1 SATELLITE INTERCALIBRATION

At CGMS XXV in St. Petersburg in 1997 it was agreed that designated CGMS members should collect some data sets with overlap between a polar orbiting sensor (HIRS or AVHRR) and some of the geostationary images (GMS, Meteosat, and GOES) for the purpose intercalibration. Over the last years CGMS participants have processed intercalibration data sets with their own algorithm and have presented results at CGMS meetings. Thereby the potential of satellite intercalibration has been demonstrated but routine or operational implementation is still pending.

In order to make a step toward an operational implementation CGMS XXVIII in Woods Hole in 2000 placed the following action:

Each satellite operator to post on the CGMS homepage available relevant papers and results on satellite radiance (VIS, IR, WV) inter-comparisons in convenient format and to update them periodically throughout the period until CGMS XXIX.

The following presents the fulfillment of this action by EUMETSAT. It is also seen as a first step toward a regular web site on operational satellite cross-calibration performed at EUMETSAT.

It is important that the satellite cross-calibration is performed by satellite operators in an operational fashion because it provides a continuous basis for the quality checking of the operational calibration. To date users of satellite data have had to make their own calibration adjustments when using multi-satellite data. The International Satellite Cloud Climatology Program (ISSCP) is an illustrious example; ISCCP has produced a multi-year and multi-satellite calibrated data set by inter-comparing and adjusting satellite infrared window and visible radiance measurements from the past seventeen years. Since the ISCCP is a research effort with a finite lifetime, it can not and should not assume responsibility for the continued production of such a calibrated data set. It is also noted that the ISCCP results are only available months after the actual satellite observation. Therefore they are not useful for an operational monitoring or for the support to real-time NWP applications of satellite radiance data which commonly require a bias correction. Such an activity needs to be embraced by the satellite operating agencies.

1.1 Purpose

A satellite intercalibration is beneficial for two reasons:

- Intercalibration can identify problems and increase the confidence in the operational calibration of individual satellites. Hence, intercalibration can serve as a monitoring tool for the operational calibration.
- Intercalibration can provide the basis for a normalised calibration, which is a prerequisite for the derivation of global products from different satellites. Normalisation is to be done with respect to a particular satellite, where a polar orbiter is best suited due to its global coverage.

1.2 Results of intercalibration between Meteosat and NOAA satellites

During the past three years, a rather continuous time series of intercalibration coefficients have been obtained between the two Meteosat satellites and the HIRS instrument onboard NOAA-16 as well as NOAA-17. The Meteosat IR and WV channels were compared to HIRS channels 8 and 10, respectively. This analysis shows:
Gain changes are also apparent in the calculated cross calibration coefficients.
Both the operational and the intercalibration coefficients are currently very stable in time. The intercalibration coefficient shows a little more variability, but that can easily be explained by the variability in different orbits, where the number of possible collocations changes, the time difference between the images varies, and the cloud situation is always different. These variations, however, are much smaller than the uncertainty due to scatter of the local intercalibration coefficients as indicated by the error bars.
The IR coefficients are rather close, and the operational coefficient is practically always within the error bounds of the cross-calibration coefficient.

The table below links to the calibration coefficients and temperature biases resulting from the intercalibration between the two Meteosat satellites and NOAA-16 and NOAA-17.

Meteosat-5 Intersatellite Calibration								Meteosat-7 Intersatellite Calibration							
NOAA-16				NOAA-17				NOAA-16				NOAA-17			
Calib. Coeffs		Temp. Biases		Calib. Coeffs		Temp. Biases		Calib. Coeffs		Temp. Biases		Calib. Coeffs		Temp. Biases	
IR	WV	IR	WV	IR	WV	IR	WV	IR	WV	IR	WV	IR	WV	IR	WV
2003	2003	2003	2003					2003	2003	2003	2003				
2004	2004	2004	2004					2004	2004	2004	2004				
2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005
2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
2007	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007

The seasonal variation of the temperature biases resulting from the intercalibration between the two Meteosat satellites and NOAA-16 and NOAA-17 is shown here.

1.3 The following papers describe this method:

PDF, 1.6 MB	Intercalibration of Meteosat-7 Water Vapor Channel with SSM/T-2
PDF, 1.1 MB	Satellite Intercalibration of IR Window Radiance Observations
PDF, 78 KB	Results From EUMETSAT IR and WV Satellite Intercalibration Work (XXIX CGMS 2001)