CGMS-XXXII EUM-WP-14
Prepared by EUMETSAT
Agenda Item: II/4

DERIVATION OF GLOBAL SURFACE ALBEDO MAPS FROM GEOSTATIONARY WEATHER SATELLITES

The paper provides the status of efforts at EUMETSAT to process VIS sensor radiances from geostationary satellites with the goal to produce the first global surface albedo map from geostationary satellites.

The paper refers to Actions 31.27 and 31.28 from CGMS XXXI.

Derivation of Global Surface Albedo Maps from Geostationary Weather Satellites

1 INTRODUCTION

At CGMS XXXI in Working Group II a EUMETSAT paper (EUM-WP-19) summarised the derivation of global surface albedo maps from Meteosat satellites. A detailed presentation had been made to the CGMS XXXI plenary. The purpose of the presentation and the associated paper EUM-WP-19 was to demonstrate the utility of geostationary satellite observations for the production of a consistent climate product, eventually spanning the complete period of available data from all geostationary satellites. Such a data set would be very valuable for studies on inter-annual variability of surface albedo and associated processes, as well as for climate model validation. The surface albedo is considered a “prototype climate product” from geostationary meteorological satellites. The project also provides unique opportunity to learn general lessons concerning the difficulties in reprocessing archived data for climate applications in a consistent manner.

It was pointed out that geostationary radiance observations for inferring surface albedo have a distinct advantage as the observations throughout a day can be used to estimate the anisotropy of the surface reflection. The frequent temporal sampling also provides more opportunities to observe the cloud free atmosphere. The generation of a consistent global surface albedo map needs to address the following points for all spacecraft and instruments being utilised in the retrieval: (i) radiometric noise, (ii) spectral response characterisation, (iii) calibration, (iv) temporal sampling, (v) spatial resolution.
Example surface albedo maps derived from both Meteosat-7 and Meteosat-5 demonstrate good performance of the retrieval algorithm; the product from two satellites shows a seamless transition from one satellite to the other. It has also been possible to derive an albedo map from the very first archived Meteosat-2 data (September 1981). This indicates that EUMETSAT has developed the necessary expertise to calibrate the Meteosat VIS band and to derive consistent surface albedo maps from geostationary observations.
Following the discussion in Working Group II at CGMS XXX the plenary CGMS endorsed the following actions:

Action 31.27 EUMETSAT to request, in written form, from all geostationary satellite operators (hourly) VIS channel observations for a common period of one month in late 2002 when MODIS, MISR and MERIS data are also available. Deadline: 30 November 2003

Action 31.28 All geostationary satellite operators to provide the VIS data requested according to Action 31.27 to EUMETSAT. Deadline: 31 January 2004

2 Status

Action 31.27 has been closed with letters from the Director-General of EUMETSAT to all CGMS operators of geostationary satellites. The requested period is May 2001. This period has been requested because Meteosat 5 and 7 have already been processed for that period. Based on that experience, we conclude that the month of May is particularly adequate since the Inter Tropical Convergence Zone has not yet developed in its most Northern position over the continents and thus gives more opportunity to retrieve clear-sky or surface albedo values. Additionally, other surface albedo products currently generated with the MODIS and MISR onboard the Terra platforms are available for 2001.

With regard to action 31.28 a full month (May 2001) of data has been received on tape from Japan Meteorological Agency and a sample data set for one day of May 2001 from NOAA/NESDIS both for GOES Eat and West data.

A two folds approach will be adopted to derive a global albedo map from Meteosat-7, -5 GOES 10, -12 and GMS. In a first step, the Meteosat Surface Albedo algorithm will be modified to allow the processing of any geostationary observations in the VIS band. In this first phase, the main effort will consist in the generation of daily time series of Top-Of-Atmosphere observations for each pixel required for the inversion process as well as the preparation of all the required look-up tables. This version of the algorithm, referred to as Geostationary Surface Albedo (GSA), should permit the processing of any VIS band observations provided the observations are accurately geo-referenced and the following information available:

- calibration information;
- the actual sub-satellite point at the time of acquisition;
- the radiometric noise (\eg, standard deviation of the space count);
- the rectification accuracy estimation (\eg, with respect to landmarks);
- the sensor Spectral Response uncertainty.

It is expected that this phase is completed by the end of 2004.

In a second phase, the consistency among these various products will be addressed. The challenges and problems related to different spectral, temporal or spatial resolution will have to be carefully examined in this phase.