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Global Space-based Inter-Calibration System

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Dr. Robert A. Iacovazzi, Jr., Editor

Importance of satellite inter-calibration for CM-SAF data sets

The EUMETSAT Satellite Application Facility on Climate Monitoring (CM-SAF, www.cmsaf.eu) aims at the provision of satellite-derived geophysical parameter data sets suitable for climate monitoring (Schulz et al., 2009). CM-SAF focuses on the atmospheric part of the Essential Climate Variables (ECV), as defined within the Global Climate Observing System framework in support of the United Nations Framework Convention on Climate Change (UNFCCC). Satellite observations are vital for climate monitoring due to global coverage in combination with high spatial resolution. In addition, satellite data sets also need to cover a long time period in order to be useful for climate monitoring. The demands on accuracy increase with increasing length of the time series. At the seasonal to inter-annual scale the detection of small changes in an observed parameter requires already stringent accuracy levels. In order to detect trends in data sets covering decennial or centennial time scales, their accuracy must be one order of magnitude higher (Ohring et al., 2005) relative to the needs of detecting inter-annual variability. Thus, a central goal of CM-SAF is to further improve all existing CM-SAF data products to a quality level that allows for studies of inter-annual variability and beyond.

Two data set categories are, and will be, provided by CM-SAF. In near-real time, so called Environmental Data Records (EDR) are obtained by converting satellite sensor data into geophysical variables using nominal calibration. Within an operational environment such EDRs are integrated over time to obtain daily and monthly averages. In its current implementation these operational products are suitable for analyses on diurnal to seasonal time scales. The products support routine climate monitoring applications at the national meteorological services of the EUMETSAT member states. A second class of products is generated by improving the calibration, by homogenisation of the time series of data from different satellites, and by utilisation of only one single, state-of-the-art retrieval scheme for the whole series. Such Thematic Climate Data Records (TCDRs) are produced by a reprocessing of the whole data record of a satellite instrument and might extend the suitable analysis capability to inter-annual scales. In these records any obvious error, e.g., jumps created by instrument changes on successive satellites, are already resolved. Other subtle changes caused by changes in the spectral response function or orbital drift of satellites need further attention to achieve quality that is suitable for studies on decadal variability and trend detection.

Currently the following EDR products are available from CM-SAF:

- Cloud parameters (based on SEVIRI and AVHRR): cloud fractional cover, cloud type, cloud top properties, cloud phase, cloud optical thickness, and cloud water path;
- Radiation budget products (AVHRR, SEVIRI, CERES, DIARAD, VIRGO and GERB): Incoming shortwave, net shortwave, net longwave, downward and outgoing longwave radiation, surface radiation budget, various thermal radiative fluxes, and surface albedo; and
- Humidity products (ATOVS): Total column-integrated water vapour, layer-integrated water vapour, mean temperature and relative humidity for 5 layers, specific humidity and temperature at the six layer boundaries.

Recently, CM-SAF released an approximately 20-year TCDR of total column-integrated water vapour from SSM/I. The data record of SSM/I radiances was homogenised by matching radiance probability distribution functions of overlap periods between satellites. An exemplary anomaly analysis is presented in Figure 1.

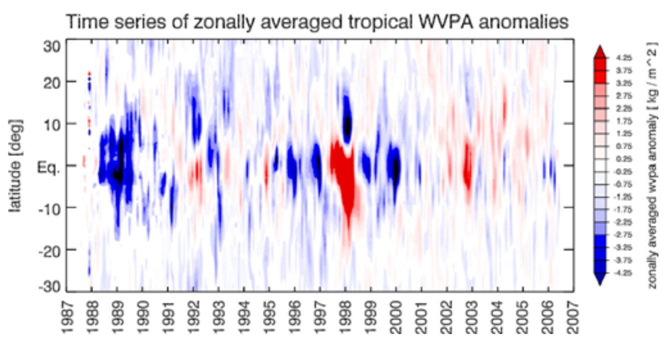

Figure 1: Tropical Water Vapour anomalies from the CM-SAF data set derived from SSM/I.

CM-SAF will generate a long time series (~30 years) of free tropospheric humidity from MVIRI and SEVIRI in the near future. While the MVIRI time series is homogenised, its temporal extension with SEVIRI observations is an open issue. Also, a long time series of spectrally-resolved solar irradiances from MVIRI is currently under development at CM-SAF. For this, a self-calibration in count space was developed and implemented.

As described above, the main objective of CM-SAF is to establish TCDRs suitable for the detection of climate variability and for trend detection. Homogenisation and inter-calibration of the various satellite observations is a major and ambitious effort that needs international collaboration. CM-SAF can largely benefit from inter-calibration efforts carried out within GSICS. Partly, GSICS results can be used to confirm or improve currently applied homogenisations at CM-SAF. In particular for SEVIRI-dependent TCDRs, CM-SAF relies on GSICS (inter-)calibration coefficients or radiance records reprocessed by space agencies utilising GSICS results. Such efforts will strongly accelerate the production of TCDRs at CM-SAF. In addition, the (inter-)calibration coefficients might be useful for operational processing, if provided in near-real time.

CM-SAF aims at supporting GSICS by evaluating GSICS-type inter-calibrated satellite radiances, employing a fast radiative transfer model (RTTOV) applied to observations from ground-based instruments such as lidars, microwave radiometers and research quality radiosondes from GCOS Reference Upper-Air Network (GRUAN) sites. These measurements can be operationally used to infer residual biases after applying the GSICS inter-calibration by comparing simulated and observed radiances. Additionally, a line-by-line radiative transfer model in the infrared will be utilised in an off-line mode to estimate uncertainties of RTTOV, and to extend the evaluation to the high spectral resolution observations of IASI on a regular basis. In this way the efforts of the (inter-)calibration of satellites, in particular of SEVIRI, carried out within the GSICS framework, are tested independently.

References

Ohring, G., B. Wielicki, R. Spencer, B. Emery, and R. Datla, 2005: Satellite instrument calibration for measuring global climate change. *Bull. Am. Meteorol. Soc.*, **86**, 1303-1314.

Schulz, J., et al., 2009: Operational climate monitoring from space: the EUMETSAT satellite application facility on climate monitoring (CM-SAF). *Atmos. Chem. Phys.*, **9**, 1-23.

[Drs. M. Schröder and J. Schulz, (CM-SAF, DWD)]

GSICS Science Corner

Inter-calibration of the reflective solar bands of *FY-3A* MERSI using *EOS Terra* MODIS

The MEdium Resolution Spectral Imager (MERSI) instrument, onboard the new generation China meteorology satellite *FY-3A*, has been operational over a year, since the satellite was launched on 27 May 2008. MERSI has 20 spectral bands, the first five bands – 4 visible (VIS) and 1 thermal infrared (IR) – image the Earth with a high resolution of 250m. The other 15 bands have a spatial resolution of 1km, with a spectral range distributed from visible to shortwave wavelengths. Since *FY-3A* launch, the 19 reflective solar bands of MERSI could not be calibrated through the onboard calibration assembly, which is an experimental standard lamp-integration sphere system. Until now, this calibration assembly has not been able to perform operational absolute radiometric calibration. Thus, it is very urgent to verify the MERSI sensor status and data quality through vicarious and cross calibrations.

An inter-calibration method was proposed by J. J. Liu et al. (2004), and is now used to calibrate the 19 MERSI reflective solar bands. Essentially, the Earth Observing System (*EOS*) *Terra* MODerate resolution Imaging Spectroradiomter (MODIS) was used as a reference sensor, because of its excellent calibration accuracy and local overpassing time similar to *FY-3A*. During July 2008 and June 2009, clear sky measurements over the Gobi Desert Dunhuang site were collocated from MODIS and MERSI. Using the 6S radiative transfer model, MODIS reflectance measured at the top-of-the atmosphere (TOA) is converted into surface reflectance. They were corrected to the viewing geometry of the MERSI using the bidirectional reflectance distribution function (BRDF) measured on the ground. The BRDF-corrected surface reflectance data were interpolated with a spline function to obtain a continuous surface reflectance spectrum. With the MERSI spectral response function, the BRDF-modified and interpolated spectral reflectances were further converted to TOA values from the 6S radiative transfer model and the same atmospheric conditions used for MODIS. Using observations of dark space from the MERSI as another point, the sensor gains of all 19 reflective solar bands were computed for all the matched data.

According to China Meteorological Administration standard, MERSI's reflective solar band observation was calibrated to apparent reflectance, which was defined as:

$$\rho_a = \rho_{TOA} \cos(\theta_s) / D^2 = \pi L / \int Es(\lambda) R(\lambda) d\lambda \,, \qquad (1)$$

where ρ_a is apparent reflectance, ρ_{TOA} is the reflectance at the top of atmosphere, θ_s is solar zenith angle, D is earth-sun distance in AU, $E_S(\lambda)$ is TOA solar spectral irradiance at the mean solar-earth distance, and $R(\lambda)$ is the band's relative spectral response function. The calibration function was expressed as:

$$\rho_a = \text{Scale}(\text{DN} - \text{Offset}), \qquad (2)$$

where *Scale* is the inverse of the Gain and *Offset* is set to the sensor's space view count.

As a typical example, apparent reflectance calibration results (*Scale* and *Offset*) for MERSI Band 8 are showed in Figure 1. The data at 27 June 2008 is the pre-launch calibration data. It can be found that this band's response gain (1/*Scale*) has obviously degraded through the past year. If we assume that this kind of degradation is nearly linear, the linear regression of *Scale* reflects the sensors degrading rate, and the fluctuation

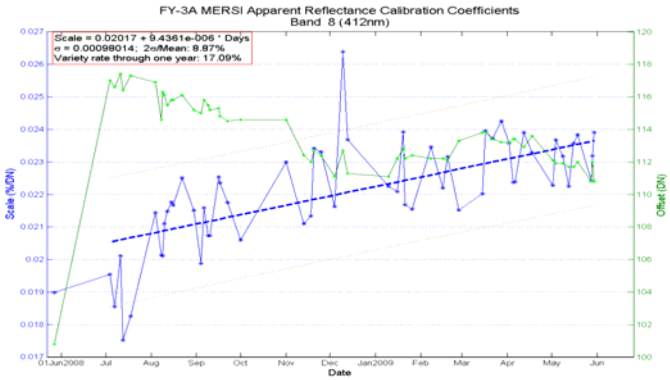

Figure 1: The *FY-3A* MERSI Band 8 calibration result. The blue solid line represents *Scale*, while the green solid line the *Offset*, or space view count. Also, the blue-dashed and two red-dotted lines represent the *Scale* parameter linear regression and its 2σ uncertainty, respectively.

of *Scale* around the linear regression line (standard deviation, σ) reflects the uncertainty of the calibration. These analysis data are shown on the upper-left corner of the figure.

It can be seen from Table 1 that, apart from bands 6 and 7 (the SWIR bands) and bands 17, 18, and 19 (bands around water vapor absorption bands), the calibration uncertainty (2*σ /Mean) of the other 14 bands are within the range of 5% to 10%. It has been proven that there are sudden jumps in the two SWIR band's response gains, during the past year because of unknown reasons. Thus, their calibration uncertainties and degradation rates determined using regression become meaningless. As for the water vapor absorption bands (bands 17, 18 and 19), the uncertainty of this kind of inter-calibration method is still too high to be accepted.

Table 1: FY-3A MERSI reflective solar band calibration results.

Apparent Reflectance = Scale * (DN_EarthView - DN_SpaceView) (%)					
Scale = (a + b * Days_SinceLaunch) (%/DN)					
Band/ λ (nm)	**a (%/ DN)**	**b (%/DN/ Days)**	**Uncert. σ**	**2*σ / Mean (%)**	**Deg. Rate (%/yr)**
1/470	0.0301	4.5725E-06	0.0012	7.56	5.55
2/550	0.0296	2.0652E-06	0.0009	6.16	2.55
3/650	0.0245	-8.9419E-07	0.0007	5.59	-1.33
4/865	0.0303	-2.9805E-06	0.0007	4.72	-3.59
6/1640	0.0274	-5.3055E-06	0.0036	27.32	-7.06
7/2130	0.0219	2.2112E-06	0.0014	12.21	3.70
8/412	0.0202	9.4361E-06	0.0010	8.87	17.09
9/443	0.0229	5.3128E-06	0.0012	10.40	8.47
10/490	0.0239	2.6142E-06	0.0008	6.61	3.99
11/520	0.0197	2.0512E-06	0.0006	6.37	3.80
12/565	0.0236	7.2853E-07	0.0007	6.16	1.13
13/650	0.0226	-1.3091E-06	0.0007	5.99	-2.12
14/685	0.0215	-6.0897E-07	0.0006	5.89	-1.03
15/765	0.0265	1.3321E-06	0.0007	5.36	1.84
16/865	0.0219	-3.6810E-07	0.0005	4.75	-0.61
17/905	0.0268	-5.5240E-06	0.0014	11.15	-7.54
18/940	0.0415	-3.2657E-05	0.0057	32.54	-28.71
19/980	0.0255	-5.6258E-06	0.0013	11.04	-8.06
20/1030	0.0278	1.3589E-06	0.0007	4.91	1.79

Bands 8 and 9 have the biggest degradation rates of 17% and 8% per year, respectively. Bands 1, 2, 7, 10 and 11 have medium degradation rates, ranging from 2% to 5% per year. The other bands, except the two SWIR bands (bands 6 and 7) and three water vapor absorption bands (bands 17, 18, and 19) have a near stable gain with the degradation rates less than 2% per year.

It should be noted that the calibration data for *FY-3A* MERSI shown above is not a formal result, and can be used for reference only.

References

J.-J. Liu, Z. Li, Y.-L. Qiao, Y.-J. Liu and Y.-X. Zhang, 2004: A new method for cross-calibration of two satellite sensors. *Int. J. Remote Sensing*, **25**, No. 23, 5267–5281.

Acknowledgements

I'd like to thank Dr. HU, Xiuqing for helping me collect the MODIS data and discussing the results, and Dr. Robert Iacovazzi for his extensive review and editing work.

[Prof. J.-J. Liu, (NSMC, CMA)]

Assessing Calipso IIR radiance accuracy via stand-alone validation and a GEO/LEO inter-calibration approach using MODIS/*Aqua* and SEVIRI/*MSG*

The NASA/CNES Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (*Calipso*) satellite was launched in April 2006 and has been flying in formation with other satellites of the A-Train since June 2006. It trails behind the Earth Observing System (*EOS*) *Aqua* satellite by 73 s, and crosses the equator 215 km east of *Aqua*. The global coverage of its observations is between 82°N and 82° S. One of the instruments on board *Calipso* is a 3-channel nadir-looking Infrared Imaging Radiometer (IIR) developed by SODERN and CNES.

General approach

Based on work with TOVS (NOAA/NASA Pathfinder Programme), ATOVS, AIRS and IASI, the idea was born in April 2004 at LMD (Laboratoire de Météorologie Dynamique) to ascertain the quality of the IIR/*Calipso* radiances through two *complementary* approaches: (i) an intercalibration approach and (ii) a "stand alone" approach. Both approaches aim at identifying deviations or trends between pairs of channels of different instruments. For that purpose, "companion instruments and channels" of IIR/*Calipso* have to be selected, based on the coherence of their space-time resolutions, viewing geometry and their radiative transfer properties. Such similar channels exist in both the MODerate resolution Imaging Spectroradiometer (MODIS)/*Aqua* and Spinning Enhanced Visible and Infrared Imager (SEVIRI)/*Meteosat Second Generation* (*MSG*).

The inter-calibration approach is based on channel-by-channel comparisons of the observations made by IIR and by the two other instruments. The stand alone approach is based on comparisons between observed and simulated radiances, for each selected channel of IIR, MODIS and SEVIRI. Simulated radiances result from a forward radiative transfer model fed either with *in situ* radiosonde data, or with products of reanalysis runs collocated in time and space with clear sky satellite observations.

The combination of the two approaches, and the use of *two* companion instruments, enhances the ability to identify which instrument deviates from the other(s). The first approach, not being restricted to clear scenes, allows wide ranges of brightness temperatures to be compared. The second one "screens" each channel of each instrument, individually.

Selection of companion instruments and channels

This selection is based on sensitivity studies performed with the radiative transfer tools derived and maintained at LMD: the forward radiative transfer model (4A) and the GEISA, TIGR, and ARSA databases. (See: http://ara.lmd.polytechnique.fr for references and acronyms).

Companion channels for the IIR 8.65 µm, 10.6 µm, and 12.05 µm bands have been selected as the MODIS/*Aqua* channels 29, 31, and 32 and as the SEVIRI/*MSG* channels IR 8.7, 10.8, and 12. The spectral matching is very good and does not require the use of any pseudo-channel. Furthermore, the inter-instrument simulated brightness temperatures biases are less than 1 K, and standard deviation less than 0.3 K.

Satellite Data and Auxiliary Datasets

All satellite and auxiliary datasets required for this study are archived on the CNES/CNRS/INSU/USTL thematic center Icare (http://www.icare.univ-lille1.fr): level 1 of IIR, MODIS and SEVIRI; the operational IIR level 2 cloud mask product developed by Latmos (Laboratoire Atmosphères, Milieux, Observations Spatiales); the ERA_interim reanalysis products from ECMWF; a 1km Land/Sea flag dataset; and the 4A model (operational version "4A/OP" maintained by Noveltis - http://www.noveltis.net/4AOP) .

Spatial and Temporal mapping of the three instruments

The maximum time difference is 73s for IIR/*Calipso* and MODIS/*Aqua*. For SEVIRI/*MSG* this time difference is half of a 15 min *MSG* repeat cycle, or 7 min 30 s. MODIS angles are between nadir and 20°, while SEVIRI angles are limited to less than 50°. Based upon threshold values tests, spurious values are rejected and uniformity tests are performed to ensure the homogeneity of the scenes. So far, no spatial averaging of IIR nor MODIS nor SEVIRI pixels is performed. Based on these specifications, Icare has developed the so-called "Remap" tool for the mapping of IIR, MODIS, and SEVIRI. Remap is operated by Icare since June 2007.

Processing and results reporting

The inter-calibration approach is applied to all pairs of companion channels. The stand alone approach is applied to every individual channel. Results are presented as time series of the daily-averaged brightness temperature differences: IIR vs MODIS; IIR vs SEVIRI; SEVIRI vs MODIS; and IIR vs IIR. Examples are given in Figures 1 and 2. Also, results for biases, standard deviations, trends, anomalies are reported within LMD, and within Icare to be distributed to users, in tables and/or plots – e.g., 20K wide temperatures bins ranging from 220 to 320 K, and for several conditions such as latitude, day, night, viewing angles, etc.

Some results obtained soon after the launch

First comparisons made during the initial validation period highlighted inconsistencies in IIR radiances, leading to a correction of the level 1b processing by the CNES Technical Expertise Center (TEC) in August 2006. Also, a parasitic effect reminiscent of a Scottish "tartan" weaving was observed, being more obvious on homogeneous scenes, is under study at CNES/TEC.

Some example of outputs

We observe in Figure 1 an excellent stability of the day-to-day variability of IIR channels with respect to MODIS, within 0.1 K over the whole period, which is not the case for IIR versus SEVIRI (Figure2), more likely due to the difference in viewing geometry. It is also interesting to notice in Figure 2 sudden changes in the IIR-SEVIRI differences: one occurs in April 2007 due to the switch from MSG1 to MSG2; the other

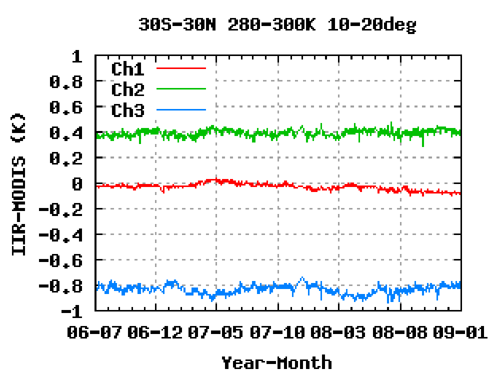

Figure 1: Time series of IIR-MODIS daily-averaged brightness temperature differences for the three pairs of companion channels. Latitude range: 30° S-30° N. Temperature range: 280-300 K. Sea only.

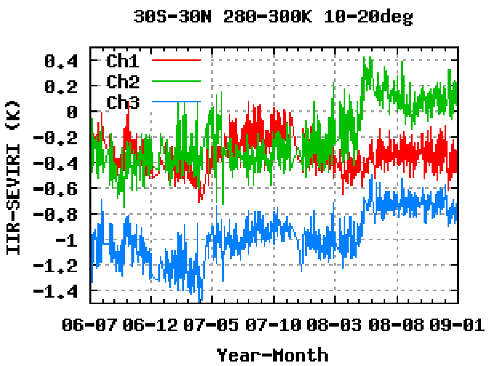

Figure 2: Same as Figure 1, except for IIR and SEVIRI

change is in early May 2008 due to the switch from "monochromatic" to "effective" computation of radiances in the SEVIRI product (see: M. König, *GSICS Quarterly*, Vol2, N°1, Jan 2008), which is not taken into account here.

This illustrates the fact that this approach of inter-calibration with three instruments helps disentangling which one is responsible for jumps or trends. A more complete description of the work and results is planned for the near future.

Co-workers and Acknowledgements

Anne Garnier, J. Pelon, PI of the *Calipso* mission, M. Faivre (Latmos/IPSL), Icare (B. Six, F. Ducos, J. Descloitres, J-M. Nicolas), LMD/IPSL (R. Armante, L. Crépeau, V. Capelle, O. Chomette), T. Tremas CNES /TEC, Climserv/IPSL computer Center. Warmest thanks to Didier Renaut (CNES) for stimulating discussions and to A. Chédin (LMD/IPSL) for important suggestions. CNES is acknowledged for its constant support, including activities related to GSICS.

[Dr. N. A. Scott, (LMD/IPSL, Laboratoire de Météorologie Dynamique/ Institut Pierre Simon Laplace)]

Brief report on AIRS and IASI accuracies evaluated by the spectral compensation method

A spectral compensation method has been developed for the GSICS infrared inter-calibration technique based on hyperspectral sounders, such as AIRS and IASI, in order to compensate for radiances missing from their observations (Tahara and Kato, 2009). This method computes the missing hyperspectral radiances using validly observed radiances and previously simulated radiances with respect to eight atmospheric model profiles.

Figure 1 shows an example of computed radiances over the water vapor absorption region. The computed radiances (black line) are well correlated to the observed radiances (red boxes), even though there are several strong water vapor absorption lines. This indicates that comparison between observed and computed radiances is feasible to study the accuracy of the hyperspectral sounder observations.

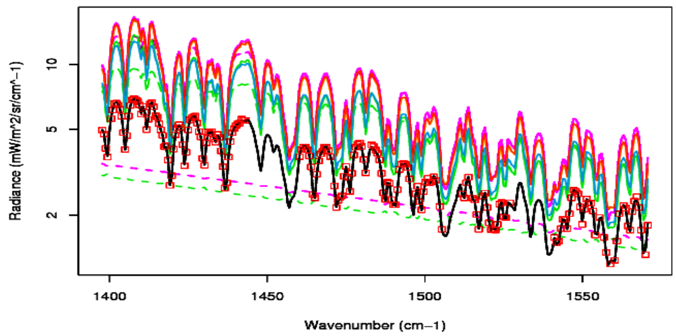

Figure 1: An example of calculated radiances (black line) using AIRS observed radiances (red boxes) and simulated radiances of eight atmospheric model profiles (colored lines) over the water vapor absorption region.

Figure 2a shows the residuals of observed brightness temperatures from computed ones with respect of AIRS channels (red points), AIRS blacklisted channels (blue points) and IASI channels (black lines). The residuals are almost the same between red points and black lines. The correlated residuals between AIRS and IASI originate from radiance computation error. Some blue points depart from the black lines. In addition, even red points around 680 cm^{-1} (AIRS channel #121, #122, #133 and #134) show large residuals. Degradation for these AIRS channels is shown. Variation of the black lines over the larger wavenumber region is increased, since the noise of IASI observations increase.

Figure 2b shows standard deviation difference (SDD) values between observed and computed radiances. Again, the degradation of AIRS blacklisted channels, and the increased noise of IASI channels in the large wavenumber region, are recognized. In addition, AIRS SDDs are slightly larger than IASI SDDs over the 650 – 1000 cm^{-1} band. Furthermore, AIRS SDDs within the 910 – 920 cm^{-1} band have a systematic trend.

From this brief study, the degradation of some AIRS valid channels, as well as AIRS blacklisted channels, can be observed. Since the spectral compensation method does not compute radiative transfer during operations, this study proposes a computational cost effective way to monitor hyperspectral sounder data.

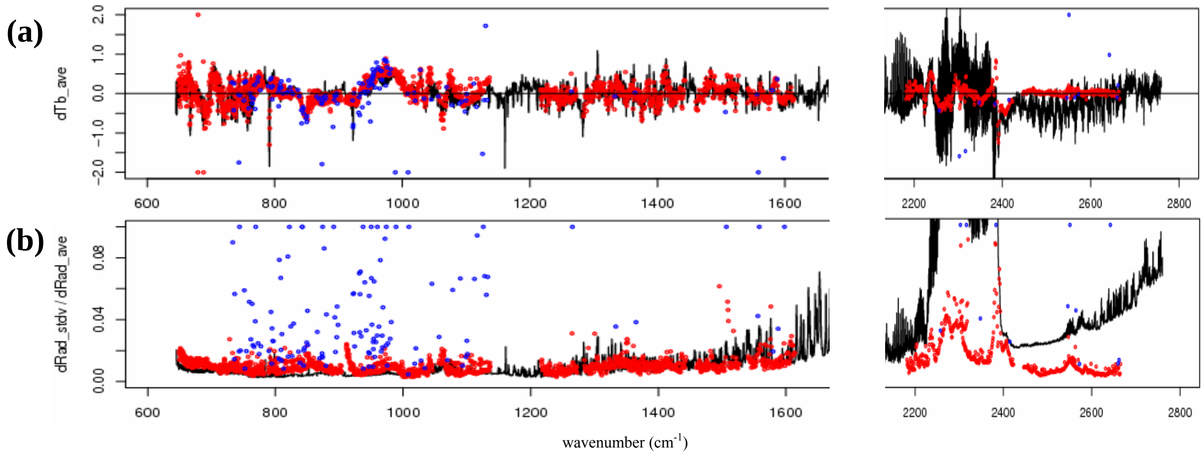

Figure 2: **(a)** Residuals of AIRS and IASI observed brightness temperatures from computed ones; and **(b)** standard deviation differences of radiances normalized by dividing by averaged radiances. The red points represent AIRS channels, blue points represent AIRS channels included in a blacklist, and the black lines represent IASI channels.

References

Tahara, Y. and K. Kato, 2009: New Spectral Compensation Method for Intercalibration Using High Spectral Resolution Sounder, Meteorological Satellite Center Technical Note, No. 52, 1-37, http://mscweb.kishou.go.jp/monitoring/gsics/ir/msctechrep52-1.pdf.

[by Mr. Y. Tahara and Ms. H. Owada, (JMA)]

News in this Quarter

Executive Panel VI Meeting

The GSICS Executive Panel (EP) VI meeting was held 3-4 June 2009 at the Earth System Science Interdisciplinary Center (*ESSIC*) in College Park, MD, USA. The meeting was hosted by NOAA and facilitated by Mitch Goldberg, GSICS Executive Panel Chair. After introductory remarks from the Chair, and review and adoption of the agenda, each organizational entity within GSICS – GSICS Coordination Center, GSICS Research and Data Working Groups, GSICS Processing and Research Centers – gave reports to the EP. Also, during the first day of the meeting, the terms of reference of the EP and the two working groups were reviewed. In addition, user feedback on the GSICS Information, Services and Product Roster; plans for an end-to-end GSICS evaluation; and the status of actions from previous EP meetings were discussed.

The second day of the GSICS EP VI meeting was quite busy. Topics of interest included review and update of the 2009 Operations Plan; presentation and feedback on the Quality Assurance Framework for Earth Observation (QA4EO) developed by the Committee on Earth Observation Satellites (CEOS) Working Group on Cal/Val (WGCV); as well as the NIST-developed document on pre-launch characterization of instruments. Furthermore, relationships with other relevant organizations and projects were examined, including the Global Precipitation Measurement (GPM) mission, the reanalysis of intercalibrated satellite data by the National Centers for Environmental Prediction (NCEP), the Sustained Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM formerly R/SSC-CM) network, and the Global Climate Observing System (GCOS) Reference Upper-Air Network (GRUAN). Calibration of microwave sounders was identified as a potential collaboration area between GSICS and GPM. The second day ended with discussion regarding GSICS outreach activities, including GSICS websites, participation in conferences and other relevant events, and publications. Before adjourning, there was a brief discussion of the upcoming GSICS Users Workshop to be held in Bath, UK on 22 September, and the location and date of GSICS EP VII meeting was chosen to be concurrent with *CGMS-37*, which is planned to be held at Jeju Island, South Korea from 26 to 30 October 2009.

[by R. Iacovazzi (NOAA) and J. Lafeuille (WMO)]

Just Around the Bend …

GSICS-Related Meetings

- **CALCON Technical Conference,** 24-27 August 2009, Logan, UT, USA, http://www.sdl.usu.edu/conferences/calcon/.
- **EUMETSAT Meteorological Satellite Conference**, 21-25 September 2009, Bath, UK. GSICS User's Workshop held concurrently on 22 September at the conference.

- **GPM Cross-Calibration Meeting,** 24-25 October 2009, Salt Lake City, UT, USA. Contact Tom Wilheit (wilheit@tamu.edu). Note that this meeting is held in conjunction with PMM Meeting during 26-30 October 2009.

GSICS Publications

Gunshor, M. M., T. J. Schmit, W. P. Menzel, and D. C. Tobin, 2009: Intercalibration of Broadband Geostationary Imagers Using AIRS. *J. Atmos. Oceanic Technol*., **26**, 746–758. The paper can be found online at http://dx.doi.org/10.1175/2008JTECHA1155.1 .

GSICS Classifieds

Job Vacancy: **EUMETSAT Climate Product Expert**

This new post will work on the operational implementation of GSICS and particularly on re-processing of satellite data for climate applications. Job is open to nationals of the EUMETSAT member states. For more information, please follow the link to http://tinyurl.com/qcb756.

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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 *GSICS Quarterly* European Correspondent, Dr. Tim Hewison of EUMETSAT, and Asian Correspondent, Dr. Yuan Li of CMA, in helping to secure 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 Bob.Iacovazzi@noaa.gov, *GSICS Quarterly* Editor.**