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GSICS Global Space-based Inter-Calibration System **Quarterly** **V6 No. 1 2012**

CMA • CNES • EUMETSAT • IMD• ISRO• JAXA•JMA • KMA • NASA • NIST • NOAA • ROSHYDROMET• USGS• WMO

http://gsics.wmo.int *Dr. Fangfang Yu, Editor*

Special Issues on the Vicarious Calibration of GEO Solar Reflective Channel s

MTSAT-2 Visible Vicarious Calibration Approach and Its Monitoring Webpage

The Japan Meteorological Agency (JMA) has been operating the geostationary satellite series Geostationary Meteorological Satellite (GMS) and Multifunction Transport Satellite (MTSAT) over the Western Pacific region for more than 30 years. Each satellite carries one visible and infrared imager. The infrared images provided to users are operationally calibrated onboard, whereas no onboard calibration is performed for visible data.

To meet the increasing requirements for high quality satellite data, JMA, in collaboration with the University of Tokyo and the Chiba University, has developed the visible vicarious calibration method to calibrate the historical visible images. This vicarious calibration method is based on the simulated reflectivity over different earth targets, including cloud-free ocean, deserts and water clouds to reconstruct the linear visible calibration coefficients (Kosaka *et al.*, 2012). First, the visible images are used to select the spatially uniform and temporally stable areas of cloud-free ocean, cloud-free desert and water cloud. Second, the satellite measured radiances of the selected areas are regressed against the simulated ones. The RSTAR radiative transfer model developed by Prof. Nakajima in the University of Tokyo and his colleagues (Nakajima and Tanaka, 1986) is used to simulate the satellite measurements. The inputs to the radiative transfer calculation include the satellite independent observations such as the temperature and water vapor profiles from the JMA Numerical Weather Prediction models, the total column ozone amount from Aura/OMI data, and the aerosol and cloud optical parameters retrieved from MODIS Level 1B data. Figure 1 show the linear calibration coefficients of the MTSAT-2 visible channel, which are also monitored on the webpage of the Meteorological Satellite Center of JMA (https://mscweb.kishou.go.jp/monitoring/calibration.htm).
The uncertainty of this approach is estimated by comparing the simulated radiances with the Terra/MODIS observations. Root Mean Square Difference (RMSD) between the simulations and the observations shows that uncertainty of the simulation process is less than 1%.

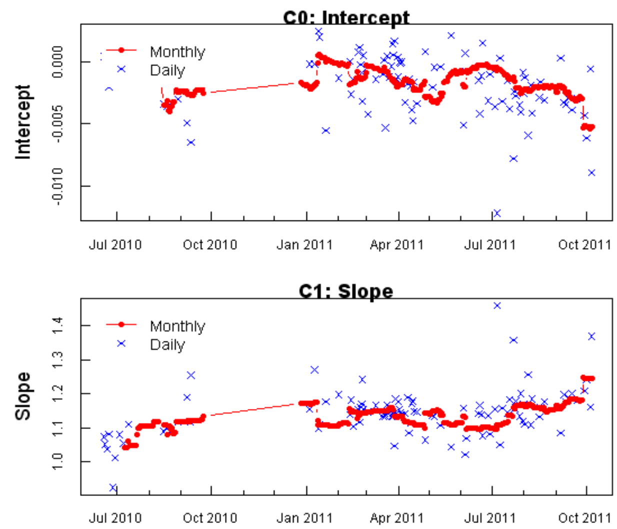

Figure 1: Time-series of calibration coefficients for MTSAT-2 visible channel.

JMA has re-calibrated the GMS-5 visible data since the operation of the MODIS in 2000. Using the re-calibrated GMS-5 historical data, JMA, in cooperation with EUMETSAT, has retrieved the land surface albedo (Govaerts *et al.*, 2008) for the WMO climate program, "Sustained, Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM)". Figure 2 shows an example of the surface albedo product.

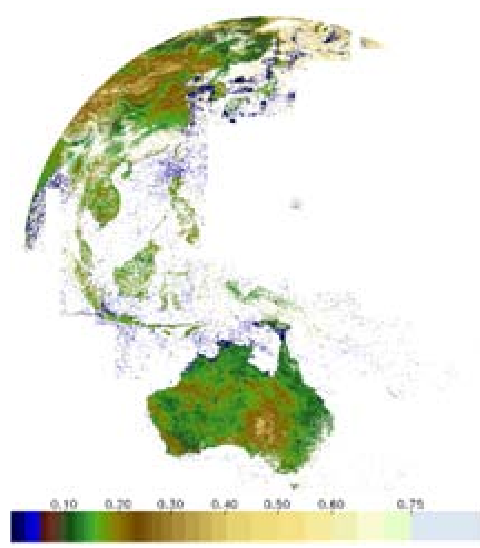

Figure 2: Composite surface albedo retrieved from calibrated GMS-5 visible data from 01 to 10 May 2001.

Currently JMA is working to add the deep convective cloud (DCC) as the fourth reference target to improve the calibration accuracy. To simulate DCC radiance, the radiative transfer code must compute scattering by non-spherical ice particles. Determining ice cloud parameters such as particle shape and size is an issue. JMA plans to use this technique to validate the on-board calibrated radiance of the six visible and near-infrared channels of the new imager Advanced Himawari Imager (AHI) on the next generation Japanese geostationary meteorological satellite Himawari-8, which will be launched in 2014.

(by Mr. Yuki Kosaka and Mr. Arata Okuyama, [JMA])

REFERENCES

Kosaka, Y., A. Okuyama, H. Takenaka, and S. Fukuda, 2012: Development and improvement of a vicarious calibration technique for the visible channel of geostationary meteorological satellites. *Meteorological Satellite Center Technical Note*, **57**, 2012 (In Japanese).

Nakajima, T., and M. Tanaka, 1986: Matrix formulation for the transfer of solar radiation in a plane-parallel scattering atmosphere. *J. Quant. Spectrosc. Radiat. Transfer*, **35**, 13-21.

Govaerts, Y.M., A. Lattanzio, M. Taberner and B. Pinty, 2008: Generating global surface albedo products from multiple geostationary satellites. *Remote Sensing of Environment*, **112,** 2804-2816.

The CNES Rayleigh Scattering Technique to Calibrate LEOs and GEOs

Physical Basis

The Rayleigh scattering calibration technique provides an absolute radiance for instruments in the visible spectral range, typically from 410 to 670 nm. The idea is to observe the atmospheric scattering, for very clear sky conditions, and over a dark surface (i.e. the ocean). In such situations, the purely molecular sky scattering, the so-called Rayleigh scattering, is about 85 to 90% of the top-of-atmosphere signal. This dominant contribution is accurately predictable, and after corrections of the residual effects of other minor contributions, provides an efficient radiometric absolute calibration tool.

After a very restrictive set of screening steps, measurements are selected for only very clear sky and surface conditions. Perturbations by clouds, aerosol loads, sunglint, and surface whitecaps are discarded using thresholds on wind speed, viewing geometries, and measured reflectance of a near-infrared band (assumed to be calibrated with accuracy better than 5%).

As illustrated in Figure 1, the surface oceanic reflectance (marine contribution) is the secondary contributor for blue to green bands (about 10%), and the aerosol residual background for red band (about 10%). Measurements were only collected over predefined oceanic sites which were selected due to their moderate seasonality, spatial homogeneities, and atmospheric cleanliness in term of aerosol events (Fougnie *et al.*, 2002).

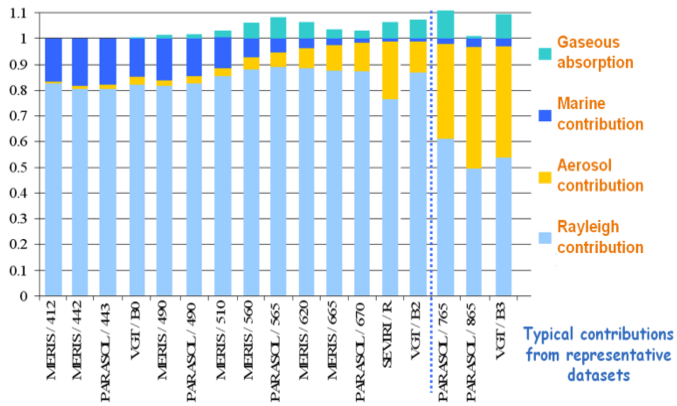

Figure 1. The Rayleigh scattering technique: typical relative contribution for each process (molecular scattering, aerosol scattering, gaseous absorption, and surface reflectance) for a representative set of spectral bands and for various sensors: MERIS, PARASOL, Végétation, and SEVIRI.

Update of Climatology

For each oceanic site, the marine reflectance is characterized through a climatology based on one year of SeaWiFS data (Fougnie *et al.*, 2002). These values have been used in the operational processing at CNES for nearly 10 years. Recently, a revision of the climatology based on 10 years of SeaWiFS data was performed (Fougnie *et al.*, 2010). Improvements in surface reflectance were quantified in Fougnie *et al*. (2010), and are mainly due to the more representative longer time series - 10-years versus only one year - and a reprocessing of a small calibration readjustment of SeaWiFS data in 2009.

We recently quantified the impact of the updated climatology using the MERIS calibration. The test showed better consistency between statistical results for some bands; bias between different sites and throughout the year being slightly reduced (Figure 2, upper panel). For other cases, i.e. other bands or sites, no significant improvement was statistically shown (Figure 2, lower panel). Because the new climatology built over 10 years is more representative than the historical one, we intend to update the table in our operational processing soon.

LEO Calibration: SeaWiFS

The calibration method was applied to SeaWiFS data for the entire 1997-2010 archive and for all oceanic sites. Results presented in Bruniquel *et al*., (2012) show a nearly perfect agreement between the Rayleigh scattering calibration and the official calibration of level-1 products: within ±0.5% for top of atmosphere (TOA) reflectance (see Figure 3). A very low dispersion is observed: less than 2% in the UV portion, and less than ±1% for the red bands. These values are an excellent indicator of the error budget of the calibration method. A small drift is observed over the time series, and investigations are being conducted to determine if it is a possible calibration drift or if it can be indirectly linked to an orbital drift (since 2005) leading to changes in the geometrical and geophysical sampling of the atmosphere.

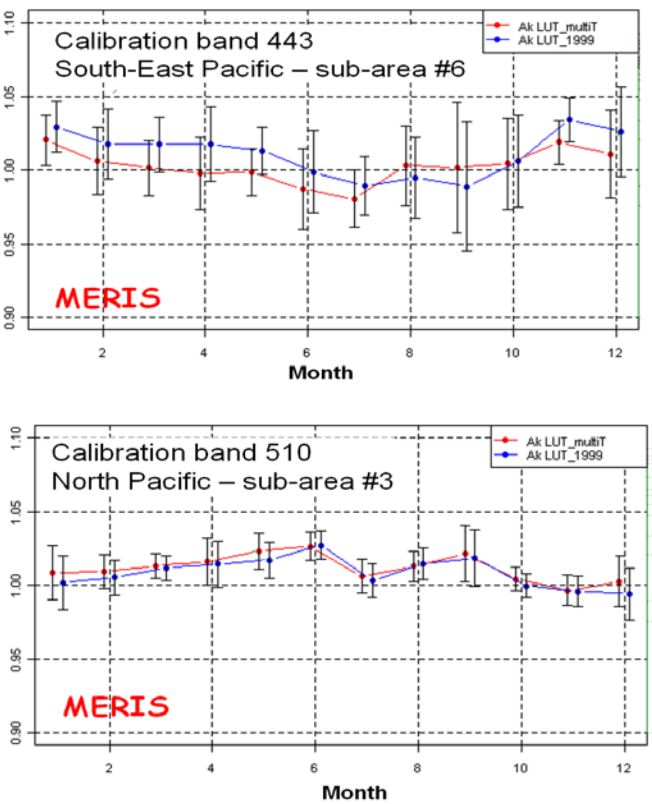

Figure 2. Comparison between MERIS Rayleigh calibration using the historical climatology (year 1999, Fougnie *et al.*, 2002) and the new improved climatology (10 years, Fougnie *et al.*, 2010). The upper panel is for Band 443 and lower panel for Band 510. The y-axis is the ratio of measured to predicted reflectance. Error bar reports the standard deviation over all measurements for the considered month and spectral band.

Preliminary GEO Calibration: SEVIRI

Transferring the methodology from LEO to GEO sensors is not so direct. The GEO and LEO sensors have significantly different geometrical sampling and a GEO sensor is not able to collect data over all the required oceanic sites. These two conditions can lead to larger errors. On the other hand, observations at larger airmass (due to very large viewing angles) should improve the accuracy of the method if the spatial homogeneity of the atmosphere and surfaces is confirmed. A first experiment was performed for the SEVIRI red band (see Jolivet *et al.*, 2009). A calibration bias of -6% is evidenced for the red band confirming the tendencies from the other studies (Figure 4). This result was established for viewing angles ranging from 55° to about 70°. For large viewing angles, some problems arise: inability to predict the sea state with a sufficient accuracy, growing difficulties to correct for gaseous absorption, and the challenge of implementing a radiative transfer computation using a spherical instead of plan/parallel description of the Atmosphere-Earth system.

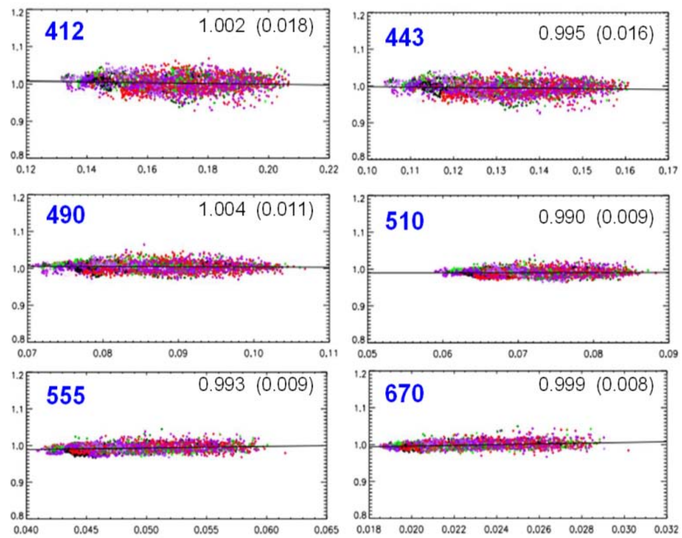

Figure 3. Absolute calibration of SeaWiFS visible bands using Rayleigh scattering for year 2000. Calibration results, ratio of measured to predicted reflectance, are plotted as a function of the measured reflectance at the y-axis.

(by Drs. Bertrand Fougnie and Patrice Henry, [CNES])

REFERENCES

Fougnie et al., 2002: Identification and characterization of stable homogeneous oceanic zones: Climatology and impact on in-flight calibration of space sensor over Rayleigh scattering. *Proceedings of Ocean Optics*.

Fougnie *et al*., 2010: Climatology of oceanic zones suitable for in-flight calibration of space sensors. *Proceedings Earth Observing Systems XV, SPIE*.

Bruniquel-Pinel *et al*. 2012: Absolute calibration of SeaWiFS using Rayleigh scattering over oceanic surfaces, *Proceedings of IGARSS*.

Jolivet *et al*., 2009: Rayleigh calibration of SEVIRI. *EUMETSAT conference*.

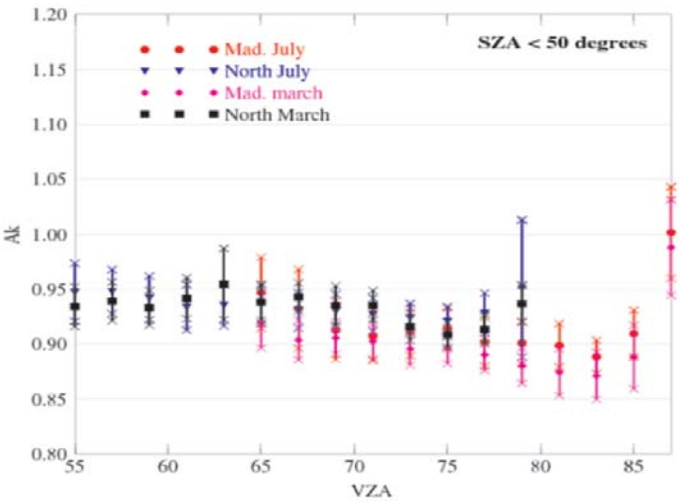

Figure 4. Absolute calibration of SEVIRI (red band) with Rayleigh scattering method for North Atlantic and Madagascar oceanic sites (from Jolivet *et al.*, 2009). Calibration results, ratio of measured to predicted reflectance, are plotted as a function of the viewing zenith angle.

Vicarious Calibration of GOES Imager Visible Channel Using the Moon

The Moon is a very stable calibration reference target for satellite climate change studies. Its surface reflectivity is extremely stable, changing less than 10^{-8} per year (Kieffer, 1997). The effect of the atmosphere between the satellite and the Moon's surface is very small and can be neglected in the lunar calibration of the satellite instrument. Unlike the common onboard calibration systems, the satellite instrument usually utilizes the normal Earth-viewing optical path to view the Moon, making it an important reference for the validation for the on-board instrument. In addition, as the Moon is accessible to all spacecraft, it can be used as a common stable reference for instrument inter-calibrations, which is the main objective of the GSICS program.

Since GOES is in a geostationary orbit above the Equator, a gibbous Moon appears in one of the space corners within its field of regard (FOR) approximately two to four times per month. However, most of these observing opportunities have been missed due to the complicated scan schedule (Wu *et al.*, 2006). Some of the by-chance Moon images can be clipped by the edges of GOES FOR or by the Earth, leaving only about two to three unclipped "good" moon images per year. Figure 1 shows an example of unscheduled lunar appearance in the upper left corner of the GOES-12 full-disk image around 17:45 UTC on September 19, 2005. To ensure sufficient and reliable frequency of lunar observations, NOAA started scheduled lunar image collections each month for each satellite by replacing the scheduled stellar views since November 2005 (Wu *et al.*, 2006).

The relative calibration accuracy of the satellite instrument can be estimated by trending the time-series of the ratios between the satellite measurements and the modeled irradiance. The GOES lunar irradiance E can be calculated as follows (Wu *et al.*, 2006):

$$E = \sum_i R_i \omega_i \qquad (1)$$

where ω_i is the solid angle subtended by a lunar pixel *i*. For GOES, the solid angle is a constant value for each pixel. R_i is the radiance from a pixel *i* on the Moon and can be calculated as follows:

$$R_i = S(C_{i,moon} - C_{i,background}) \qquad (2)$$

where S is the calibration slope (reciprocal of the instrument gain) to convert the instrument response to the radiance. $C_{i,moon}$ is the raw count for the moon pixel *i* (instrument response to the radiance from pixel i) and $C_{i,background}$ is the space count or the background value (instrument response to zero radiance).

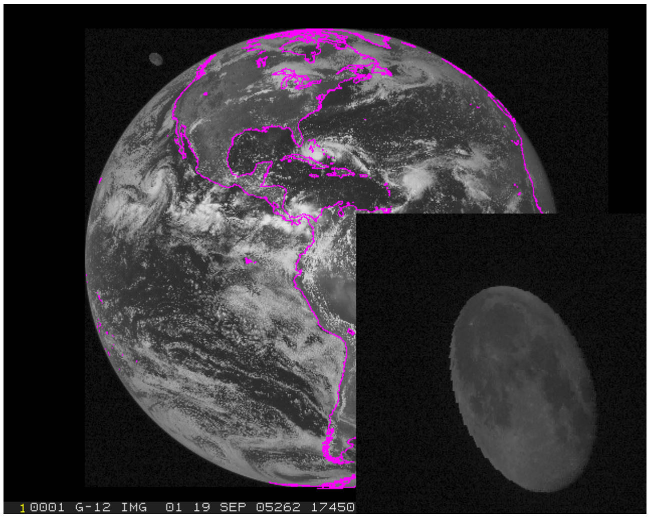

Figure 1. A good moon image appearing in the upper left space view area in the full-disk scan frame around 17:45 UTC on Sept. 19, 2005 (from Wu *et al.*, 2006). Blow-up of moon image in lower right.

In this study, the modeled irradiances were calculated with the USGS lunar calibration model which is developed based on over six years of ground-based Robotic Lunar Observatory (ROLO) measurements (Stone and Kieffer, 2004). It is believed that the relative calibration accuracy of this lunar irradiance model is less than 1% with absolute calibration accuracy estimated at 5-10% (Stone and Keiffer, 2004). Figure 2 shows the time-series of the measured to the modeled irradiance for GOES-10 Imager visible channel. The relative calibration uncertainty is about 2-3%, consistent with those of the other vicarious calibration methods employed at NOAA (http://www.star.nesdis.noaa.gov/smcd/spb/fwu/homepage/GOES_Imager_Vis_Cal.php).

Several factors contributing to the uncertainty of the relative calibration model have been identified: 1) the space count values $C_{i,background}$. GOES Imager has 8 detectors in the visible channels and each detector has a different responsivity to the zero-radiance space after the space clamp events. In addition, the 1/f random noise of the Imager instrument can also affect the background count values; 2) uncertainty in the moon edge and the on-moon pixel radiance $C_{i,moon}$. The optical system is not perfectly aligned and evidence of stray-light or ghost light can be observed at the vicinity of the Moon (Wu *et al.*, 2006); 3) angular-dependent reflectance, which was observed in the satellite measurements in (Wu *et al.*, 2006) and later confirmed with ground measurements of witness sampling (Wu *et al.*, 2011); and 4) oversampling of the moon pixels. The Moon moves during the one minute scan time. Accurate oversampling of the moon measurement in both vertical and horizontal directions is needed for the lunar irradiance simulation. Efforts to improve the measurement of GOES lunar irradiance are ongoing. The outline of the Algorithm Theoretical Basis Document (ATBD) for the GEO lunar calibration can be found at the GSICS ATBD wiki webpage at https://gsics.nesdis.noaa.gov/wiki/Development/AtbdCentral .

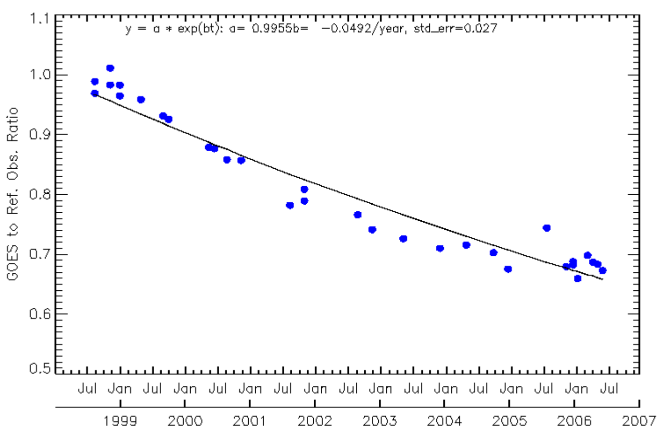

Figure 2. Time series of ratio between the GOES measured irradiance and the simulated irradiance for GOES-10 Imager visible channel, fitted with an exponential algorithm.

(by Drs. Fangfang Yu and Xiangqian Wu, [NOAA])

REFERENCES

Kieffer, H., 1997: Photometric stability of the lunar surface,.*Icarus*, **130**, 323-327, dio:10.1006/icar.1997.5822.

Stone, T. and H. Keiffer, 2004: Assessment of uncertainty in ROLO lunar irradiance for on-orbit calibration, *Proc. SPIE*, **5542**, 300-310.

Wu, X. T. Stone, F. Yu and D. Han, 2006: Vicarious calibration of GOES Imager visible channel using the Moon. *Proceedings of SPIE*, 6296-38.

Wu, X., D. Ryan-Howard, T. Stone, G. Sindic-Ranic, F. Yu, M. Weinreb, and M. Grotenhuis, 2011: Angular variation of GOES Imager scan mirror reflectance. *Proceedings of SPIE* (poster).

Star-Based Calibration Techniques – Application to GSICS Inter-Calibration of Solar Channels of Satellite Radiometers: Part II

In the first part of this report (Chang *et al.*, 2011), we presented our principal method of detecting the presence of a star in the Imager's field of view and determining the strength of its signal in units of digital instrument output. We then showed a time series of such star signals and discussed briefly the concept of estimating the rate of degradation of the instrument's responsivity from the trajectory of the time series. In this article, we will now describe more fully on how the time series of a collection of stars can be used to estimate the degradation rate of the responsivity, and how this can be combined with observations from the MODIS instrument on NASA's EOS satellites to place our instrument degradation results on an absolute radiance scale. In doing this, we will be moving beyond the mission of monitoring instrument responsivity – advancing further into areas of inter-satellite comparison and calibration for the three-axis stabilized Geostationary satellites that can use the star observations for the radiometric calibration.

Up to the present (February 2012), we have estimated the rate of degradation of a visible channel by fitting the time series of star signals with an exponential function of the form $\beta e^{-\alpha t}$, where t is time in years since the launch of the satellite. For each satellite, we chose approximately fifty stars to obtain a set of degradation rates { α_l }, one rate from each star. We then computed the mean of this set of rates $\overline{\alpha}$. The mean degradation rate has been assumed to be the mean exponential degradation rate for the visible channel of the satellite. The latest values of $\overline{\alpha}$ are listed on the NESDIS/STAR calibration web page (http://www.star.nesdis.noaa.gov/smcd/spb/fwu/homepage/GOES_star_cal.php). However, certain problems with the star data cannot be accounted for in this simple approach. To minimize the effects of these problems, we have developed a more advanced method for estimating degradation rates.

Using individual stars presents several problems for the instrument degradation determination. The inherent data noise produces unstable trending results for several years after the start of data collection (start of operational use). These inaccuracies produced questionable relative calibration for up to five years after the initiation of data collection. This lost of latency was reduced in the transition from signal calculation Method 2 to Method 3 (Chang *et al.*, 2008), but the new star signal calculation still left enough residual noise in the signal to require several years for the trending to stabilize. The majority of the remaining noise is, as yet, unexplained, but at least part is systematic, related to a diurnal variation thought to be due to instrument temperature variation. An example of the diurnal variation is shown in Figure 1 for the GOES-12 Imager. The actual dependence on time of observation remains essentially the same over the lifetime of a given Imager, but it varies from satellite to satellite.

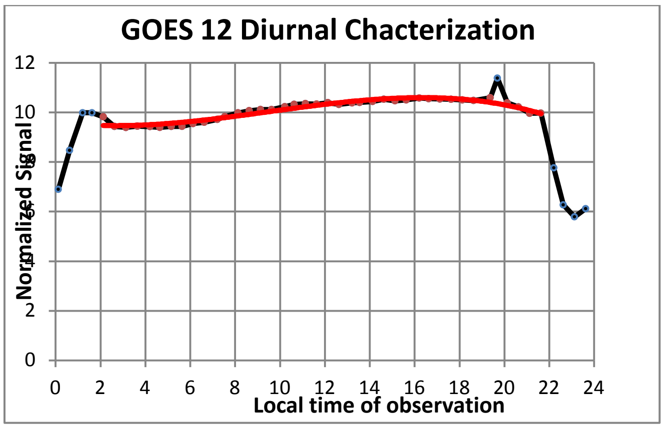

Figure 1. The star signal strength as a function of the local time of observation. The black curve is the mean normalized star signals and the red the fitting function used to correct for the variation.

While the signal intensity from all stars decreases over time as the instrument degrades, the actual intensity also varies from star to star according to the star's intrinsic brightness. This star-to-star brightness difference may be removed by normalizing the star signals to a common reference. The data sets formed from the normalized star signals are used in all subsequent processing. To estimate the absolute degradation from the star observations, we first determine a correction for the diurnal variation. For each satellite, all normalized observations were binned according to the half hour interval for the data acquisition. The mean of the normalized data within each of the 48 time bins was used to characterize the diurnal variation (Figure 1). These data for each satellite were used to determine a correction procedure for the diurnal effect. An exponential decay has been the assumption for the instrument degradation. However, we have evidence that this assumption is incorrect. We first realized this when we observed that the computed exponent values increased with each successive coefficient update (see the StAR Calibration web page). And we confirmed it with the additional observation that the exponential is a poor fit to the time series of GOES 10 and 12 and a polynomial fitting can be a replace. The exact form of the polynomial and further arguments for its appropriateness will be presented elsewhere.

For each month, the visible channel's loss of signal is calculated as that month's mean signal divided by the mean signal of the first month of the time series. The relative calibration coefficient, which is one of the subjects of the rest of this report, is the inverse of the loss of signal.

Next, an adjustment is made to place the GOES star calibration on the same absolute radiance scale as NASA's MODIS instrument aboard the EOS satellite. This is done with GOES absolute calibration data generated by Wu and Sun (2005) from inter-calibration between GOES and MODIS observations (http://www.star.nesdis.noaa.gov/smcd/spb/fwu/homepage/GOES_Imager_Vis_OpCal.php). The MODIS-based GOES absolute calibration coefficients are used in the form of monthly means in order to correspond to the monthly means of the star-based calibration data. The ratio of the MODIS-based absolute calibration coefficient to the star-based relative coefficient is computed for each time increment having both star-based and MODIS-based means. The mean of all such ratios is then the scaling factor that adjusts the star-based relative calibration coefficients to the MODIS absolute radiance scale. The GOES star and GOES MODIS absolute radiance data sets are then combined to produce a merged time series of absolute calibration coefficients, in which the units of the calibration coefficients are (W/m^2-sr-μm)/count. Figure 2 displays the blended time series for GOES 12.

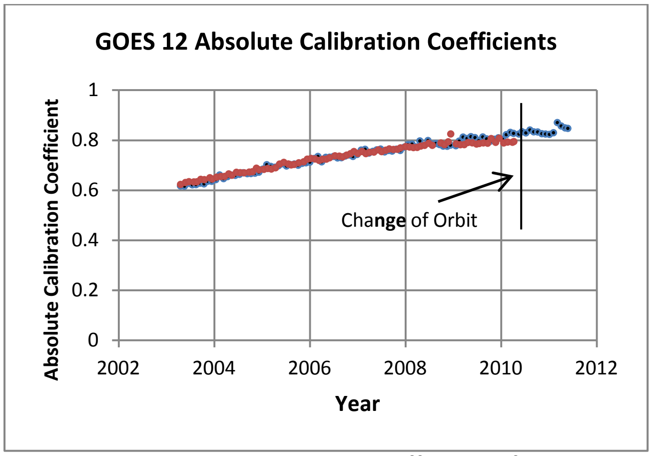

Figure 2. The absolute calibration coefficients of the GOES 12 visible channel from the GOES/stars (black) and the GOES/MODIS (red) calibrations.

By merging the GOES star trending and the GOES MODIS absolute calibration, we have utilized the best of both techniques. The GOES star observations provide a calibration target without dependence on observations from another instrument, and star observations occur at a relatively high temporal frequency. The GOES MODIS product provides the absolute spectral radiance in W/m^2-sr-µm.

An estimate of the precision of this technique can be obtained from the percentage deviations of the absolute calibration coefficients (as in Figure 2) from the polynomial fit. Figure 3 shows the histogram of the deviations for the visible-channel calibration coefficients for the GOES-10 and -12 imagers. In both cases the distributions appear relatively normal and only a few percent deviation from the fitted function. This is also the case for GOES 10 and 13 (not shown). With each month 's averaged data exhibiting a precision of a few percent, a reliable trending can be determined very quickly. The new trending procedure nearly eliminates the latency, yielding reliable degradation within two or three months of operational processing.

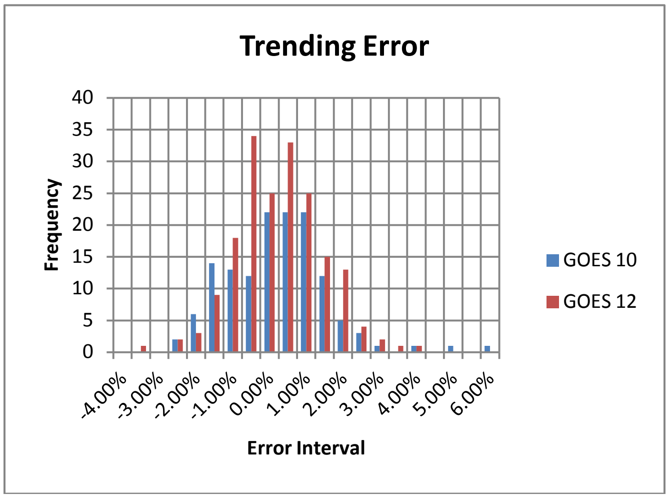

Figure 3. The histogram of trending errors for GOES 10 and 12. These are percentage deviations of the absolute calibration coefficients from the fitted polynomial.

(by Drs. C. Dean, I. Chang, Z. Li, M. Weinreb, X. Wu and F. Yu, [NOAA])

REFERENCES

Bremer, J.C., J.G. Baucom, H. Vu, M. P. Weinreb, and N. Pinkine, 1998: Estimation of long-term throughput degradation of GOES 8 & 9 visible channels by statistical analysis of star measurements, *Earth Observing Systems III, Proc. SPIE*, **3439,** 145-154.

Chang, I-L., *et al.*, 2008: Using Raw Star Signals in the Monitoring of GOES Imager Visible–Channel Responsivities. *Earth Observing Systems XIII, Proc. SPIE* **7081**, 70810G-1 – 70810G-13.

Chang, I.-L, *et al.*, 2011: Star-based calibration techniques – Application to GSICS inter-calibration of solar channels of satellite radiometers: Part I. *GSICS Quarterly Newsletter*, **5(4)**, 6-7.

News in this Quarter

New GSICS User Messaging Service

Since January 2012, a new GSICS user messaging service has been used to facilitate communication between the GSICS development group and the user community. By registering at the online server (http://noaa.us2.list-manage.com/subscribe?u=24cb92e219660091ec8836edc&id=ce8328da86), which is also accessible from the GSICS GCC (http://www.star.nesdis.noaa.gov/smcd/GCC/index.php) and WMO portal (http://gsics.wmo.int/) websites, the users will receive the GSICS Quarterly Newsletter, as well as any other available options selected.

Success of 2012 Annual GSICS GRWG/GDWG Joint Meeting

The 7th GSICS Research Working Group (GRWG) and 6th GSICS Data Working Group (GDWG) meeting was successfully held at the National Satellite Meteorological Center (NSWC) of China Metrological Administration (CMA), Beijing, China from 5 to 9 March 2012.

Announcement of the 4th GISCS Users' Workshop at the EUMETSAT 2012 Conference

The 4th GSICS Users' workshop is officially announced. The coming workshop will take place at the EUMETSAT conference which will be held at Sopot, Poland from 3-6 September, 2012. The GSICS workshop logistics:

- Tuesday 4 September 2012 at 1300-1800 CEST (UTC+2).
- In the Sheraton Hotel Conference Centre in Sopot, near Gdansk, Poland.
- We intend to mirror the entire meeting online, allowing remote presentations and viewing.
- The initial program of the conference will be published in early May. There will be a dedicated session on "Sensor Inter-Calibration for Climate Data Records" on Wednesday morning.
- Registration for the EUMETSAT Satellite Conference is not a pre-requisite for attending the workshop.
- Those who wish to participate in the workshop are asked to send an "intent to attend" to Dr. Tim Hewison (tim.hewison@eumetsat.int) by 31 July 2012.
    - this includes remote attendance online so we can send invitations
    - this will ensure admittance to the venue and helps us plan the agenda

Just Around the Bend …

GSICS-Related Meetings

- The 12th GSICS Executive Panel meeting will take place in College Park, Maryland, USA from 30 May 2012 to 1 June 2012.
- The IEEE international Geoscience and Remote Sensing Symposium (IGARSS) meeting will be held in Munich, Germany from 22 to 27 July 2012.
- The SPIE meeting will be held in the San Diego Convention Center, San Diego, California, USA from 12 to 16 August 2012.
- The Conference on Characterization and Radiometric Calibration for Remote Sensing will be held in Logan, Utah, USA from 27 to 30 August 2012.
- The 2012 EUMETSAT Meteorological Satellite conference will be held in Sopot, Poland from 3 to 7 September 2012. The 4th GSICS Users' Workshop will be held in one of the EUMETSAT conference's post sessions on 4 September, 2012 (Tuesday).

GSICS Publications

Shi, L. *et al*. 2012: Surface air temperature and humidity from intersatellite-calibrated HIRS measurements in high latitude, *J. Atmos. and Ocean. Tech*., **29(1),** 3-13.

With Help from our Friends:

The *GSICS Quarterly* Editor would like to thank those individuals who contributed articles and information to this newsletter. The Editor would also like to thank Dr. George Ohring for careful proofreading and editing assistance, our European Correspondent, Dr. Tim Hewison of EUMETSAT, and Asian Correspondent, Dr. Yuan Li of CMA, in helping to secure and edit articles for publication.

Submitting Articles to GSICS Quarterly: The *GSICS Quarterly* Press Crew is looking for short articles (<1 page), especially related to cal/val capabilities and how they have been used to positively impact weather and climate products. Unsolicited articles are accepted anytime, and will be published in the next available newsletter issue after approval/editing. **Please send articles to Fangfang.Yu@noaa.gov.**