An Overview of the Operational Processing at the EUMETSAT Satellite Application Facility on Climate Monitoring (CM-SAF)

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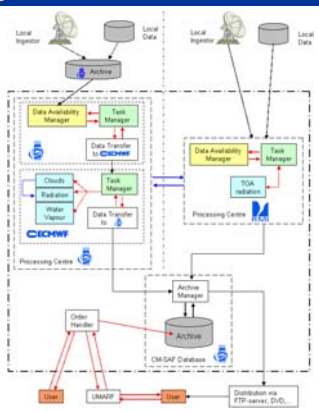
CM-SAF overview

The EUMETSAT Satellite Application Facility on Climate Monitoring (CM-SAF) generates, archives and distributes widely recognized high-quality satellite-derived products relevant for climate monitoring in an operational mode and provides related services. Products covering cloud parameters, surface albedo, radiation fluxes at the top of the atmosphere and at the surface, atmospheric temperature and water vapour profiles as well as vertically integrated water vapour are derived from different sensor types on operational geostationary and polar orbiting meteorological satellites including instruments such as ATOVS, AVHRR, GERB and SEVIRI.

Structure of Processing Centres

- CM-SAF operates 2 processing centres, one at DWD in Offenbach and one at RMIB in Brussels
- The DWD processing centre uses resources at DWD and ECMWF computing environments
- All products are archived at DWD (intermediate to end products)
- All user requests are handled at DWD
- Two types of product generation are performed:
  - "Near real time" processing of time series done with a maximum time delay of two to four months depending on product type
  - Processing of long time series/datasets using inter-calibrated satellite data (dedicated processing events)



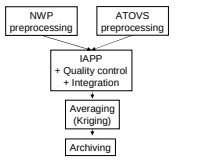
Product types

Product group	Specific products	Sensor, area and available period	Resolution
Cloud parameters	Cloud Fractional Cover (CFC) Cloud Type (CTY) Cloud Top Pressure (CTP) Cloud Top Height (CTH) Cloud Top Temperature (CTT) Cloud Phase (CPH) Cloud Optical Thickness (COT) Cloud Water Path (CWP)	AVHRR: Baseline* / since 01 Nov 2004 Arctic (except cloud physical products) / since 01 Jan 2009 SEVIRI: Baseline* / 01 Sep 2005 – 31 Apr 2007 Meteosat disc / 01 May 2007 - today	(15 km)²
Humidity products	Total (HTW) and layered (HLW) precipitable water. Mean temperature and relative humidity for 5 layers (HLW) as well as specific humidity and temperature at the six layer boundaries (HSH).	ATOVS: global / since 01 Jan 2004	(90 km)²
	Vertically integrated water vapour (HTW)	SSM/I (ocean):Global / 01 Jul 1987 – 31 Aug 2006	(0.5°)²
Surface Radiation	Incoming short-wave radiation (SIS) Surface albedo (SAL) Net shortwave radiation (SNS) Net long-wave radiation (SNL) Downward long-wave radiation (SDL) Outgoing long-wave radiation (SOL) Surface radiation budget (SRB)	AVHRR: Baseline* / since 01 Nov 2004 Arctic (SAL only) / since 01 Jan 2009 SEVIRI and merged AVHRR+SEVIRI: Baseline*/ 01 Sep 2005 – 31 Apr 2007 Meteosat disc / since 01 May 2007	(15 km)²
Top-of-Atmosphere radiation	Total Incoming solar radiative flux (TIS) Total Reflected solar radiative flux (TRS) Total Emitted Thermal radiative flux (TET)	GERB and CERES (merged dataset): Meteosat disc + Arctic/ since 01 Feb 2004	(45 km)²

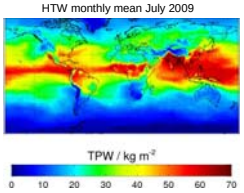
*Baseline: 30° N – 80° N, 60° W – 60° E

Procedures for ATOVS based products

- ATOVS Level 1c data from NOAA and Metop satellites and NWP analysis from operational GME model as input data
- Currently used SW packages:
  - AAPP v6.10 for pre-processing
  - IAPP v3.0b (developed at Univ. of Wisconsin) for water vapour and temperature profile retrieval
  - Quality control and integration software developed at CM-SAF
  - Using Kriging routine for averaging
- Routine runs once per month
- Daily and monthly mean products are provided

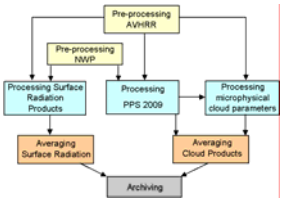


HTW monthly mean July 2009

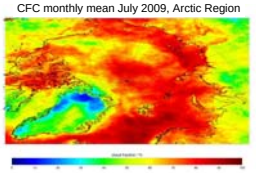


Procedures for AVHRR based products

- NOAA/AVHRR data (EARS) , Metop/AVHRR data (EUMETCAST) and NWP analysis from operational GME model as input data
- Currently used SW packages:
  - AAPP v6.9 for pre-processing
  - NWC-SAF PPS v2009 for most cloud products
  - Software developed within CM-SAF for generation of cloud microphysical products and surface radiation products
- Temporal resolution ranges from daily to monthly mean depending on product

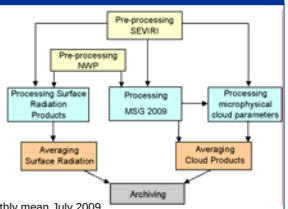


CFC monthly mean July 2009, Arctic Region

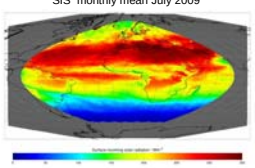


Procedures for SEVIRI based products

- MSG/SEVIRI Level 1.5 data in hourly resolution and NWP analysis from operational GME model as input data
- Currently used SW packages:
  - NWC-SAF MSGv2008 software for most cloud products
  - Software developed within CM-SAF for cloud microphysical products and surface radiation products.
- Depending on product type daily, weekly, monthly mean and monthly mean diurnal cycle products are available

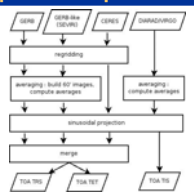


SIS monthly mean July 2009

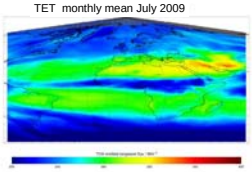


GERB/SEVIRI + CERES based products at the top of atmosphere

- Total Reflected Solar (TRS) and Total Emitted Thermal (TET) fluxes are based on GERB and SEVIRI data onboard MSG and the CERES instrument onboard the Terra satellites,
- Total incoming Solar (TIS) flux is based on the DIARAD experiment
- Daily mean, monthly mean and monthly mean diurnal cycle products are generated
- Data are given according to a sinusoidal map with a pixel size of 45 km by 45 km with a slight variation according to the latitude (less than 1 km)



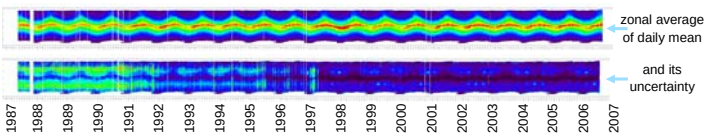
TET monthly mean July 2009



Processing of long time series

Products	Data Coverage	Available	Satellite data
Cloud products / Surface radiation products	1982-2010/ 2001-2010 (CPP)	2011	AVHRR (GAC)
Cloud products /TOA/Surface radiation/ water vapour	2004-2010	2011	SEVIRI and GERB
Surface radiation products (SIS, SAL, SDL)	1983-2010	2010 (0°)	MVIRI/SEVIRI
Free tropospheric humidity (including cloud mask)	1983-2010	2010 (IODC)/2011 (0°)	MVIRI/SEVIRI
Total precipitable water (HTW)	07/1987-08/2006	Released Jan 2009	SSM/I (ocean)
HOAPS (Latent heat flux, precipitation, etc)	07/1987-12/2007	July 2010	AVHRR/SSM/I (Ocean)
Layered precipitable water vapour, relative humidity, temperature in 5 layers (HLW), Specific humidity and temperature at 6 pressure levels (HSH), Total precipitable water (HTW)	1998-2010	2010	ATOVS

The processing of thematic climate data records (TCDR) will become the main focus of the CM-SAF within the next years. CM-SAF data sets shall be based on carefully intersensor calibrated radiances.



Services

- Provision of CM-SAF operational products and data sets in HDF5 or netcdf format
- Add-on products and ancillary data (e.g., latitude/longitude maps, land/sea mask, etc.) as well as example files are available via the CM-SAF webpage
- A Graphical User Interface and data conversion tools (CDO) are provided
- Service messages, information on changes in processing as well as known product disruptions are provided on the webpage www.cmsaf.eu

- Product search and ordering via a Web User interface including quicklooks of products are available
- Data provision is realized via temporary ftp-access, CD, DVD, or email (small data amounts only)
- Standing product orders can be realised
- The User Help Desk is available during normal office hours
- Data are provided free of charge to any interested user, a user registration is mandatory
- All intellectual property rights of the CM-SAF products belong to EUMETSAT

International TOVS Study Conference, 17th, ITSC-17, Monterey, CA, 14-20 April 2010. Madison, WI, University of Wisconsin-Madison, Space Science and Engineering Center, Cooperative Institute for Meteorological Satellite Studies, 2011.