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PERFORMANCE OF METEOSAT-5 CALIBRATION USING A SATELLITE CROSS CALIBRATION TECHNIQUE

This paper presents results from the Meteosat-5 Satellite Cross Calibration technique and, in particular, addresses the following topics:

- Cross Calibration Method
- Performance of Meteosat-5 Calibration

CGMS Members are invited to take note.

PERFORMANCE OF METEOSAT-5 CALIBRATION USING A SATELLITE CROSS CALIBRATION TECHNIQUE

1 INTRODUCTION

Since 31st May 2001, Meteosat-5 imagery has been calibrated using a satellite cross calibration technique using the Meteosat-7 black body calibration as reference. The main aim of the cross calibration technique is to stabilise the Meteosat-5 WV calibration, which could vary several degrees K over short periods. This large variability is thought to be caused by the large variability in types and quality of radiosonde ascents, and by the large variability in the acceptance of radiosonde observations. Furthermore, since the quality control system prevents the use of observations in cloudy regions, the number and geographical distribution of radiosonde observations can vary considerably depending upon the meteorological situation.

This paper discusses the cross calibration method and presents some first indications of calibration performance.

2 SATELLITE CROSS CALIBRATION METHOD

The Meteosat-7 black body calibration is taken as a reference in the present method and the overlap area between Meteosat-5 and Meteosat-7 imagery is used for cross calibration. Since both spacecraft scan the Earth in exactly the same time frame, there are no problems relating to the timeliness of imagery. However, the main constraint on the use of overlap imagery is the difference in the viewing angle. In order to exclude this effect, only those pixels from both spacecraft are used whose difference in viewing angle is less than 5^0.

The radiances of the Meteosat-7 pixels in the overlap area are determined using Meteosat-7 calibration coefficients. A relationship between Meteosat-7 and Meteosat-5 radiances has been derived from radiative transfer calculations using a large set of radiosonde observations and the resulting transformation formulae will be published on the EUMETSAT web pages (www.eumetsat.de) in due course. Hence, knowing the expected Meteosat-5 radiances and the observed Meteosat-5 counts, a calibration can be derived using a linear relationship between radiances and counts.

A cross satellite calibration coefficient is generated for every Meteosat-5 image when a corresponding Meteosat-7 image is available. However, these series of calibration coefficients cannot be used operationally without quality control, as there might be deficiencies in either of the Meteosat-5 or Meteosat-7 images (the most noticeable examples being the warm spots and cold bands in WV imagery during the eclipse periods). Clearly, use of such images would lead to erroneous calibration coefficients, hence, the operational calibration of Meteosat-5 imagery is performed only twice daily at 08:00 UTC and 20:00 UTC. The latest 24 cross calibration coefficients are then quality controlled and used to generate an averaged Meteosat-5 calibration coefficient.

Within the quality control step, an averaged calibration coefficient of the 24 values is first determined. In the next step, all individual values that differ more than 10 % from the averaged value are flagged as suspect, and of the remaining values a new calibration coefficient is determined. The operational calibration coefficient is then only updated by a new value when it differs by more than 0.1 % from the new calibration coefficient.

3 METEOSAT-5 CALIBRATION PERFORMANCE

The improved Meteosat-5 calibration using a cross satellite calibration technique became operational on 31st May 2001. Following a two-month comparison (June and July 2001) the operational calibration is about 1 % lower than the vicarious calibration used previously. Whilst the variability of the IR calibration is similar for both methods, the variability of the WV calibration is reduced by about a factor of 4 (Figure 1). The largest impact of this upon products can be seen with Clear Sky Radiance.

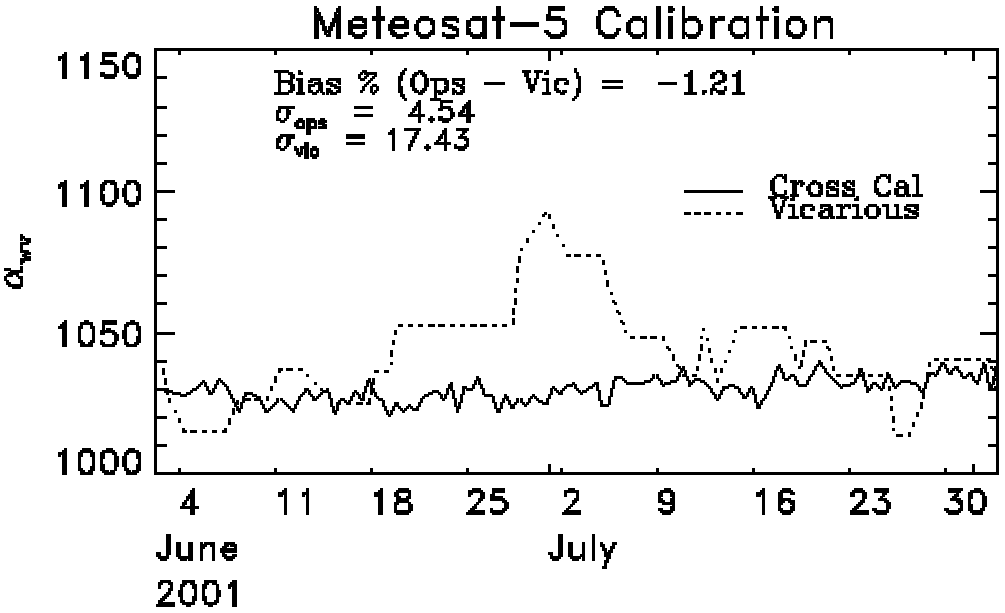

Figure 1: Operational Meteosat-5 satellite cross calibration coefficient compared with the vicarious calibration coefficient for the WV channel.

4 CONCLUSION

CGMS Members are invited to take note of the results from the Meteosat-5 Satellite Cross Calibration technique. It should be recalled that the main aim of the method has been to improve the stability of the WV channel calibration. Clearly, the behaviour of the calibration within eclipse periods has to be monitored closely and the currently used threshold might possibly need updating, nevertheless, the stability improvement of the WV channel calibration is significant.