Long term surface albedo dataset from Meteosat Images

J. Schulz[1], A. Lattanzio[1,3], B. Theodore[1,2], Y. Govaerts[1], R. Roebeling[1]
[1] EUMETSAT, Eumetsat Allee 1, 64295 Darmstadt, Germany
[2] MOLTEK, United Kingdom
[3] Makalumedia Gmbh, Germany

Introduction

Land surface albedo has been recognized as an essential climate variable that is both controlling the surface energy budget as well as a sensitive indicator of environmental changes.

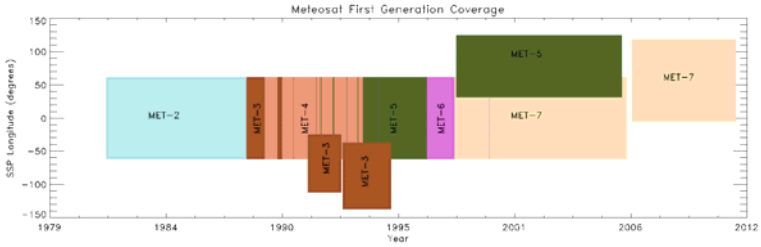
In the frame of its Climate Data Record generation activities, EUMETSAT has generated a unique multi-decadal surface albedo climate data record. Meteosat First Generation observations, acquired every 30 minutes during almost 30 years represents a valuable resource to monitor and understand climate. The retrieval is based on the multi-angular sampling of the surface reflectance during daylight hours (Pinty *et al.*, **JGR**, 2000).

Product content and coverage

The Geostationary Surface Albedo (GSA) climate data record covers:

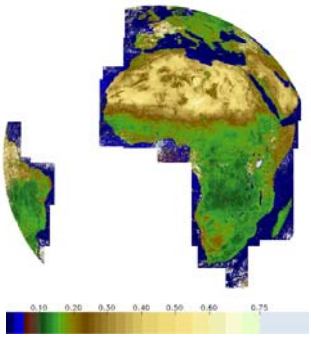
- Time period 1982-2006, prime 0 Sub Satellite Point (SSP) coverage (6 satellites);
- Time period 1998-today Indian Ocean Data Coverage at 57 E and 63 E SSPs (2 satellites);
- Time period 1991-1995, (Extended) Atlantic Data Coverage at 50 W and 75 W SSPs;
- A spatial domain of 60° around the sub-satellite point.

The processing at EUMETSAT has been finished for all data except the Extended Atlantic data Coverage that is ongoing.



The GSA product is derived from Meteosat visible band observations for 10 days periods at a pixel resolution of about 3 km at equator and contains the following main quantities:

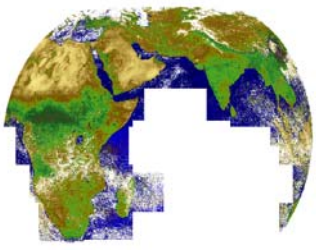
Prime Mission centred over Africa



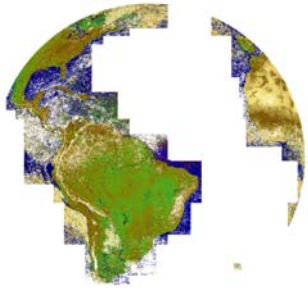
- Directional Hemispherical Reflectance (DHR30), namely the integral of the Bidirectional Reflectance Factor (BRF) over all exiting angles for direct illumination conditions only, computed for a solar position fixed at 30 degrees;
- Isotropic BiHemispherical Reflectance (BHRiso), namely the integral of the BRF over all exiting angles under isotropic illumination;
- Aerosol Optical Thickness (AOT) at 0.55 µm as a by-product;

Included for each pixel are quality indicators and uncertainty estimates associated with the product.

Indian Ocean Data Coverage



Atlantic Data Coverage



How to get the data ?

This dataset and user manual are available free of charge from the EUMETSAT Data Centre at:

http://www.eumetsat.int/ **-> Product Navigator**

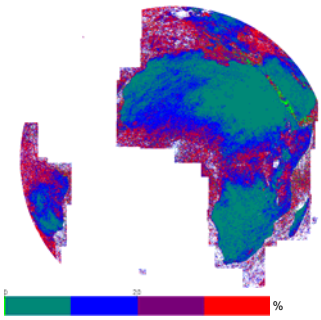
The products are provided in **BUFR** and **HDF4** formats and comprise:

- The GSA product (BHR, DHR30, AOT);
- The ancillary data containing in particular the retrieval uncertainty;
- The static data containing the position (latitude and longitude) of each pixel.

Note that in HDF4 the variables are provided in separate files while they are provided in a single file in BUFR.

Quality assessment

Different quality measures have been used to assess the GSA product:

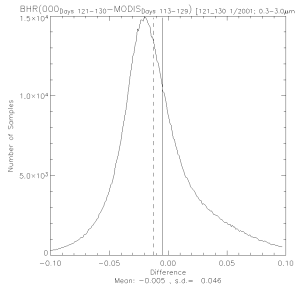


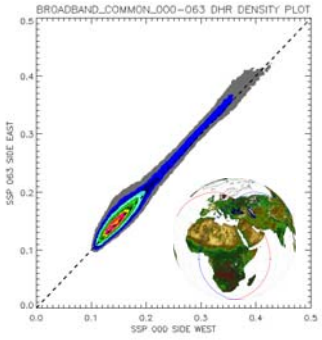
Estimation of retrieval uncertainty

The uncertainty is calculated from both the instrumental uncertainty and the forward model approximations and is provided as part of the product. The image to the left shows an example of the DHR30 relative uncertainty in percent.

Comparisons with MODIS

The BHR from the GSA product has been compared against corresponding MODIS measurements. An example of a histogram of the BHR differences MET-MODIS for the period 1-10 May 2001 is shown on the right side.



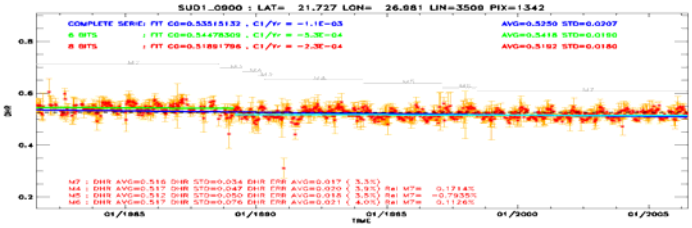


Comparison of GSA products from different satellites

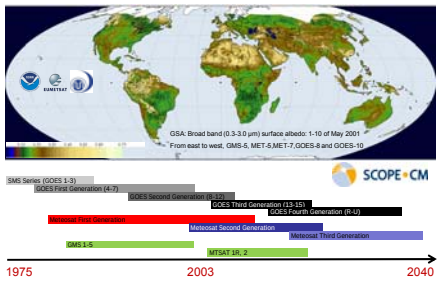
Taking advantage of the overlap between Meteosat satellites at 0 and IODC positions, an estimate of the spatial consistency of the retrieval has been performed. The left panel shows a comparison of the DHR retrieved by MET-7 at 0° and MET-5 at 63°E.

Temporal Consistency

A long-term analysis of the Meteosat surface albedo data was performed using stable targets (e.g. bright and dark deserts) to analyse the temporal consistency of the surface albedo estimate coming from different satellites. The analysis revealed biases, within the measurement error, in the broadband surface albedo estimates between consecutive Meteosat satellites. Loew and Govaerts (2010) have found that these inconsistencies can be attributed to uncertainties in the spectral conversion from the satellite measurement to broadband. Loew and Govaerts provided an empirical fit that improves the consistency.



Perspective: SCOPE-CM



In the framework of the WMO initiative ***Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring*** (***SCOPE-CM***), the GSA algorithm is used to derive the surface albedo from the NOAA, JMA and EUMETSAT geostationary satellites.
This will provide data for more than 50 years from more than 30 geostationary satellites from 5 orbit positions and 3 satellite agencies.

References

Pinty B. *et al*, Surface Albedo Retrieval from Meteosat. 1. Theory, **JGR**, 2000, 105, 18099-18112.
Loew. A and Govaerts Y. Toward Multidecadal consistent Meteosat Surface Albedo Time Series. **Remote Sensing**, 2010, 2, 957-967.

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