

30 Years of Land Surface Albedo from GEO Satellites: Status of the SCOPE-CM LAGS Project

A.Lattanzio¹, J. Matthews², M. Takahashi³, K. Knapp², J. Schulz¹, R. Roebeling¹, R. Stoeckli⁴



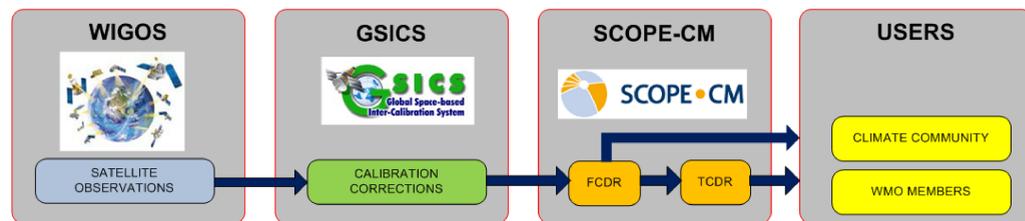
¹EUMETSAT, Darmstadt, Germany ²NOAA National Climate Data Center, Asheville, NC USA ³JMA, Meteorological Satellite Center, Tokyo, Japan
⁴Federal Office of Meteorology and Climatology MeteoSwiss, Zürich, Switzerland
 Corresponding author address: Alessio Lattanzio, EUMETSAT, Eumetsat Allee 1 64295 Darmstadt, Germany. E-mail: alessio.lattanzio@eumetsat.int

Abstract

The Sustained and Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) - Land surface Albedo from Geostationary Satellites (LAGS) project is involving the operational meteorological satellite agencies in Europe (EUMETSAT), in Japan (JMA: Japan Meteorological Agency) and in the USA (NOAA: National Oceanic and Atmospheric Administration). The project started in January 2014 and aims at the generation of a Land Surface Albedo Climate Data Record enclosing almost 30 years starting in the early 1980s covering the ring of geostationary satellites. The main issue addressed is the limitation in quality due to clouds not removed by the embedded cloud screening procedure. As also demonstrated in a study performed by independent researchers, the loss of quality in the retrieval is quite significant over dark dense vegetated areas. Two alternative strategies are followed to efficiently improve the cloud detection and removal. The first strategy to screen out outlier values, relies on a post processing analysis of the albedo seasonal variation together with the usage of a priori information contained in a background albedo map. The second strategy to apply a robust and reliable cloud mask during the retrieval taking advantage of the information contained in the measurements of the infrared and visible channels. The second issue addressed in the project concerns the consistency of the ancillary information needed for the atmospheric correction and of the input reflectance data for all exploited geostationary satellites. This poster presents the activities performed and the results obtained.

SCOPE-CM

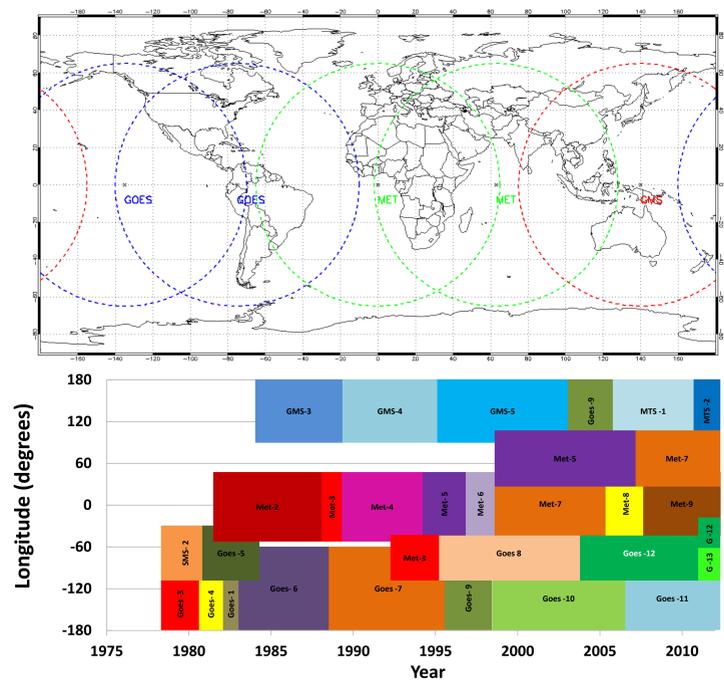
The aim of SCOPE-CM is the establishment of a sustained international network to produce Climate Data Records (CDR) from multi-agency mission data in operational environment for climate monitoring. The satellite-based key climate variables datasets aim at analysis of climate variability and trends. CDRs are defined as a "time series of measurements of sufficient length, consistency, and continuity and can be divided into two classes: (i) **Fundamental Climate Data Records (FCDR)**, a homogenous long-term dataset of radiances or brightness temperatures encompassing different sensors and platforms with spatial and temporal overlap; and (ii) **Thematic Climate Data Record (TCDR)**, geophysical variables derived from the FCDRs, which can be understood as the satellite product associated with a Global Climate Observing System (GCOS) Essential Climate Variable (ECV). **The sustained and coordinated generation of FCDR and TCDR is the ultimate objective of SCOPE-CM.**



This initiative is one component of an end-to-end system with the final objective of climate monitoring having the satellite observations represented by the World Meteorological Organization (WMO) Integrated Global Observing System (WIGOS) at one end and the CDR user community at the other end. The current participants of the network are operators of meteorological satellites namely the **China Meteorological Administration (CMA)**, the **European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)**, the **Japan Meteorological Agency (JMA)** and the **National Oceanic and Atmospheric Administration (NOAA)**.

The SCOPE-CM LAGS project (<http://www.scope-cm.org/projects/scm-03/>) is devoted to the retrieval of land surface albedo from satellites in geostationary orbit [2]. The retrieval scheme, based on a method proposed by Pinty et al [3], simultaneously estimates aerosol optical depth and surface albedo and provides an uncertainly estimation for each pixel [4], which is important for climate analysis. Important for this project is also the output of the SCOPE-CM IOGEO project (<http://www.scope-cm.org/projects/scm-06/>) that will provide inter-satellite calibrated visible, infrared, and water vapor radiances to serve as consistent input for reanalysis. A cooperation with GSICS (<http://gsics.wmo.int/>) has been also started in order to use new calibration coefficients (visible band) for all geostationary satellites (GEO satellites), obtained with homogeneous methods.

GEO Ring Temporal and Spatial Coverage

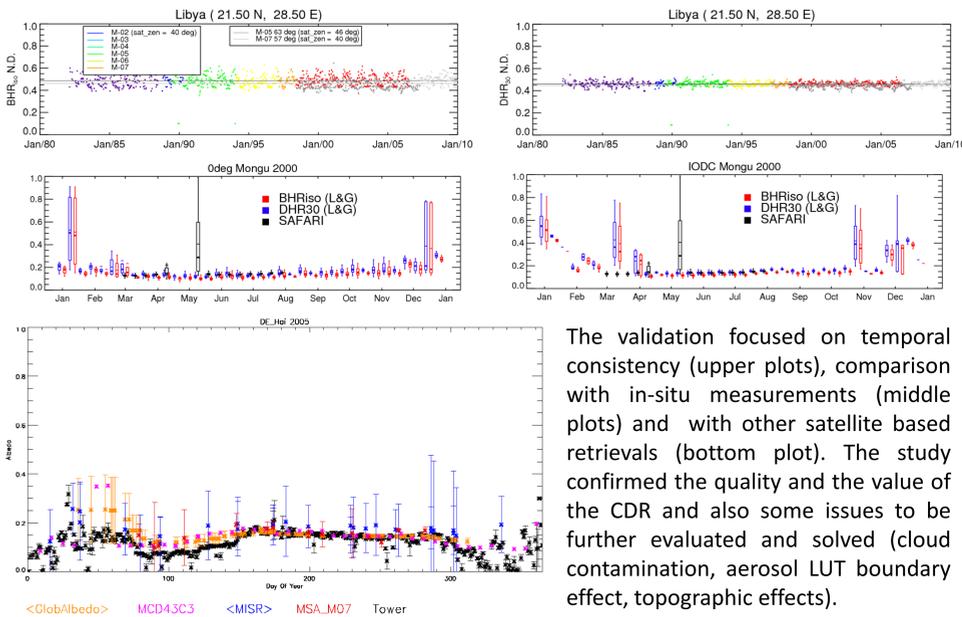


Using a ring of GEO satellites is possible to cover almost the full earth land and ocean surface with the only exclusion of the poles.

The potential temporal coverage of the SCOPE-CM CDR is spanning from the beginning of the 1980s to the present with only one gap around 60E.

Meteosat Dataset Validation

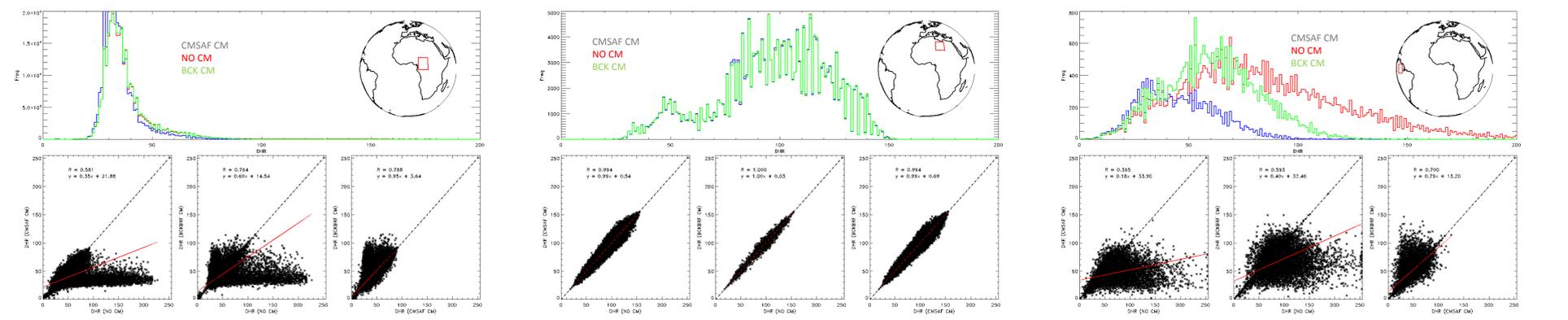
Essential is the validation of the full CDR involving independent experts. EUMETSAT conducted such a validation study for the Meteosat First Generation land surface albedo CDR [3].



The validation focused on temporal consistency (upper plots), comparison with in-situ measurements (middle plots) and with other satellite based retrievals (bottom plot). The study confirmed the quality and the value of the CDR and also some issues to be further evaluated and solved (cloud contamination, aerosol LUT boundary effect, topographic effects).

Current Activities: Improved Cloud Screening

A simple cloud mask based on the generation of a background reflectance map and a more sophisticated cloud mask generated at CM SAF have been used to check 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 similar to Meteosat First Generation (MSG, GOES, GMS, MTSAT).



The effect of clouds, as expected, is negligible on desert area (middle panel). On rain forest regions sensed under low VZA the effect is to increase the number of retrievals (left panel). In a similar region in South America sensed under high VZA the effect is opposite, leading to a decrease of retrieved pixels with an efficient removal of unrealistically high albedo values caused by cloud contamination. The usage of a background albedo climatology value or of the analysis of seasonal variations to screen out clouds after retrieval are still under investigation.

Summary

- SCOPE-CM is a framework established by the WMO in order to generate CDRs. The main actors are satellite data providers. The second phase of the framework started middle 2014 with 10 projects (<http://www.scope-cm.org/>);
- The SCOPE-CM project on land surface albedo retrieval from geostationary satellites has successfully implemented retrieval software at EUMETSAT, NOAA and JMA;
- Quality analysis by independent scientists has shown that among other things residual undetected clouds are an issue for product quality;
- The positive impact of a new cloud mask applicable to all historic and current geostationary satellites on the quality of the retrieval has been shown;
- Further work will focus on homogenisation of input data, in particular, inter-satellite calibrated reflectance and water vapour and ozone from reanalysis data.

References

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