CGMS-XXVII JPN WP-17
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Agenda Item : II/2

OPERATIONAL CALIBRATION PRACTICES OF GMS-5

The purpose of this document is to report on the generation of calibration tables and its application. A problem in the GMS-5 calibration is also described (A/I-26.35).

OPERATIONAL CALIBRATION PRACTICES of GMS-5

1. Operational Data Processing of GMS-5

The GMS-5 is a spin-stabilized satellite. The Visible and Infrared Spin Scan Radiometer (VISSR), the imaging instrument of GMS-5, scans the Earth with one visible channel and three infrared channels from north to south as the rotation of the spacecraft. The size of image of VISSR consists of 2,500 lines by 2,500 pixels for the IR channels and 10,000 lines by 10,000 pixels for the visible channel.

Electric voltages of VISSR sensors are sampled and converted to digital counts, i.e., eight bits for the infrared channels, and six bits for the visible channel. The sensor counts are sent to the Command and Data Acquisition Station (CDAS) and converted to the Stretched-VISSR (S-VISSR) signal, and disseminated to the Medium scale Data Utilization Stations (MDUSs) via GMS-5. Calibration tables and navigation parameters are sent with the S-VISSR image.

2. Calibration table of the infrared channels

The calibration tables for infrared channels define the relationship between raw S-VISSR counts and brightness temperatures. There is a calibration table for each of the three infrared channels. Each table is generated using a warm blackbody and the cold space as reference. The warm blackbody is an internal radiation source inserted into the optical path of VISSR, and its radiance is detected by IR sensors. The detected counts appear in the fourth line of the imaging frame. The cold space is VISSR counts of space area observed in the imaging frame.

A set of calibration tables is generated for each of hourly observations and twenty-four sets of tables are generated per day. A set of tables generated from a particular observation will be applied to the observation at the same hour on the following day.

No calibration tables are generated for wind observations, and calibration tables included in the wind observations are appropriated from the calibration tables for the following hourly observations. The relation between table generations and its applications are illustrated in Figure.1.

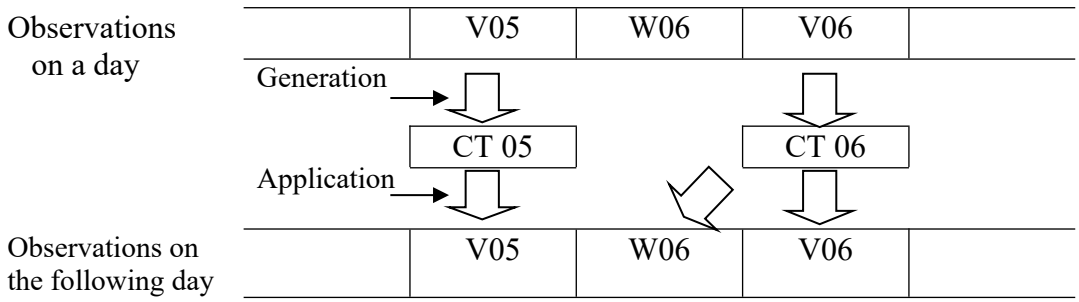

Figure.1 Relationship between generation and application of calibration tables.

The one-day delay between generation and application of the calibration tables may affect the precision of brightness temperature especially in equinox seasons. Its effects on the calibration were evaluated and it was confirmed that the effect is well kept within a half of the brightness resolution of each channel even in the equinox seasons.

3. Calibration table of the visible channel

The calibration tables for the visible channel define the relationship between raw S-VISSR counts and albedos. The VISSR has four visible detectors and one calibration table is defined for each detector. As no brightness reference object for the visible channel is available operationally, the calibration tables in S-VISSR for the visible channel have fixed values that are generated from pre-launch measurements. No operational calibration is applied to the visible channel.

4. Spectral Response Function of WV channel

When the GMS calibration process was reviewed, it was revealed that the response function of IR3 (water vapor channel) may have been affected by atmospheric water vapor during the pre-launch measurement. The VISSR manufacturer admitted it but the atmospheric conditions at the measurement site weren't recorded.

Figure.2 shows an example of the response function of the water vapor channel and the transmissivity that is calculated by MODTRAN for a four-meter path under the standard atmosphere conditions i.e., 20 degrees Celsius, and 50 percent relative humidity. As transmissivity is critical to conditions, it is not possible to determine the real response function of the channel. Therefore, we continue to carry out the calibration as usual without modifying the response function of WV channel.

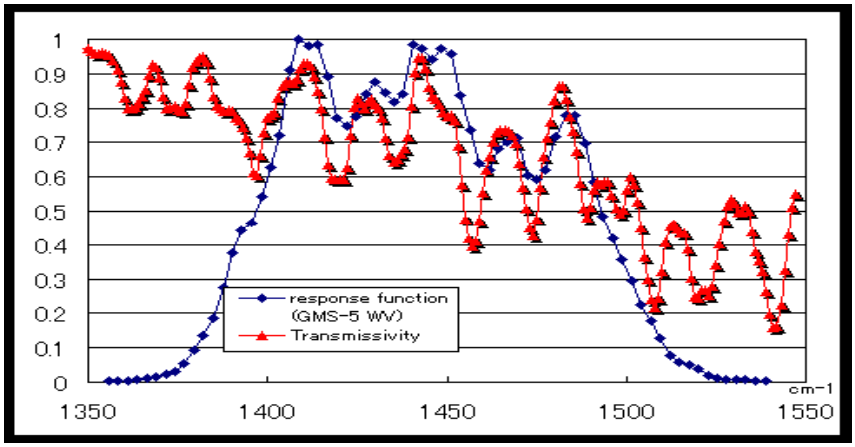

Figure.2 Example of relationship between spectral response function of WV channel of GMS-5 and transmissivity of 4 meter path in standard atmosphere.

5.Operational Calibration of MTSAT

MTSAT disseminates the High Resolution Image Data (HiRID) in place of S-VISSR. Though HiRID is upper compatible with the S-VISSR, operational calibration of MTSAT differs from GMS. Details of the operational calibration methods of MTSAT are described in the other document (WP-16).