1. Vicarious Calibration

Because Meteosat is a spin-stabilised spacecraft the vicarious calibration was in the beginning of the Meteosat project the only method available to derive absolute calibration information. For Meteosat 7 a new blackbody calibration was put into operation 29th May 2000, and from 31st May 2001 a cross calibration has been used for Meteosat 5.

The vicarious calibration method uses external data for calibration of the Meteosat infra red channels. For the IR channel the NCEP (National Centers for Environmental Prediction, USA) surface data, and for the WV channel radiosonde observations are used as reference data sets.

1.1 IR Channel Calibration

For every image sea surface temperatures from the NCEP data sets are converted to radiances, taking the impact of the intervening atmosphere into account. These expected radiances are then correlated with observed counts of pixels that have been identified as sea surface scenes. The relation between the expected radiances and the observed counts are the instantaneous calibration coefficients. Twice daily at 08 and 20 UTC, 24 relevant instantaneous calibration coefficients are averaged. This means that for the 08 UTC calibration the 24 calibration coefficients between 08 and 20 UTC of the former day are averaged. The operational IR calibration coefficient is updated then only if the new average differs by more than 0.0002 (Wm-2sr-1count-1) from the calibration coefficient that was operational up to that moment.

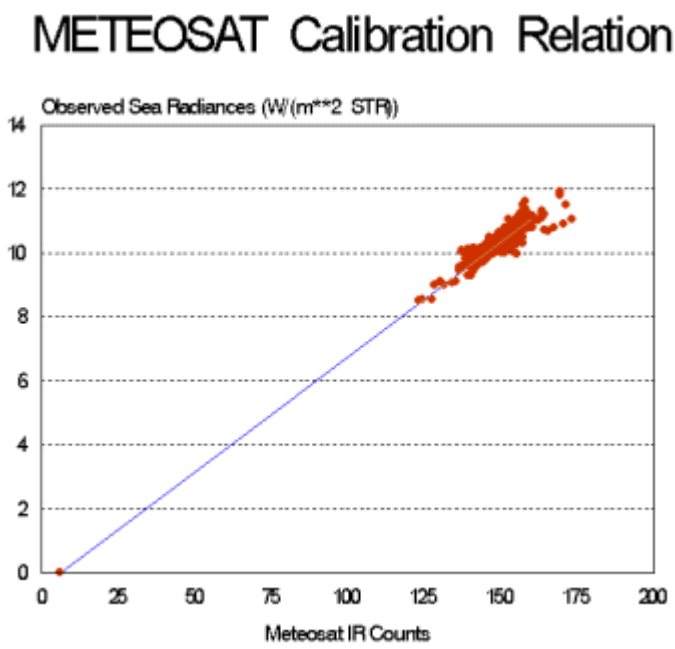
1.2 WV Channel Calibration

The calibration of the WV channel is performed using radiosonde observations as external reference. From the temperature and humidity profile the expected radiance at the top of the atmosphere is determined. These expected radiances are then related to the mean WV count of the segment, in which the radiosonde station is located, when it fulfils the following conditions:

- The radiosonde station must be located within the 550 great circle arc around the sub-satellite point
- The segment must be free of clouds above 700 hPa.

From all remaining collocations of expected radiances and observed counts the instantaneous calibration coefficient is derived twice daily. As there can be large fluctuations of the instantaneous calibration coefficients the following stabilising algorithm is applied. Twice daily at 08 and 20 UTC the latest six instantaneous calibration coefficients are used to determine a primary average. Of those six instantaneous calibration coefficients those coefficients that deviate by more than one standard deviation from the average are removed from the list of usable calibration coefficients. From the remaining data a new average is determined, and the operational WV calibration coefficient is updated if this new average deviates by more than 1 % from the currently operational calibration coefficient.

The calibration coefficients are calculated as the slope of the line connecting the centre of gravity of the collocation data and the so-called space count, which is the radiometric reading when the satellite is viewing space. An example of the calibration relation is given in the figure below:



The calibration relation is given by:

$R = \alpha (C_{nt} - C_0)$

where:

R = Radiance
α = Calibration Coefficient
C_{nt} = Digital Meteosat Count
C_0 = Space Count