Software supported by CM SAF

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Introduction

Are you a registered user of CM SAF?

Yes \hspace{1cm} No

Have you already ordered CM SAF data through the Web User Interface (WUI: www.cmsaf.eu/wui)?

Yes \hspace{1cm} No
Introduction

Which operating system are you using?

Windows
- XP
- 7
- 2000
- Vista

Linux/Unix
- MAC OSX
Introduction

Did you visit the CM SAF Community Site?

- Yes
- No

Have you used the CM SAF Toolbox?

- Yes
- No
- Very little
Which software are you using when working with CM SAF data?
Ordering data

www.cmsaf.eu/wui
Data Formats

**hdf**
(http://www.hdfgroup.org/HDF5/)

+ supports additional data compression
+ commonly used in satellite data community
+ provides a standard

- not very common
- only limited software available to access the data
- complex to read data
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**netcdf**
(http://www.unidata.ucar.edu/software/netcdf)

+ growing number of meteorological / climatological users
+ wider range of software available to access the data, incl. GIS
+ standard for climate data available
  - no data compression, larger files
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It is recommended to order CM SAF data in netcdf-format via the Web User Interface (WUI)!
• All **CM SAF Data sets** are provided in netcdf-format, i.e., Meteosat, CLARA, ATOVS, HOAPS, CLAAS
  e.g., PREmm200807010000001130034201GL.nc

• **Operational Products** from CM SAF can be ordered in netcdf-format for user specific regions and spatial resolutions:
  e.g., CFCmm201007010000320UD0023201UD.nc

• CM SAF data files provided through the Web User Interface always contain only one time step!
Example:

*SIS*dm200407150000300070017901MA

..... contains

- the daily mean SIS product
- for 15 July 2004
- from version 300
- derived from Seviri/MSG1 data
- for the MSG full disk
- in 15x15km² sinusoidal projection
The free, open-source climate data operators (`cdo`) and the statistical software tool `R` are the main tools supported to analyse CM SAF data. `Panoply` is a very useful viewer for netcdf-data files.

- **Panoply**: [http://www.giss.nasa.gov/tools/panoply](http://www.giss.nasa.gov/tools/panoply)
- **cdo**: [https://code.zmaw.de/projects/cdo](https://code.zmaw.de/projects/cdo)
- **R**: [http://www.r-project.org](http://www.r-project.org)
tools: panoply

Panoply

• developed at NASA GISS:  
  http://www.giss.nasa.gov/tools/panoply

• Based on Java, freely available

• Displays netcdf (hdf, grib) data
Climate Data Operators

- developed at Max Planck Institute for Meteorology, Hamburg
- freely available including extensive documentation: [https://code.zmaw.de/projects/cdo](https://code.zmaw.de/projects/cdo)
- works with multiple file formats, including grib, netcdf etc.
- collection of operators for processing climate (model) data e.g.
  - spatial interpolation
  - data selection
  - Subsampling
  - statistical and arithmetical functions
  - ...
- is accessible from the ‘command line’ (‘prompt’)

tools: cdo
R

- programming language and software environment for statistical computing and graphics: [http://www.r-project.org/](http://www.r-project.org/)
- includes an interface to netcdf
- has extensive statistical and graphical capabilities, mainly through additional packages
- supports the use of scripts
- extensive online-documentation available on the official webpage and on other webpages
- wide user community
tools: cdo + R

A collection of software scripts including example CM SAF data is provided on the CM SAF Community Page: accessible via [http://training.eumetsat.int](http://training.eumetsat.int)
• Scripts are based on Windows, rearranging them for Unix/Linux/Mac-operating systems should be straightforward.

• Before running these scripts, install cdo and R on your local computer system (see further instructions on the Course Page)!

• Suggestion: install panoply (visualize netcdf-files) and Notepad++ (text-editor).

• Have a look at the screencasts (provided on the Course page) that describe the use of the scripts!
tools: cdo + R

• Have a look at the screencasts (provided on the Community Site) that describe the use of the scripts!
1. Order data in netcdf-format on a regular lon-lat grid from the CM SAF Web User Interface

www.cmsaf.eu/wui
1. Order data in netcdf-format on a regular lon-lat grid from the CM SAF Web User Interface

Software scripts based on cdo:
1. Combine the individual time steps into one netcdf-file
2. Extract the time series for a single location
3. Calculate the temporal / spatial means
4. Calculate the multi-year monthly averages
5. Calculate the monthly anomalies

Visualize the data (netcdf) with panoply!
Step-by-step

Software scripts based on R:
1. Plot time series data
2. Analyse time series data,
   e.g., calculate average annual cycles, trends
3. Visualize the 2D Data,
   e.g., monthly means / temporal means / anomalies
Software support is provided through the Software Forum on the CM SAF Community Site.

Please post your questions and comments concerning the software tools odo and R and the provided software scripts.

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<tr>
<th>DISCUSSION</th>
<th>STARTED BY</th>
<th>REPLIES</th>
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<th>LAST POST</th>
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Additional examples

Regional Climate Center on Climate Monitoring (RCC-CM),
http://www.dwd.de/rcc-cm

Andre Obregon, RCC, DWD
Additional examples

Solar Energy Applications (solaR), analysis and visualisation of gridded data (raster, rasterVis)

Fig. 1. Hovmöller plot with the time evolution of the daily horizontal irradiation (Wh/m²) as published by CM SAF, averaged along 10°W to 5°E.

Fig. 2. Average of yearly horizontal irradiation (kWh/m²) on the horizontal plane as published by CM SAF during 2010 and 2011.

Comparative assessment of global irradiation from a satellite estimate model (CM SAF) and on-ground measurements (SIAR): A Spanish case study
F. Antonanzas-Torres a, F. Cañizares b, O. Perpiñán c,d

Renewable and Sustainable Energy Reviews 21 (2013) 248–261
Many more examples are available on the CM SAF Community Site.
Final words....

- CM SAF offer not only high-quality climate data, but does also provide software incl. support to analyse CM SAF data based on free software packages

- cdo and R are very powerful tools for in-depth data analysis, incl. CM SAF data; other tools (Matlab, IDL, GIS) are also suitable to analyse CM SAF data

- The CM SAF Community Site provides a huge source of information on CM SAF and is intended to allow user interactions

- Feel free to share your questions / comments / results with us and other users of CM SAF data through the forums at the CM SAF Community Site
Any Questions / Comments?

Have fun playing with the data!

Looking forward to see your application!