cross calibration results with data other spacecraft (e.g. HIRS data) will be performed as well.

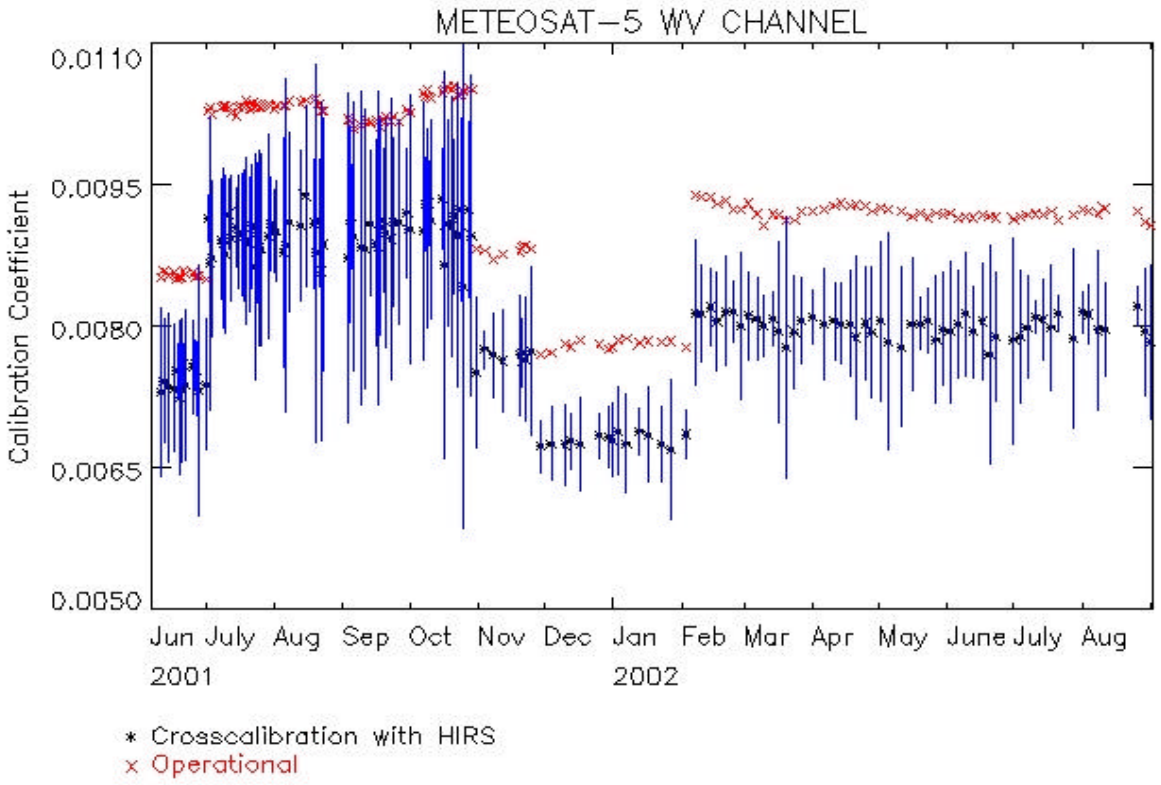

Figure 4: As Figure 3, but for the Meteosat-5 WV channel (crosses) and channel 12 of HIRS (asterisks) onboard NOAA-14.

5 CONCLUSIONS

A cross calibration is routinely performed to compare the IR-window and WV channels of Meteosat-7 and Meteosat-5 (at 63° E) with channels 8 and 12 of the HIRS instrument on NOAA-14. The current results indicate a similar bias for both Meteosat-7 and –5 (as measured against HIRS) of the order of –1 to –2 K for the IR window channel and roughly + 3 K for the WV channel.

There are several potential sources of the observed bias. These include errors in the operational calibration and uncertainties in the instrument characterisation, especially in the spectral response functions. In order to improve the calibration further investigations on the potential error sources are ongoing with the aim to have a better understanding of all elements impacting the image calibration.