

SCOPE-CM Project 6

Inter-calibration of passive imager observations
from time-series of geostationary satellites (IOGEO)

Status Report



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1 Introduction

This report presents the status of the SCM-06 Inter-calibration of passive imager observations from time-series of geo stationary satellites (IOGEO) project for the year 2014 and the planning for 2015.

The project team composition at the end 2014 is as follows:

EUMETSAT (Darmstadt, Germany)	Rob Roebeling, Tim Hewison, Alessio Lattanzio, and Viju John
EUMETSAT CM SAF, DWD (Offenbach, Darmstadt)	Marc Schröder
JMA (Tokyo, Japan)	Masaya Takahashi
NOAA's NCDC (Asheville, NC, US)	Kenneth Knapp, Anand Inamdar
CMA NSMC (Beijing, China)	Peng Zhang, Xiuqing Hu
IMD (Delhi, India)*	A.K Sharma, Ashim Mitra

* The India Meteorological Department (IMD) has been invited to become part of the SCM-06 IOGEO project team. IMD responded positively, and first steps have been taken to define the collaboration with IMD. In order to formalize this collaboration the project plan needs to be modified by adding IMD members to the project team and by including IMD related tasks in the project plan. Take note that IMD is already actively sharing information with the IOGEO project partners. IMD is expected to become a formal SCM-06 partner in the course of 2015.

2 General progress in 2014

- The China Meteorological Administration (CMA) became official partner in the SCM-06 project. The project proposal has been modified. CMA members have been added to the project team and CMA contributions have been made part of the project plan.
- NASA (Dave Doelling) indicated to be interested to become partner in SCM-06 as well. The participation of NASA as SCM-06 will be defined and formalized in the course of 2015.
- Several Tele Conferences were held to report progress, to present scientific results, and to discuss deviations from the initial planning.
- Further to the suggestion made by NOAA (Ken Knapp) at the Teleconference held in March 2014, the project team developed an interest in providing an additional SCM-06 deliverable, beside the provision in inter-calibrated Fundamental Climate Data Records of the heritage geostationary satellites. This deliverable would be a re-gridded global fundamental climate data record of inter-calibrated VIS, IR, and WV radiances, similar to GridSat-B1, but with better specifications (e.g. radiances and/or BTs at a 0.05x0.05 degree grid every hour). To assess the requirements and interests in such a product needs to be further discussed in the context of CGMS and other inter-national forums.
- The project proposal has been updated.
- The year plan 2015 has been prepared.

3 Progress at Project Partners in 2014

3.1 EUMETSAT:

During 2014 EUMETSAT has been working on the following SCM-06 related tasks:

- The full data record of HIRS data has been collected from NOAA NCDC.
- The data record of HIRS data has been converted to standard NetCDF files.
- The quality checking and evaluating the converted HIRS data record has started in collaboration with the DWD. Although the evaluation revealed some issues with the HIRS data, such as occasionally missing lines and in some cases missing pixels, the data record appears to be stable in time and space. After fixing the issues remaining issues it can be used as reference for the re-calibration of the IR and WV radiance of the METEOSAT first generation satellites.
- The AIRS and IASI data have been collected to cover the period 2002 – date.
- It has been researched if AIRS data can be used to simulate HIRS/2 radiances and if these simulated radiances can be used to extend the length of the HIRS/2 data record from 2002 – date. This research revealed that HIRS/2 IR and WV radiances can be very well explained and simulated from AIRS spectra, with differences smaller than 1%.
- A Space Time Angle Match Procedure, denoted as STAMP, has been developed and tested to find Simultaneous Nadir Overpasses between the geostationary and polar orbiting data records. This procedure is now operational and can be shared between the IOGEO project partners.
- The collocations between the METEOSAT data record (METEOSAT-2 till METEOSAT-7) and the HIRS/AIRS/IASI reference data record have been generated.
- The inter-calibration of the METEOSAT-5 and METEOSAT-7 series has started. First analysis reveals differences of up to 5 Kelvin with the reference instruments. Some results are shown in Figure 1.

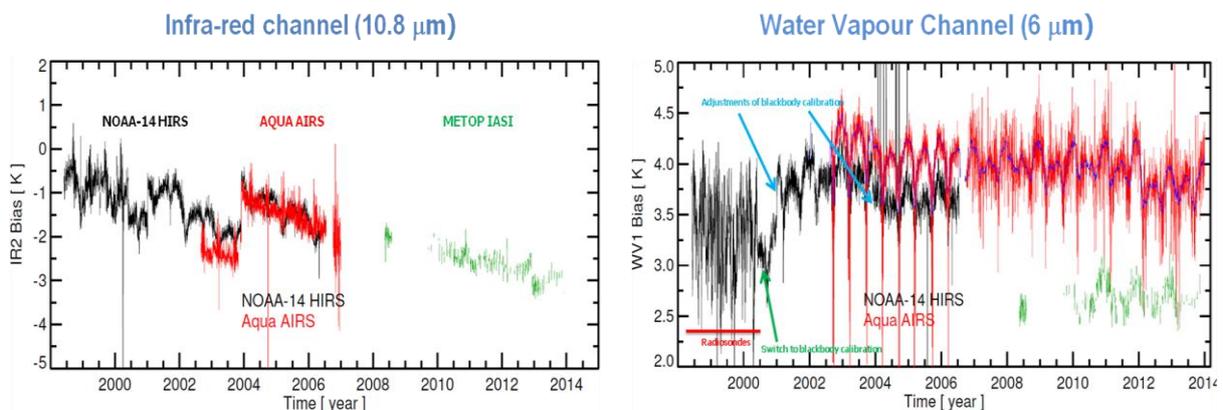


Figure 1 Time-series of MET-7 infra-red (left panel) and water vapour (right panel) channel biases relative to HIRS/2 and AIRS radiances adjusted for spectral band differences.

3.2 Progress at DWD:

During 2014 DWD has been working on several SCM-06 related tasks.

DWD/CM SAF developed a FTH geo-ring demonstrator product for July 2009. In addition, DWD/CM SAF will generate a METEOSAT-based FTH product and plans to release this product in Q3 2016. For both products DWD/CM SAF needs re-calibrated water vapour observations from all geostationary satellites for July 2009 (FTH geo-ring product) and from all METEOSAT satellites (CM SAF FTH product) together with information on cloud cover and cloud top pressure. For the geo-ring and the METEOSAT based products DWD/CM SAF would like to get re-calibrated

geostationary data together with information on the applicable SRF preferably before the end of 2014. NOAA (Ken Knapp) pointed out that the DWD/CM SAF could use the GridSat-B1 data record (3 hourly radiance product aggregated to a 0.07x0.07 degrees grid). This data record is available, and NOAA can provide DWD/CM SAF with a test data set. The provision of the full resolution re-calibrated data records from all the geostationary satellites (objective IOGEO) will take longer, and depends on the priorities and progress by the IOGEO partners. EUMETSAT gives high priority to the re-calibration of the METEOSAT series; the aim is to complete the reprocessing by the beginning of 2015. Once the first data records have been derived EUMETSAT will inform CM SAF and CM SAF will serve as beta tester.

EUMETSAT delivered to DWD the HIRS data record that was converted to standard NetCDF files. DWD is evaluating this data record as beta user.

3.3 Progress at NOAA:

NOAA shortly reported on their contribution to SCM-06 in 2014. The main activities they worked on are:

- VIS (and NIR) re-calibration. NOAA uses the PATMOS time-series as reference to re-calibrate the GOES time-series for the visible (and near-infrared) channels. NOAA (Anand Inamdar) presented the work done on the VIS and NIR recalibration during a science dedicated SCOPE-CM Teleconference held in November 2014.
- NOAA has implemented an extensive QC (Quality Control) process for the ISPC B1U data. The QC monitoring identifies fatal errors like excessive number of scan lines (image unreadable), bad navigation, too hot/ too cold images, mixed up images, calibration-related errors, etc. The ISCCP Global Browse System (GIBBS) at NOAA has been upgraded recently, with for example filling up previously missing images. The QC monitoring has been performed using both an automated code from the ISCCP team, and also inspection of individual images manually.

3.4 Progress at JMA:

JMA shortly reported on their contribution to SCM-06 in 2014. The main activities they worked on are:

- JMA main performed research on using visible calibration methods in combination, and will exchange this information with the members of SCM-06.
- JMA will collaborate with EUMETSAT and NOAA on the IR/WV re-calibration, and adopt the method that is developed within SCM-06 (2014-2015)
- JMA plans to perform the re-calibration of the IR/WV channels of the GMS satellites in 2015.
- Arata Okuyama for JMA is interested to attend the SCM-06 TCs. Arata Okuyama is leading SCM-10 (*Atmospheric Motion Vectors and Clear/All Sky Radiances from historical meteorological satellites in geostationary and polar orbit*), which is a user of the re-calibrated VIS/IR/WV radiances from SCM-06.

3.5 Progress at CMA:

CMA has become part of the project team in 2014. At the Teleconference held in August 2014 CMA (Xiuqing Hu) presented the work CMA is doing within GSICS, and the work CMA is planning to do in the framework of IOGEO. Among others CMA showed the improvement in calibration accuracy due to using GSICS calibration. CMA also showed how the GSICS calibration compares to the Calibration of Inner Blackbody corrected by Lunar Emission (CIBLE). The latter method has a larger bias than the IASI based GSICS method, but CIBLE shows stable calibration.

CMA provided inputs to the modified SCM-06 project plan, including Curriculum Vitae of the SCM-06 project team members from CMA and input to the overall and annual work plans.

4 Work plan for year 2015

The work plan presented in Table 1 contains a list of the tasks the team plan to perform and an indication of the schedule. The scheduled periods are given on a quarterly basis (Q1, Q2, Q3, and Q4).

Please note that the proposed contributions of the project partners, CMA, EUM, JMA, NOAA, and DWD in this work plan are best effort estimates that may be subject to change.

Table 1: List of planned activities in SCM-06 during 2015

Task	Description	Period	Actors
WP 0			
Management			
0.1	Define the involved of IMD and NASA within this SCOPE-CM-project	Q1	EUM
0.2	Set-up a web application for exchange of project information	2015	EUM
0.3	Detail project implementation plan with participating partners. Among others, to include a schematic view of the data flow between the participating space agencies (as requested by the SEP).	2015	ALL
0.4	Attend quarterly Tele Conferences	2015	ALL
0.5	Contribute to <i>Progress Report 2015</i> and <i>Work Plan 2016</i>	Q4	ALL
WP 1			
R & D inter-calibration methods			
1.1	R&D on method to create a bias correct time-series of HIRS/2, HIRS/2 (based on AIRS), and HIRS/2 (based on IASI) radiances.	Q1	EUM
1.3	Knowledge exchange with SCOPE-CM and GSICS activities: <ul style="list-style-type: none"> to share and discuss inter-calibration methods used within the SCM-05 (AVHRR_FCDR) and SCM-09 (ISCCP); to exchange experiences on settings to be used for selecting simultaneous overpasses between the monitored and reference instrument, and for applying the double difference approach. 	2015	EUM, NOAA, JMA,CMA
1.4	Assessment of visible (VIS) calibration methods in close collaboration with GSICS, including methods using well understood targets (e.g. DCC, desert, or moon targets) and simultaneous nadir overpass radiance comparisons (e.g. against other imagers or spectrometers);	2015	EUM, NOAA, JMA,CMA
1.5	Initiate a pilot study on making a Gridded Satellite Data product including the heritage channels (VIS, IR, WV) on all geostationary satellites (e.g. hourly product at 0.05x0.05° resolution)	Q4	EUM, NOAA, JMA,CMA
WP 2			
Implementing and testing the IR & WV inter-calibration approach			
2.1	Update of the IR and WV inter-calibration approach(es) for the METEOSAT, GOES, GMS, MTSAT, or FY-2 (C and later) satellites.	Q1	EUM, NOAA, JMA,CMA
2.2	Implement the updated IR & WV inter-calibration approach at the participating space agencies;	Q1	EUM, NOAA, JMA,CMA
2.3	Generate, for a common test period, a datasets of inter-calibrated IR and WV radiances from the geostationary satellites operated by the participating space agencies (i.e. METEOSAT, GOES, GMS, MTSAT, or FY-2 (C and later));	Q1	EUM, NOAA, JMA,CMA
2.4	Compare, for a common test period, the METEOSAT, GOES, GMS, MTSAT, or FY-2 (C and later) the inter-calibrated IR and WV radiances in overlap regions;	Q2-Q3	EUM, NOAA, JMA,CMA

2.5	Compare inter-calibrated IR and WV radiances derived from full resolution data against those derived using sub-sampled ISCCP data;	Q1-Q2	NOAA
WP 3 Generation of inter-calibrated IR & WV radiances for the GEO satellites;			
3.1	Generation of FCDRs including inter-calibration coefficients for IR & WV radiances from observations from the METEOSAT geostationary satellites;	Q1	EUM
3.2	Generation of FCDRs, or inter-calibration coefficients, for IR & WV radiances from observations from the GOES, MTSAT, or FY-2 (C and later) geostationary satellites;	Q2-Q3	NOAA, JMA,CMA
3.3	Prepare and provide user documentation for public distribution of the IR & WV FCDRs or their recalibration coefficients;	Q4	EUM, NOAA, JMA,CMA
WP 4 Free Tropospheric Humidity demonstrator product			
4.1	Regenerate the FTH demonstrator product with the WV FCDRs as input and assess the improvement	Q4	DWD