METEOSAT VIS CHANNEL CALIBRATION INFORMATION

The vicarious calibration of the Meteosat VIS channel relies on the SEVIRI Solar Channel Calibration (SSCC) algorithm which has been specifically developed for the operational calibration of the solar channels of SEVIRI. This algorithm is based upon radiative transfer simulation over bright desert and sea targets accounting for the spectral response of the calibrated channels (see reference 1). To reduce and estimate the calibration error, a large number of images, typically corresponding to 5 to 10 days of daylight data acquired under different illumination conditions, are processed. Under normal operation, the calibration is performed four to eight times a year to monitor the drift of the instrument, assuming a linear degradation (see reference 3).

The method includes the following features:

- Both clear sky sea surface and bright desert targets are used. The sea surface properties are essentially determined by the wind speed and direction as provided by ECMWF. Desert targets are located in the Saharan and Arabian deserts.

- Cloud screening over sea relies on a simple threshold method. For each processed image, the darkest 40 X 40 pixels window is extracted from the target area. If the variation range within that window is less than 5 VIS counts, it is flagged as a very clear sky area and the 3 X 3 pixels sub-window located in the centre of the window is selected for calibration. Because of the darkness and homogeneity criteria, the extracted sub-window can be assumed cloud free and with a very low aerosol optical thickness. Over bright deserts, cloud screening is based upon a second order polynomial fitting on daily observations.

- Over both sea and desert targets, the radiation transfer is calculated with the 6S code. The radiation transfer in the atmosphere account for the total column water vapour derived from ECMWF analysed meteorological data and the total column ozone content derived from Total Ozone Mapping System (TOMS) observations. A constant value is assigned to the aerosol optical thickness.

- The calculated spectral radiances are weighted by the VIS detector spectral response. For Meteosat-5 and -6, the sensor spectral response has been corrected with the Meteosat-7 spectral response function due to a pre-launch problem.

- To reduce the calibration error, a large number of images acquired at different illumination conditions are processed.

Table 1 below shows the calibration coefficient C_f[Wm $^{-2}$sr $^{-1}$/DC] estimated at the launch date together with the daily degradation rate [Wm $^{-2}$sr $^{-1}$/DC DAY^{-1} 10^{+5}] of the VIS band. **Space counts** together with detailed information on all the calibrated periods are also available, linked from Table1 below.

Table 1 - Meteosat VIS band calibration coefficients in W m $^{-2}$ sr $^{-1}$/DC and its associated drift

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Meteosat	Launch date	Version	C_f at launch	C_f error	Drift	Drift error	First period	Last period	Irradiance	Space Count	I.SSR	Gain Value	Remark
2	19 Jun 1981	07.07.01	0.5454	0.1029	1.4926	4.5826	13/09/1982	14/06/1988	499.9	Details Met-2	0.388	1	
2	19 Jun 1981	07.07.01	0.6519	0.0417	2.3223	3.0913	17/03/1982	01/05/1987	499.9	Details Met-2	0.388	0	
3	15 Jun 1988	07.07.01	0.6277	0.0915	3.5465	41.2877	09/12/1988	05/01/1989	602.2	Details Met-3	0.453	1	
3	15 Jun 1988	07.07.01	0.7571	0.1913	3.9283	25.8182	31/01/1990	21/01/1991	602.2	Details Met-3	0.453	0	
4	2 Mar 1989	07.07.01	0.7320	0.0300	5.2390	2.8305	21/06/1989	30/01/1994	599.5	Details Met-4	0.439	4	
5	2 Mar 1991	07.07.01	0.8142	0.0564	2.9916	1.3890	28/10/1994	13/09/2006	690.6	Details Met-5	0.504	5	MET-7 spectral response
6	20 Nov 1993	07.07.01	0.8376	0.0629	3.9443	1.9778	21/10/1996	13/09/2006	691.4	Details Met-6	0.504	5	MET-7 spectral response
7	2 Sep 1997	07.07.01	0.9184	0.0174	5.3507	0.8157	17/10/1997	07/29/2008	690.8	Details Met-7	0.504	6	

The estimation of C_f at a given date t should be computed with the following formula:

$$C_f(t) = C_f + (D_f N_t 10^{-5})$$

where

C_f	Calibration coefficient at launch date	W m $^{-2}$ sr $^{-1}$/DC
D_f	Daily drift	W m $^{-2}$ sr $^{-1}$/DC DAY^{-1}10^{+5}
N_f	Number of days since launch date	DAY
DAY^{-1}	Drift scaling coefficient	Unitless

Legend:

Meteosat : The simulated spectral radiances at the front of the telescope are weighted by the sensor spectral response. The VIS channel is composed of two detectors. Since the rectified images used for the calibration result from an equalization process between these two detectors, the mean value of their spectral response is used, except for Meteosat-5 and -6. For these two spacecrafts, the sensor spectral response has been corrected with the Meteosat-7 spectral response function due to a pre-launch problem. Detailed information available in reference 2 below.

Launch date : Date at which the calibration coefficient C_f is estimated with a linear regression performed on all the processed periods. Note that the launch date instead of the start of operation date is used.

Version : Calibration coefficient version number as delivered by the SSCC algorithm. This algorithm includes a control of the version number of all the input data. The version number accounts for the algorithm release number and the input data version number.

C_f at launch time : Value of the calibration coefficient estimated at the launch date in $Wm^{-2}sr^{-1}/DC$. The effective radiance can be retrieved with the following formula:

$$L_f = C_f (DC - DC_0)$$

where

Lf	Effective radiance	$W\ m^{-2}\ sr^{-1}$
C_f	Calibration coefficient	$W\ m^{-2}\ sr^{-1}/DC$
DC	Observed digital count	DIGITAL COUNT UNIT
DC_0	Offset	DIGITAL COUNT UNIT

The value DC_0 is estimated as the mean value of the two VIS detector offset.

C_f error: Estimated error of C_f at launch time in $Wm^{-2}sr^{-1}/DC$.

Drift: Daily drift of C_f in $W\ m^{-2}\ sr^{-1}/DC\ DAY^{-1}\ 10^{+5}$.

Drift error: Estimated daily drift error of C_f in $W\ m^{-2}\ sr^{-1}/DC\ DAY^{-1}\ 10^{+5}$.

First period: First period used for the estimation of the drift.

Last period: Last period used for the estimation of the drift.

I. SSR Integral of the Sensor Spectral Response in micrometer.

Irradiance: Solar irradiance in Wm^{-2} in the Meteosat VIS band spectral response at 1AU.

If you have questions about Meteosat VIS calibration, please contact the User Service.

References

	Reference	Details
Abstract	1	Govaerts, Y.M., and Clerici, M. (2004) Evaluation of radiative transfer simulations over bright desert calibration sites, IEEE Transactions on Geoscience and Remote Sensing, 42,176-187.
Abstract	2	Govaerts, Y.M. (1999) Correction of the Meteosat-5 and -6 VIS band relative spectral response with Meteosat-7 characteristics, International Journal of Remote Sensing, 20, 3677-3677.
Abstract	3	Govaerts, Y.M., Clerici, M., and Clerbaux, N. (2004) Operational Calibration of the Meteosat Radiometer VIS Band, IEEE Transactions on Geoscience and Remote Sensing, 42, 1900-1914.