CM SAF Data Access and Toolbox

Dr. Steffen Kothe
Deutscher Wetterdienst
Was the sunshine duration in April 2019 higher than usual in Mainz and Germany?
http://cm-saf.eumetsat.int
### List of products

<table>
<thead>
<tr>
<th>Name</th>
<th>Version</th>
<th>Data source</th>
<th>Time</th>
<th>Statistics</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDU - Sunshine Duration</td>
<td>SARAH ed. 2.1</td>
<td>MVIRI/SEVIRI on METEOSAT</td>
<td>Monthly</td>
<td>Sum</td>
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<tr>
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6 Products found, displaying all Products.
Your current orders

Here you are able to finish your order. To do this we need your preferred product format and way of data transfer. Usually it takes 15 minutes at least and up to some days until you receive your data (depending on the way of transfer, the amount of data and the CPU effort to do the postprocessing).

Please note that standing orders and orders larger than 5 MB will always be delivered from our data server.

ORDER TRANSFER

Submit your order

Please consider that the total size of your order is 7.9 GB which will take approx. 34 minute(s) to download from CM SAF’s data server at 4 MB/s transfer speed.

Choose your preferred type of data transfer

- HTTPS/SFTP - Delivery of data via data server (HTTPS/SFTP).
- E-MAIL - Delivery of data via Email attachment.

Please keep in mind that delivery via e-mail attachment is feasible up to 5 MB order order size only. Larger orders will be made available for download on our data server automatically.

ORDER CART

<table>
<thead>
<tr>
<th>Position</th>
<th>Description</th>
</tr>
</thead>
</table>

Place an order
CM SAF product request has been finished: ORD33397

CMSAF Contact <Contact.Cmsaf@dwd.de>

Die unnötigen Zeilenumbrüche des Nachrichtentextes wurden automatisch entfernt.

Gesendet: DI 28.05.2019 17:16
An: Steffen.Kothe@dwd.de

Dear Steffen Kothe,

The extraction of your ordered CM SAF product (SDU, MVIRI-SEVIRI on METEOSAT, Monthly, Sun, Version 003, Latitude-longitude grid (0.05x0.05 degree), MSG full disk (includes Europe, Afrika, Atlantic Ocean), NetCDF4:LatLon, 5.0, 55.0, 16.0, 47.0, 0.0, 0.05, 0.05, 2016-01-01 - 2017-12-01) from our archive has been finished successfully.

Your order has a total size of 2.9 MB (3082240 Byte) and contains 24 individual data files.

The order data files are available on our data server for the next 14 days.

You can get access to the data server via https:
host: cmsaf.dwd.de
Username: routcm
Password: 4gVdHUpq8UHdJJP
Directory: data/ORD33397
Link: https://cmsaf.dwd.de/data/ORD33397/
wget: wget -r -np -nH --cut-dirs=1 --reject="Index.html" --user=routcm --password=4gVdHUpq8UHdJJP
https://cmsaf.dwd.de/data/ORD33397/
or via sftp:
host: cmsaf.dwd.de
Username: routcm
To-Do-List

- Find data ✓
- Download data ✓ Piece of cake
- Work with data ?
- Results
CM SAF R TOOLBOX

The CM SAF R TOOLBOX can be used to prepare, analyze and visualize CM SAF NetCDF data. For this the CM SAF R TOOLBOX consists of prepared R-scripts, which require only few adaptations of file- and path names. Thus, no R scripting experience is needed. After starting a script the user is guided through all options. The heart of the CM SAF R TOOLBOX is the `cm SAF` R-package. The `cm SAF` R-package contains a collection of more than 50 functions for analysis and manipulation of CM SAF NetCDF formatted data. There are R-scripts, which help unexperienced R-users to apply easily the functions of the `cm SAF` R-package.

The `cm SAF` R-package can be downloaded here. For the CM SAF R TOOLBOX a small tutorial-video, a tutorial-pdf and a brief manual are available.
The CM SAF R TOOLBOX

R-based tools for an easy usage of CM SAF NetCDF data

**PREPARE**
Extract, unzip, select time range and region, merge.

**ANALYSE**
The cmsaf R-package contains more than 60 useful operators.

**VISUALIZE**
Visualize spatial data, statistical analysis and 1D-timeseries.
CM SAF R TOOLBOX Scripts

- The CM SAF R TOOLBOX requires no R or scripting experience
- After starting the main script the user is guided through all options
Data Preparation

- This step helps to get from downloaded .tar-file to ready-to-use NetCDF
- Use the **Prepare** step to:
  - Extract
  - Unzip
  - Select time range
  - Select region
  - Merge single files into one
Data Analysis

The **Analyze** step is a simple-to-apply interface to functions of the *cmsaf* R-package.

**cmsaf** R-package

The *cmsaf* R-package is a collection of functions for basic analysis and manipulation of CM SAF NetCDF data.

It contains more than 60 operators, such as:

- `fldmean` → mean of a 2d field
- `mon.anomaly` → monthly anomalies
- `monmean` → monthly means
- `ncinfo` → content of a NetCDF file
- `remapbil` → bilinear interpolation
- `selpoint` → extract a point or time series
- `trend` → linear trend
'cmsaf' R-package downloads since 26-06-2015

Total downloads: 25249 (14 April 2019)
Data Visualization

- The **Visualize** step allows an easy creation customized plots
Data Visualization

- The **Visualize** step allows an easy creation of customized plots
  - 2d maps
  - 1d line plots
Data Visualization

- The **Visualize** step allows an easy creation of customized plots
  - 2d maps
  - 1d line plots
  - Statistical figures of 1d time series
- Provides useful information on the data
- There are several possibilities of adaptations
CM SAF R Toolbox

Let’s try it!

Mainz: 50 N, 8.25 E
CM SAF R Toolbox

Results

Sunshine Duration

Monthly Anomaly April 2019

Average Seasonal Cycle

Box Plot

Annual Means

Histogram of Sunshine Duration
To-Do-List

- Find data ✔
- Download data ✔
- Work with data ✔
- Results ✔
Summary

- CM SAF freely provides the CM SAF R Toolbox
- Easy preparation, analysis and visualization of CM SAF data
- ‘cmsaf’ R-package offers collection of functions for analysis and manipulation of CM SAF NetCDF data
  (https://cran.r-project.org/web/packages/cmsaf/index.html)

Contact:
Steffen.Kothe@dwd.de
contact.cmsaf@dwd.de

www.cmsaf.eu/tools
Article
The CM SAF R Toolbox—A Tool for the Easy Usage of Satellite-Based Climate Data in NetCDF Format

Steffen Kothe 1,*, Rainer Hollmann 1, Uwe Pfeifroth 1, Christine Träger-Chatterjee 2 and Jörg Trentmann 1

Received: 5 February 2019; Accepted: 24 February 2019; Published: 28 February 2019

Abstract: The EUMETSAT Satellite Application Facility on Climate Monitoring (CM SAF) provides satellite-based climate data records of essential climate variables of the energy budget and water cycle. The data records are generally distributed in NetCDF format. To simplify the preparation, analysis, and visualization of the data, CM SAF provides the so-called CM SAF R Toolbox. This is a collection of R-based tools, which are optimized for spatial data with longitude, latitude, and time dimension. For analysis and manipulation of spatial NetCDF-formatted data, the functionality of the cmsaf R-package is implemented. This R-package provides more than 60 operators. The visualization of the data, its properties, and corresponding statistics can be done with an interactive plotting tool with a graphical user interface, which is part of the CM SAF R Toolbox. The handling, functionality, and visual appearance are demonstrated here based on the analysis of sunshine duration in Europe for the year 2018. Sunshine duration in Scandinavia and Central Europe was extraordinary in 2018 compared to the long-term average.
CM SAF R Toolbox – The Extension

- Extension of cmsaf R-package
  - Use operators for more grids (MSG native grid, CLARA polar grids, …)
  - New operators (add.grid.info, remap, …)
  - Easier implementation of new operators
  - Integration of main scripts into one application
  - Improved stability
The CM SAF R TOOLBOX 'Infinite Monkeys'

The intention of the CM SAF R Toolbox is to help you using CM SAF NetCDF formatted data.

This includes:
1. Preparation of ordered CM SAF data files.
2. Analysis of prepared CM SAF data.
3. Visualization of the results.

To begin, choose a .tar file in the prepare section or jump right in and analyze or visualize a .nc file.

Suggestions for improvements and praise for the developers can be sent to contact.cmsaf@dwd.de.

- Steffen Kothe - 2019-01-22 -
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CM SAF R Toolbox – The Extension

» Ready for the future