SCOPE-CM Project 3: Land Surface Albedo Retrieval from Geostationary

Status Report

SCOPE•CM

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Document Change Record

Issue / Revision	*Date*	*Changed Pages / Paragraphs*

1 INTRODUCTION

This short report includes the status of the SCOP-CM project 3 on land surface albedo retrieval from geostationary satellites for the year 2014 and the planning for 2015.

Team composition:

EUMETSAT (Darmstadt, Germany)	Alessio Lattanzio, Rob Roebeling
NOAA's NCDC (Asheville, NC, US)	Jessica Matthews, Ken Knapp
JMA (Tokyo, Japan)	Masaya Takahashi
MeteoSwiss (Zurich, Switzerland)	**Reto Stöckli (as of February 2015)**

Reto Stöckli from the CM SAF consortium joined the team. His contribution is a reliable two channel cloud mask for First and Second Generation Meteosat satellites.

2 STATUS 2014

During year 2014 many tasks have been accomplished. In October 2014 for the very first time members of the team from EUMETSAT, NOAA and JMA could meet in person. The meeting took place in EUMETSAT Dr. Masaya Takahashi has been visiting scientist in EUMETSAT since March and Dr. Jessica Matthews came as visiting scientist in EUMESAT for a week.

Task	Sub-Tasks	Period	Actors	Status
Change of Level 2 product specifications	• Generation of a daily product instead of a 10 days composite • NetCDF4 format, Climate Forecast standard compliant: full definition and implementation of data and metadata	Q1	EUM NCDC	NCDC modified the GSA code for storing daily products in Native format. The modified software have been given back to EUMETSAT and distributed to JMA as well. The draft Native2NetCDF4 product converter developed at EUMETSAT has not yet been finalized and integrated in the GSA

				code.
Residual Cloud Removal	• Investigate different approaches for cloud detection and removal (usage of the IR channel, seasonal variation, surface type, etc.) that could be included in the GSA retrieval scheme. • Investigate available cloud mask products at the proper spatial and temporal resolution for all GEO platforms involved.	Q1-Q3	EUM	EUM investigated different approach to improve cloud detection for Level 2 processing Cooperation with CM-SAF started in order to use their general purpose clod mask. First impact test performed and presented at different international meetings Pre-Level 3 residual cloud screening research still ongoing. Usage of a background climatological value and/or seasonal variation under study
Inter-calibration	• Apply common methods for inter-calibration of the VIS channel. Existing GSICS methodology such as Deep Convective Clouds will be examined to allow progress with the production of an albedo time series. At a later stage, results from the SCOPE-CM project on inter-satellite calibration will be used for further improvements.	Q1-Q3	EUM, JMA, NOAA	EUM: cooperation with GSICS team to generate calibration correction coefficients for M7 for testing. On Going NCDC: There is a NOAA representative working on this effort for GOES as part of the GSICS team. Ongoing JMA: cooperation with GSICS team to generate calibration correction coefficients for GMS-5 in 2001 for testing. On Going
NWP Data	• Establish a common set of NWP data	Q2	EUM, JMA, NOAA	It has been decided to use ECMWF GRIB format NWP data.

				EUMETSAT took care of developing a Python script for downloading GRIB ERA-INTERIM NWP data from ECMWF. The script has been shared with NOAA and JMA. After registration to ECMWF they could also download the same NWP data.
Inclusion of other GEO instruments	• Investigate available options for best usage of the SEVIRI instrument in the current retrieval scheme • Investigate potential inclusion of further instruments.	Q3-Q4	EUM EUM, JMA, NOAA	No progress to report
Implementation of changes to the GSA software	• Implement potential changes to the input image data ingestion due to new methods for residual cloud removal, inter-calibration and new instruments. • Develop software changes as needed.	Q4	EUM EUM, JMA, NOAA	The current GSA version already foresees the usage of a cloud mask. The application of new calibration coefficients is done offline during input preparation
Validation	• Start development of a common protocol for evaluation of the resulting time series (see for instance Fell et al., 2012), encompassing: methods, validation datasets, software.	Q4	EUM, JMA, NOAA	EUM: a new study (ALBEDOVAL2) started to cover some items not treated during the first study. NCDC: validation started following ALBEDOVAL report as reference. Also exploring a new statistical method for validation comparisons to other data sets.

				JMA: No progress to report
Reporting and Planning	• Report to SEP, establish web content and create work plan for 2015.	Q1,Q3 and Q4	EUM, JMA, NOAA	Setting up quarterly meeting and a shared Log on GoogleDrive to report progress. Web page created and updated for the SCM03

2.1 Cloud screening

A simple cloud mask based on the generation of a background reflectance map and a more sophisticated cloud mask currently developed by the Satellite Application Facility on Climate Monitoring CM SAF have been used to study the impact on the pixel based albedo retrieval. Common to both methods is the fact that they can be applied to all past and current GEO satellites (MSG, GOES, GMS, MTSAT). They only depend on the availability of a visible (possibly broad band) and a thermal infrared (possibly at 10.8 micrometers) channel. As exemplified for the tropical rain forest region (Figure 1) sensed under a small view zenith angle (VZA) the impact of using the CM SAF cloud mask over no cloud mask is to limit the DHR to values below 0.1 (left panel). The added value of the CM SAF cloud mask using both the visible and the infrared channels over the simple visible band only based cloud mask is to better constrain the DHR values on the range below 0.1 (right panel). As expected, cloud masking has almost no effect on DHR in a desert region (Figure 2). For a tropical rain forest region in South America sensed under large VZA the effect is two-fold (Figure 3). A cloud mask efficiently removes unrealistically high albedo values caused by cloud contamination. But secondly, as shown in Table 1, a more clear sky conservative cloud masking (CM SAF) also leads to a significant decrease of the number of retrieved DHR values. This result is not surprising as visible-only cloud masking at high VZA is likely to fail due to decreased contrast at higher atmospheric path lengths. The fewer but realistic and more reliable retained DHR observations will likely increase the overall quality of the DHR.

	Retrieved Pixels			Above Threshold (~0.45)		
	NO CM	CMSAF CM	BCK CM	NO CM	CMSAF CM	BCK CM
Forest (Africa)	90%	+92%	+91%	1%	0%	0.01%
Desert	100%	100%	100%	47.9%	47.7%	47.9%
Forest (SA)	51%	17%	36%	15%	0.03%	1.2%

Table 1: Impact of cloud masking on the number of retrieved pixels (total and higher than a threshold of 0.45).

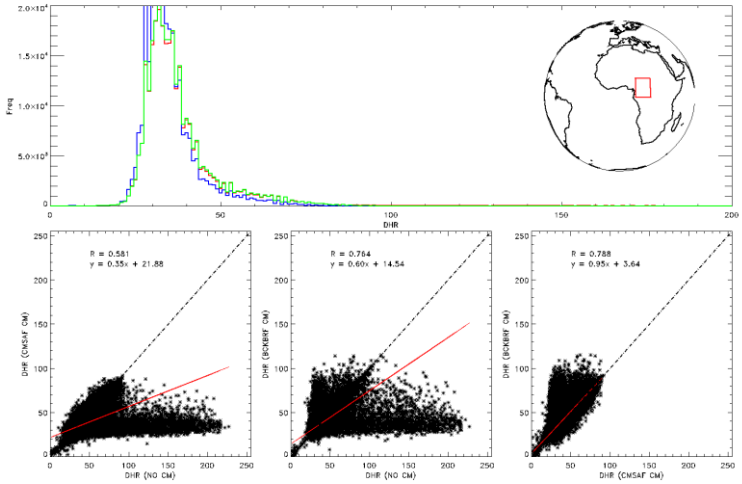

Figure 1: example of impact of a cloud mask on surface albedo retrieval. *Tropical forest region viewed under a small view zenith angle. Comparison of surface albedo retrieval with no cloud mask (NO CM), with a very simple one based on the VIS band only (BCK CM) and with a new cloud mask developed by CM SAF (CMSAF CM).*

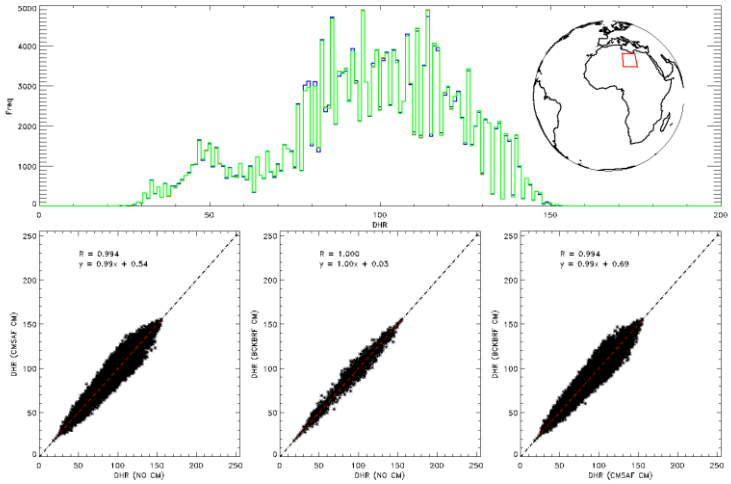

Figure 2: Same as Figure 1 but for a desert area.

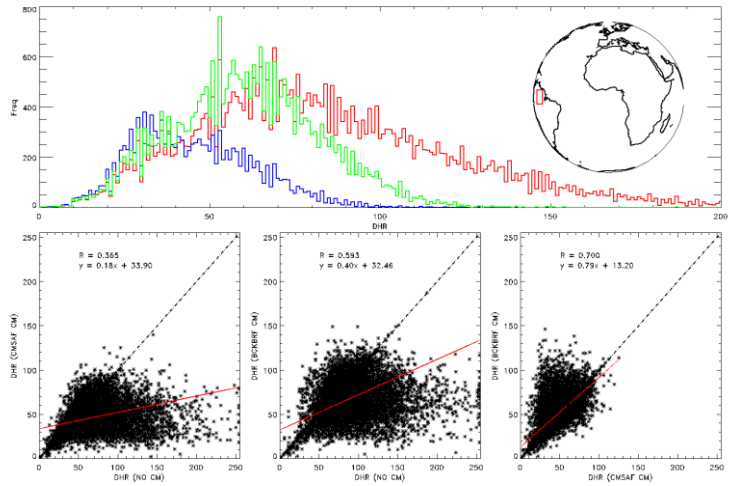

Figure 3: Same as Figure 1 but for a forest area viewed under a large view angle.

3 PLANNING 2015

The tasks planned for 2015 from the project planning description are the following:

– Technical assessment of the improved retrieval scheme; – Implementation of updated retrieval scheme at all three agencies; – Processing of data with existing validation counterpart; – Validation of test products.	2015	EUM EUM, JMA, NOAA EUM, JMA, NOAA EUM, JMA, NOAA

3.1 Detailed Planning

Tasks carried forward from 2014			
Task	**Sub-Tasks**	**Period**	**Actors**
Change of Level 2 product specifications	• NetCDF4 format, Climate Forecast standard compliant: full definition and implementation of data and metadata	Q2-Q3	NCDC
Inter-calibration[1]	• Apply common methods for inter-calibration of the VIS channel.	Q2-Q3	EUM, JMA, NOAA
New Tasks for 2015			
Task	**Sub-Tasks**	**Period**	**Actors**
Residual Cloud Removal	• Pre-Level 3 residual cloud screening research still ongoing. Usage of a background climatological value and/or seasonal variation under study • Integration of the CMSAF cloud mask at EUMETSAT for Meteosat first and second generation. • Feasibility analysis on application to GOES and GMS	Q1-Q4	EUM MeteoSwiss
Inclusion of other GEO	• Inclusion of SEVIRI • Investigate usage of GOES before	Q1-Q2	EUM

[1] The generation of calibration correction coefficients for the VIS channel for all GEOs from GSICS is still ongoing. If such list of coefficients won't be ready and available for exploitation in this project in 2016, the backup plan is to use the calibration approach and coefficients described in:

"Inamdar, A. K., and K. Knapp, 2014: Inter-comparison of Independent Calibration Techniques Applied to the Visible Channel of the ISCCP B1 data. Submitted to J. Atmos. Ocean. Tech."

instruments	1995 • Investigate processing of GMS3/4		NCDC JMA
Validation	• EUMETSAT: started a second validation study on Meteosat First Generation retrieved albedo • NCDC: continue with effort begun in 2014. • JMA: start planning validation activity	Q1-Q4	EUM NCDC JMA
Reporting and Planning	• Report to SEP. • Participation to workshop and conference • Update project web page	Q1-Q4	EUM, JMA, NOAA, MeteoSwiss EUM

3.2 Data Processing

The following processing is foreseen for 2015.

- EUMETSAT: processing of complete MVIRI time series conditional after successful Product Consolidation Review of CM-23011 cloud mask by EUMETSAT / CM SAF (TBD: Q3/2015). Generation of daily products in NetCDF4 format.
- NCDC: Processing GOES period: 1995-2014. No cloud mask. Usage of ECMWF NWP data and generation of daily/10 day composite products in NetCDF4. Processing starting in 1995 because before GOES data were stored in a different format/resolution. NCDC has an action to investigate on the possibility to process GOES data acquired before 1995.
- JMA: processing GMS-5 in 2001 using the GSICS DCC inter-calibration method (or using backup calibration method). Processing other period of data (GMS-3/-4/-5 and MTSAT-1R/-2) could be started.

4 EXTERNAL INTERFACES

The external interfaces of the SCM-03 project are divided in two different classes: Dependencies and Links

4.1 Dependencies (Input)

- **Cloud Mask:** the cooperation with MeteoSwiss (CM-SAF) in order to develop and extend to all GEO their advanced cloud mask for Meteosat evolved into a direct participation of MeteoSwiss (CM-SAF) in the project.
- **VIS channel calibration:** SCM-03 relies on SCM-06 (IOGEO) for the generation of consistent calibration coefficients for all historical GEO satellites. SCM-06 cooperates with GSICS for this task.

4.2 Links (Output)

- QA4ECV: provision of Bi-directional Reflectance Factor (BRF) with retrieval uncertainties from MFG and MSG. The same quantities from GMS and GOES will be provided under a “best effort” basis support.