

# Package ‘cmsafvis’

May 3, 2024

**Title** Tools to Visualize CM SAF NetCDF Data

**Version** 1.2.7

**Description** The Satellite Application Facility on Climate Monitoring (CM SAF) is a ground segment of the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and one of EUMETSAT's Satellite Application Facilities. The CM SAF contributes to the sustainable monitoring of the climate system by providing essential climate variables related to the energy and water cycle of the atmosphere (<<https://www.cmsaf.eu>>). It is a joint cooperation of eight National Meteorological and Hydrological Services.

The 'cmsafvis' R-package provides a collection of R-operators for the analysis and visualization of CM SAF NetCDF data.

CM SAF climate data records are provided for free via (<<https://wui.cmsaf.eu/safira>>).

Detailed information and test data are provided on the CM SAF webpage (<[http://www.cmsaf.eu/R\\_toolbox](http://www.cmsaf.eu/R_toolbox)>).

**License** GPL (>= 3)

**BugReports** <https://github.com/cmsaf/cmsaf-r-tools/issues>

**Depends** R (>= 4.0)

**Imports** assertthat (>= 0.2.1), cmsafops (>= 1.2.1), colorspace (>= 1.4), countrycode (>= 1.1), fields (>= 10.3), mapproj (>= 1.2.7), maps (>= 3.3.0), methods (>= 3.6), ncd4 (>= 1.17), png (>= 0.1), progress (>= 1.2.2), raster (>= 3.0), sf (>= 1.0), terra (>= 1.7), RColorBrewer, rasterVis, gridExtra, utils

**NeedsCompilation** no

**Repository** CRAN

**RoxygenNote** 7.3.1

**Encoding** UTF-8

**Language** en-US

**Suggests** animation (>= 2.6), FNN (>= 1.1), rainfarmr (>= 0.1), rnaturalearth, SearchTrees, spelling (>= 2.2), testthat (>= 2.3), yaml (>= 2.2)

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**Date/Publication** 2024-05-03 08:10:02 UTC

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|                  |   |
|------------------|---|
| cmsafvis-package | <i>cmsafvis: A 'cmsaf' package extension for visualization of CM SAF NetCDF data.</i> |
|------------------|---|

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## Description

The 'cmsafvis' plotting routines are designed to analyze climate files by generating graphics or videos. The functions (Fieldmean, Fieldmean and anomaly plots) were designed and tested for daily valued CM SAF NetCDF data. The functions (Absolute Map, Anomaly Map, Climatology, Warming Stripes Plot, Time Series Plot, Trend Plot) were designed and tested for daily or monthly valued CM SAF NetCDF data. As interface to NetCDF data the [ncdf4 package](#) is used.

## Author(s)

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## See Also

Useful links:

- Report bugs at <https://github.com/cmsaf/cmsaf-r-tools/issues>

---

|              |  |
|--------------|--|
| absolute_map | <i>A 'cmsaf' extension for creating absolute valued plots.</i> |
|--------------|--|

---

## Description

This plotting routine generates graphical output for the given variable within the given time range and area. Dependent on the output format a PNG or MP4 is created.

## Usage

```
absolute_map(  
  config = NULL,  
  variable = NULL,  
  accumulate = FALSE,  
  mean_value = FALSE,  
  infile = NULL,  
  temp_dir = tempdir(),  
  out_dir = getwd(),  
  start_date = NULL,  
  end_date = NULL,  
  country_code = "S_A",
```

```

lon_min = NULL,
lon_max = NULL,
lat_min = NULL,
lat_max = NULL,
outfile_name = NULL,
output_format = "animation",
animation_pace = 0.07,
freeze_animation = FALSE,
min_value = NULL,
max_value = NULL,
nbreaks = NULL,
language = "eng",
keep_files = TRUE,
states = FALSE,
attach = FALSE,
infile_attach = "auto",
dwd_logo = FALSE,
verbose = TRUE,
nc = NULL
)

```

### Arguments

|              |   |
|--------------|---|
| config       | Path to YAML config file (character). The config file does not have to specify all arguments. Each addressed argument has to be formatted according to the example config file: (#TODO: LINK EXAMPLE CONFIG FILE!).   |
| variable     | Name of variable in infile (NULL or character). If NULL then the first variable from the infile is taken.   |
| accumulate   | Whether the input file should be accumulated (logical).   |
| mean_value   | Whether the input file should be averaged (logical).  |
| infile       | Path to NetCDF file (NULL or character). If NULL then it needs to be specified in the config file.  |
| temp_dir     | Path to temporary working directory (character).  |
| out_dir      | Path to output directory (character).   |
| start_date   | Start date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the first date of the infile is used.  |
| end_date     | End date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the last date of the infile is used.   |
| country_code | Either a country code in iso3c format or from the following: 'AFR' for Africa, 'EUR' for Europe, 'TOT' for the total disc, or 'S_A' for an arbitrary region selection (character). If a country is passed the data from within this country is extracted, else a rectangular box is visualized. Directly provided latitude and longitude ranges will be ignored in case of 'AFR', 'EUR' or 'TOT'. |
| lon_min      | Longitude of lower left corner (NULL or numeric). If NULL then the smallest longitude of the infile is used.  |

|                  |  |
|------------------|--|
| lon_max          | Longitude of upper right left corner (NULL or numeric). If NULL then the largest longitude of the infile is used.  |
| lat_min          | Latitude of lower left corner (NULL or numeric). If NULL then the smallest latitude of the infile is used.   |
| lat_max          | Latitude of upper right corner (NULL or numeric). If NULL then the largest latitude of the infile is used.   |
| outfile_name     | Filename of the PNG or MP4 outfile (NULL or character). If NULL then a name is computed from the current configuration. Please match the file ending according to the output_format.   |
| output_format    | Specification of output format (either 'graphic' for PNG or 'animation' for MP4).  |
| animation_pace   | Pace of the animation in seconds (positive numeric). This only has an effect if output_format == 'animation'.  |
| freeze_animation | If TRUE then the animation will freeze at the last frame (logical).  |
| min_value        | Lower values than this are ignored (NULL or numeric). If NULL, no values are ignored.  |
| max_value        | Larger values than this are ignored (NULL or numeric). If NULL, no values are ignored.   |
| nbreaks          | Number of color breaks (NULL or positive integer). A value will be computed if NULL is passed.   |
| language         | Language used for title, legend, etc. in plots (either 'eng' for English or 'deu' for German).   |
| keep_files       | A flag indicating whether all files created in the process of obtaining the output file should be kept (logical). If false, all intermediate results are deleted, otherwise all are kept. Keeping these files could improve performance in further function calls. |
| states           | Whether to crop/plot administration level of states (logical).   |
| attach           | Whether to temporarily merge the infile to an already existing one. (logical).   |
| infile_attach    | File to attach the infile to. When 'auto', a suitable file will be searched in out_dir. If attach is false, this will be ignored(character).   |
| dwd_logo         | Whether to add the DWD logo (logical).   |
| verbose          | Whether to display progress messages (logical).  |
| nc               | Alternatively to infile you can specify the input as an object of class ncd4 (as returned from ncd4::nc_open).   |

## Details

You can pass a YAML config file and/or specify the arguments directly. Argument prioritization is done in the following way: Direct argument > config argument > default argument. Thus, if you pass a existing config file but also want to modify a specific argument you can do that easily.

---

`anomaly_map`*A 'cmsaf' extension for creating an anomaly map.*

---

### Description

This plotting routine generates a graph showing the anomaly of a given variable within the given time range and area. The intended application is for daily accumulated data, such as sunshine duration. Dependent on the output format a PNG or MP4 is created.

### Usage

```
anomaly_map(  
  config = NULL,  
  variable = NULL,  
  accumulate = FALSE,  
  mean_value = FALSE,  
  infile = NULL,  
  temp_dir = tempdir(),  
  out_dir = getwd(),  
  climate_dir = NULL,  
  climate_year_start = 1983,  
  climate_year_end = 2018,  
  start_date = NULL,  
  end_date = NULL,  
  country_code = "S_A",  
  lon_min = NULL,  
  lon_max = NULL,  
  lat_min = NULL,  
  lat_max = NULL,  
  outfile_name = NULL,  
  output_format = "animation",  
  animation_pace = 0.07,  
  freeze_animation = FALSE,  
  min_value = NULL,  
  max_value = NULL,  
  color_pal = 1,  
  relative = FALSE,  
  nbreaks = NULL,  
  language = "eng",  
  keep_files = TRUE,  
  states = FALSE,  
  attach = FALSE,  
  infile_attach = "auto",  
  dwd_logo = FALSE,  
  verbose = TRUE,  
  nc = NULL  
)
```

**Arguments**

|                    |   |
|--------------------|---|
| config             | Path to YAML config file (character). The config file does not have to specify all arguments. Each addressed argument has to be formatted according to the example config file: (#TODO: LINK EXAMPLE CONFIG FILE!).   |
| variable           | Name of variable in infile (NULL or character). If NULL then the first variable from the infile is taken.   |
| accumulate         | Whether the input file should be accumulated (logical).   |
| mean_value         | Whether the input file should be averaged (logical).  |
| infile             | Path to NetCDF file (NULL or character). If NULL then it needs to be specified in the config file.  |
| temp_dir           | Path to temporary working directory (character).  |
| out_dir            | Path to output directory (character).   |
| climate_dir        | Path to directory in which climatology is computed or contained (NULL or character). If NULL then the temp_dir directory is taken.  |
| climate_year_start | Start year of climatology (integer).  |
| climate_year_end   | End year of climatology (integer).  |
| start_date         | Start date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the first date of the infile is used.  |
| end_date           | End date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the last date of the infile is used.   |
| country_code       | Either a country code in iso3c format or from the following: 'AFR' for Africa, 'EUR' for Europe, 'TOT' for the total disc, or 'S_A' for an arbitrary region selection (character). If a country is passed the data from within this country is extracted, else a rectangular box is visualized. Directly provided latitude and longitude ranges will be ignored in case of 'AFR', 'EUR' or 'TOT'. |
| lon_min            | Longitude of lower left corner (NULL or numeric). If NULL then the smallest longitude of the infile is used.  |
| lon_max            | Longitude of upper right left corner (NULL or numeric). If NULL then the largest longitude of the infile is used.   |
| lat_min            | Latitude of lower left corner (NULL or numeric). If NULL then the smallest latitude of the infile is used.  |
| lat_max            | Latitude of upper right corner (NULL or numeric). If NULL then the largest latitude of the infile is used.  |
| outfile_name       | Filename of the PNG or MP4 outfile (NULL or character). If NULL then a name is computed from the current configuration. Please match the file ending according to the output_format.  |
| output_format      | Specification of output format (either 'graphic' for PNG or 'animation' for MP4).   |
| animation_pace     | Pace of the animation in seconds (positive numeric). This only has an effect if output_format == 'animation'.   |
| freeze_animation   | If TRUE then the animation will freeze at the last frame (logical).   |

|               |  |
|---------------|--|
| min_value     | Lower values than this are ignored (NULL or numeric). If NULL, no values are ignored.  |
| max_value     | Larger values than this are ignored (NULL or numeric). If NULL, no values are ignored.   |
| color_pal     | Color option for stripe and anomaly plots  |
| relative      | Use relative values for anomaly plots  |
| nbreaks       | Number of color breaks (NULL or positive integer). A value will be computed if NULL is passed.   |
| language      | Language used for title, legend, etc. in plots (either 'eng' for English or 'deu' for German).   |
| keep_files    | A flag indicating whether all files created in the process of obtaining the output file should be kept (logical). If false, all intermediate results are deleted, otherwise all are kept. Keeping these files could improve performance in further function calls. |
| states        | Whether to crop/plot administration level of states (logical).   |
| attach        | Whether to temporarily merge the infile to an already existing one. (logical).   |
| infile_attach | File to attach the infile to. When 'auto', a suitable file will be searched in out_dir. If attach is false, this will be ignored(character).   |
| dwd_logo      | Whether to add the DWD logo (logical).   |
| verbose       | Whether to display progress messages (logical).  |
| nc            | Alternatively to infile you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).   |

## Details

You can pass a YAML config file and / or specify the arguments directly. Argument prioritization is done in the following way: Direct argument > config argument > default argument. Thus, if you pass a existing config file but also want to modify a specific argument you can do that easily.

---

climatology\_map      A 'cmsaf' extension for creating a climatology map.

---

## Description

This plotting routine generates the climatological mean for the given variable within the given time range and area. The intended application is for daily accumulated data, such as sunshine duration. Dependent on the output format a PNG or MP4 is created.



**Usage**

```

climatology_map(
  config = NULL,
  variable = NULL,
  accumulate = FALSE,
  mean_value = FALSE,
  infile = NULL,
  temp_dir = tempdir(),
  out_dir = getwd(),
  climate_dir = NULL,
  climate_year_start = 1983,
  climate_year_end = 2018,
  start_date = NULL,
  end_date = NULL,
  country_code = "S_A",
  lon_min = NULL,
  lon_max = NULL,
  lat_min = NULL,
  lat_max = NULL,
  outfile_name = NULL,
  output_format = "animation",
  animation_pace = 0.07,
  freeze_animation = FALSE,
  min_value = NULL,
  max_value = NULL,
  nbreaks = NULL,
  language = "eng",
  keep_files = TRUE,
  states = FALSE,
  attach = FALSE,
  infile_attach = "auto",
  dwd_logo = FALSE,
  verbose = TRUE,
  nc = NULL
)

```

**Arguments**

|                         |   |
|-------------------------|---|
| <code>config</code>     | Path to YAML config file (character). The config file does not have to specify all arguments. Each addressed argument has to be formatted according to the example config file: (#TODO: LINK EXAMPLE CONFIG FILE!). |
| <code>variable</code>   | Name of variable in infile (NULL or character). If NULL then the first variable from the infile is taken.   |
| <code>accumulate</code> | Whether the input file should be accumulated (logical).   |
| <code>mean_value</code> | Whether the input file should be averaged (logical).  |
| <code>infile</code>     | Path to NetCDF file (NULL or character). If NULL then it needs to be specified in the config file.  |

|                    |   |
|--------------------|---|
| temp_dir           | Path to temporary working directory (character).  |
| out_dir            | Path to output directory (character).   |
| climate_dir        | Path to directory in which climatology is computed or contained (NULL or character). If NULL then the temp_dir directory is taken.  |
| climate_year_start | Start year of climatology (integer).  |
| climate_year_end   | End year of climatology (integer).  |
| start_date         | Start date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the first date of the infile is used.  |
| end_date           | End date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the last date of the infile is used.   |
| country_code       | Either a country code in iso3c format or from the following: 'AFR' for Africa, 'EUR' for Europe, 'TOT' for the total disc, or 'S_A' for an arbitrary region selection (character). If a country is passed the data from within this country is extracted, else a rectangular box is visualized. Directly provided latitude and longitude ranges will be ignored in case of 'AFR', 'EUR' or 'TOT'. |
| lon_min            | Longitude of lower left corner (NULL or numeric). If NULL then the smallest longitude of the infile is used.  |
| lon_max            | Longitude of upper right left corner (NULL or numeric). If NULL then the largest longitude of the infile is used.   |
| lat_min            | Latitude of lower left corner (NULL or numeric). If NULL then the smallest latitude of the infile is used.  |
| lat_max            | Latitude of upper right corner (NULL or numeric). If NULL then the largest latitude of the infile is used.  |
| outfile_name       | Filename of the PNG or MP4 outfile (NULL or character). If NULL then a name is computed from the current configuration. Please match the file ending according to the output_format.  |
| output_format      | Specification of output format (either 'graphic' for PNG or 'animation' for MP4).   |
| animation_pace     | Pace of the animation in seconds (positive numeric). This only has an effect if output_format == 'animation'.   |
| freeze_animation   | If TRUE then the animation will freeze at the last frame (logical).   |
| min_value          | Lower values than this are ignored (NULL or numeric). If NULL, no values are ignored.   |
| max_value          | Larger values than this are ignored (NULL or numeric). If NULL, no values are ignored.  |
| nbreaks            | Number of color breaks (NULL or positive integer). A value will be computed if NULL is passed.  |
| language           | Language used for title, legend, etc. in plots (either 'eng' for English or 'deu' for German).  |

|               |  |
|---------------|--|
| keep_files    | A flag indicating whether all files created in the process of obtaining the output file should be kept (logical). If false, all intermediate results are deleted, otherwise all are kept. Keeping these files could improve performance in further function calls. |
| states        | Whether to crop/plot administration level of states (logical).   |
| attach        | Whether to temporary merge the infile to an already existing one. (logical).   |
| infile_attach | File to attach the infile to. When 'auto', a suitable file will be searched in out_dir. If attach is false, this will be ignored(character).   |
| dwd_logo      | Whether to add the DWD logo (logical).   |
| verbose       | Whether to display progress messages (logical).  |
| nc            | Alternatively to infile you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).   |

### Details

You can pass a YAML config file and/or specify the arguments directly. Argument prioritization is done in the following way: Direct argument > config argument > default argument. Thus, if you pass a existing config file but also want to modify a specific argument you can do that easily.

---

cmsaf.diff

*Plotting routine designed for the CM SAF R Toolbox.*

---

### Description

This function renders a difference plot (absolute or relative) of two variables.

### Usage

```
cmsaf.diff(
  var1,
  infile1,
  var2,
  infile2,
  outfile,
  plot.out = FALSE,
  relative = FALSE,
  nc34 = 4,
  overwrite = FALSE,
  verbose = FALSE,
  toolbox = FALSE,
  nc1 = NULL,
  nc2 = NULL
)
```

**Arguments**

|           |   |
|-----------|---|
| var1      | Name of the first NetCDF variable (character).  |
| infile1   | Filename of the first input NetCDF file. This may include the directory (character).  |
| var2      | Name of the second NetCDF variable (character).   |
| infile2   | Filename of the second input NetCDF file. This may include the directory (character).   |
| outfile   | Filename of output NetCDF file. This may include the directory (character).   |
| plot.out  | logical; if TRUE, the plot will be stored in the same folder as outfile. If FALSE, the plot will not be saved.  |
| relative  | logical; if TRUE, plot a relative difference plot   |
| nc34      | NetCDF version of output file. If nc34 = 3 the output file will be in NetCDFv3 format (numeric). Default output is NetCDFv4.                              |
| overwrite | logical; should existing output file be overwritten?  |
| verbose   | logical; if TRUE, progress messages are shown   |
| toolbox   | logical; if TRUE, toolbox mode enabled. The two files are adjusted in space and time so that they can be plotted.   |
| nc1       | Alternatively to <code>infile1</code> you can specify the input as an object of class <code>ncdf4</code> (as returned from <code>ncdf4::nc_open</code> ). |
| nc2       | Alternatively to <code>infile2</code> you can specify the input as an object of class <code>ncdf4</code> (as returned from <code>ncdf4::nc_open</code> ). |

**Value**

A NetCDF file is written.

**See Also**

Other 2d visualization: [cmsaf.side.by.side\(\)](#)

---

cmsaf.hist

*Plotting routine designed for the CM SAF R Toolbox.*

---

**Description**

This function renders a histogram plot of two variables.

**Usage**

```

cmsaf.hist(
  var1,
  infile1,
  var2,
  infile2,
  outfile1,
  outfile2,
  plot.out = FALSE,
  nc34 = 4,
  overwrite = FALSE,
  verbose = FALSE,
  toolbox = FALSE,
  nc1 = NULL,
  nc2 = NULL
)

```

**Arguments**

|           |  |
|-----------|--|
| var1      | Name of the first NetCDF variable (character).   |
| infile1   | Filename of the first input NetCDF file. This may include the directory (character).   |
| var2      | Name of the second NetCDF variable (character).  |
| infile2   | Filename of the second input NetCDF file. This may include the directory (character).  |
| outfile1  | Filename of the first output NetCDF file. This may include the directory (character).  |
| outfile2  | Filename of the second output NetCDF file. This may include the directory (character).                                       |
| plot.out  | logical; if TRUE, the plot will be stored in the same folder as outfile1. If FALSE, the plot will not be saved.              |
| nc34      | NetCDF version of output file. If nc34 = 3 the output file will be in NetCDFv3 format (numeric). Default output is NetCDFv4. |
| overwrite | logical; should existing output file be overwritten?   |
| verbose   | logical; if TRUE, progress messages are shown  |
| toolbox   | logical; if TRUE, toolbox mode enabled. The two files are adjusted in space and time so that they can be plotted.            |
| nc1       | Alternatively to infile1 you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).            |
| nc2       | Alternatively to infile2 you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).            |

**Value**

Two NetCDF files are written.

**See Also**

Other 1d visualization: [cmsaf.hovmoller\(\)](#), [cmsaf.scatter\(\)](#), [cmsaf.time.series\(\)](#)

---

 cmsaf.hovmoller

*Plotting routine designed for the CM SAF R Toolbox.*


---

**Description**

This function renders a hovmoller plot of two variables.

**Usage**

```
cmsaf.hovmoller(
  var1,
  infile1,
  var2,
  infile2,
  outfile1,
  outfile2,
  plot.out = FALSE,
  nc34 = 4,
  overwrite = FALSE,
  verbose = FALSE,
  toolbox = FALSE,
  nc1 = NULL,
  nc2 = NULL
)
```

**Arguments**

|          |  |
|----------|--|
| var1     | Name of the first NetCDF variable (character).   |
| infile1  | Filename of the first input NetCDF file. This may include the directory (character).   |
| var2     | Name of the second NetCDF variable (character).  |
| infile2  | Filename of the second input NetCDF file. This may include the directory (character).  |
| outfile1 | Filename of the first output NetCDF file. This may include the directory (character).  |
| outfile2 | Filename of the second output NetCDF file. This may include the directory (character).                                       |
| plot.out | logical; if TRUE, the plot will be stored in the same folder as outfile1. If FALSE, the plot will not be saved.              |
| nc34     | NetCDF version of output file. If nc34 = 3 the output file will be in NetCDFv3 format (numeric). Default output is NetCDFv4. |

|           |   |
|-----------|---|
| overwrite | logical; should existing output file be overwritten?  |
| verbose   | logical; if TRUE, progress messages are shown   |
| toolbox   | logical; if TRUE, toolbox mode enabled. The two files are adjusted in space and time so that they can be plotted.   |
| nc1       | Alternatively to <code>infile1</code> you can specify the input as an object of class <code>ncdf4</code> (as returned from <code>ncdf4::nc_open</code> ). |
| nc2       | Alternatively to <code>infile2</code> you can specify the input as an object of class <code>ncdf4</code> (as returned from <code>ncdf4::nc_open</code> ). |

### Value

Two NetCDF files are written.

### See Also

Other 1d visualization: [cmsaf.hist\(\)](#), [cmsaf.scatter\(\)](#), [cmsaf.time.series\(\)](#)

---

cmsaf.scatter

*Plotting routine designed for the CM SAF R Toolbox.*

---

### Description

This function renders a scatter plot of two variables.

### Usage

```
cmsaf.scatter(  
  var1,  
  infile1,  
  var2,  
  infile2,  
  outfile1,  
  outfile2,  
  plot.out = FALSE,  
  nc34 = 4,  
  overwrite = FALSE,  
  verbose = FALSE,  
  toolbox = FALSE,  
  nc1 = NULL,  
  nc2 = NULL  
)
```

**Arguments**

|                        |   |
|------------------------|---|
| <code>var1</code>      | Name of the first NetCDF variable (character).  |
| <code>infile1</code>   | Filename of the first input NetCDF file. This may include the directory (character).  |
| <code>var2</code>      | Name of the second NetCDF variable (character).   |
| <code>infile2</code>   | Filename of the second input NetCDF file. This may include the directory (character).   |
| <code>outfile1</code>  | Filename of the first output NetCDF file. This may include the directory (character).   |
| <code>outfile2</code>  | Filename of the second output NetCDF file. This may include the directory (character).  |
| <code>plot.out</code>  | logical; if TRUE, the plot will be stored in the same folder as <code>outfile1</code> . If FALSE, the plot will not be saved.                             |
| <code>nc34</code>      | NetCDF version of output file. If <code>nc34 = 3</code> the output file will be in NetCDFv3 format (numeric). Default output is NetCDFv4.                 |
| <code>overwrite</code> | logical; should existing output file be overwritten?  |
| <code>verbose</code>   | logical; if TRUE, progress messages are shown   |
| <code>toolbox</code>   | logical; if TRUE, toolbox mode enabled. The two files are adjusted in space and time so that they can be plotted.   |
| <code>nc1</code>       | Alternatively to <code>infile1</code> you can specify the input as an object of class <code>ncdf4</code> (as returned from <code>ncdf4::nc_open</code> ). |
| <code>nc2</code>       | Alternatively to <code>infile2</code> you can specify the input as an object of class <code>ncdf4</code> (as returned from <code>ncdf4::nc_open</code> ). |

**Value**

Two NetCDF files are written.

**See Also**

Other 1d visualization: [cmsaf.hist\(\)](#), [cmsaf.hovmoller\(\)](#), [cmsaf.time.series\(\)](#)

---

`cmsaf.side.by.side`      *Plotting routine designed for the CM SAF R Toolbox.*

---

**Description**

This function renders a side by side plot of two variables.



**Usage**

```

cmsaf.side.by.side(
  var1,
  infile1,
  var2,
  infile2,
  outfile1,
  outfile2,
  plot.out = FALSE,
  nc34 = 4,
  overwrite = FALSE,
  verbose = FALSE,
  toolbox = FALSE,
  nc1 = NULL,
  nc2 = NULL
)

```

**Arguments**

|           |  |
|-----------|--|
| var1      | Name of the first NetCDF variable (character).   |
| infile1   | Filename of the first input NetCDF file. This may include the directory (character).   |
| var2      | Name of the second NetCDF variable (character).  |
| infile2   | Filename of the second input NetCDF file. This may include the directory (character).  |
| outfile1  | Filename of the first output NetCDF file. This may include the directory (character).  |
| outfile2  | Filename of the second output NetCDF file. This may include the directory (character).                                       |
| plot.out  | logical; if TRUE, the plot will be stored in the same folder as outfile1. If FALSE, the plot will not be saved.              |
| nc34      | NetCDF version of output file. If nc34 = 3 the output file will be in NetCDFv3 format (numeric). Default output is NetCDFv4. |
| overwrite | logical; should existing output file be overwritten?   |
| verbose   | logical; if TRUE, progress messages are shown  |
| toolbox   | logical; if TRUE, toolbox mode enabled. The two files are adjusted in space and time so that they can be plotted.            |
| nc1       | Alternatively to infile1 you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).            |
| nc2       | Alternatively to infile2 you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).            |

**Value**

Two NetCDF files are written.

**See Also**

Other 2d visualization: [cmsaf.diff\(\)](#)

---

cmsaf.time.series      *Plotting routine designed for the CM SAF R Toolbox.*

---

**Description**

This function renders a time series plot of two variables.

**Usage**

```
cmsaf.time.series(  
  var1,  
  infile1,  
  var2,  
  infile2,  
  outfile1,  
  outfile2,  
  plot.out = FALSE,  
  nc34 = 4,  
  overwrite = FALSE,  
  verbose = FALSE,  
  toolbox = FALSE,  
  nc1 = NULL,  
  nc2 = NULL  
)
```

**Arguments**

|          |  |
|----------|--|
| var1     | Name of the first NetCDF variable (character).   |
| infile1  | Filename of the first input NetCDF file. This may include the directory (character).   |
| var2     | Name of the second NetCDF variable (character).  |
| infile2  | Filename of the second input NetCDF file. This may include the directory (character).  |
| outfile1 | Filename of the first output NetCDF file. This may include the directory (character).  |
| outfile2 | Filename of the second output NetCDF file. This may include the directory (character).                                       |
| plot.out | logical; if TRUE, the plot will be stored in the same folder as outfile1. If FALSE, the plot will not be saved.              |
| nc34     | NetCDF version of output file. If nc34 = 3 the output file will be in NetCDFv3 format (numeric). Default output is NetCDFv4. |

|           |   |
|-----------|---|
| overwrite | logical; should existing output file be overwritten?  |
| verbose   | logical; if TRUE, progress messages are shown   |
| toolbox   | logical; if TRUE, toolbox mode enabled. The two files are adjusted in space and time so that they can be plotted.   |
| nc1       | Alternatively to <code>infile1</code> you can specify the input as an object of class <code>ncdf4</code> (as returned from <code>ncdf4::nc_open</code> ). |
| nc2       | Alternatively to <code>infile2</code> you can specify the input as an object of class <code>ncdf4</code> (as returned from <code>ncdf4::nc_open</code> ). |

**Value**

Two NetCDF files are written.

**See Also**

Other 1d visualization: `cmsaf.hist()`, `cmsaf.hovmoller()`, `cmsaf.scatter()`

---

fieldmean\_and\_anomaly\_map

*A 'cmsaf' extension for creating both, a spatial mean and an anomaly map.*

---

**Description**

This plotting routine generates a graph showing the evolution of the spatial mean of a given variable and the corresponding anomaly map within the given time range and area. The intended application is for daily accumulated data, such as sunshine duration. Dependent on the output format a PNG or MP4 is created.

**Usage**

```
fieldmean_and_anomaly_map(
  config = NULL,
  variable = NULL,
  accumulate = FALSE,
  infile = NULL,
  temp_dir = tempdir(),
  out_dir = getwd(),
  climate_dir = NULL,
  climate_year_start,
  climate_year_end,
  show_extreme_climate_years = NULL,
  climatology_until_eoy = FALSE,
  start_date = NULL,
  end_date = NULL,
  country_code = "S_A",
```

```

lon_min = NULL,
lon_max = NULL,
lat_min = NULL,
lat_max = NULL,
outfile_name = NULL,
output_format = "animation",
animation_pace = 0.07,
freeze_animation = FALSE,
min_value = NULL,
max_value = NULL,
nbreaks = NULL,
language = "eng",
keep_files = TRUE,
states = FALSE,
attach = FALSE,
infile_attach = "auto",
dwd_logo = FALSE,
verbose = TRUE,
nc = NULL
)

```

### Arguments

|                            |  |
|----------------------------|--|
| config                     | Path to YAML config file (character). The config file does not have to specify all arguments. Each addressed argument has to be formatted according to the example config file: (#TODO: LINK EXAMPLE CONFIG FILE!).  |
| variable                   | Name of variable in infile (NULL or character). If NULL then the first variable from the infile is taken.  |
| accumulate                 | Whether the input file should be accumulated (logical).  |
| infile                     | Path to NetCDF file (NULL or character). If NULL then it needs to be specified in the config file.   |
| temp_dir                   | Path to temporary working directory (character).   |
| out_dir                    | Path to output directory (character).  |
| climate_dir                | Path to directory in which climatology is computed or contained (NULL or character). If NULL then the temp_dir directory is taken.   |
| climate_year_start         | Start year of climatology (integer).   |
| climate_year_end           | End year of climatology (integer).   |
| show_extreme_climate_years | Whether the minimum and maximum of the climate years should be titled in the fieldmean plot (NULL or logical). This is usually only of interest when plotting accumulated data. If the default NULL is chosen, then it will be set to the value of accumulate. |
| climatology_until_eoy      | Plot the climatology and fieldmeans until the end of year (logical). Only affects fieldmean plots analyzed from January 1st.   |

|                  |   |
|------------------|---|
| start_date       | Start date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the first date of the infile is used.  |
| end_date         | End date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the last date of the infile is used.   |
| country_code     | Either a country code in iso3c format or from the following: 'AFR' for Africa, 'EUR' for Europe, 'TOT' for the total disc, or 'S_A' for an arbitrary region selection (character). If a country is passed the data from within this country is extracted, else a rectangular box is visualized. Directly provided latitude and longitude ranges will be ignored in case of 'AFR', 'EUR' or 'TOT'. |
| lon_min          | Longitude of lower left corner (NULL or numeric). If NULL then the smallest longitude of the infile is used.  |
| lon_max          | Longitude of upper right left corner (NULL or numeric). If NULL then the largest longitude of the infile is used.   |
| lat_min          | Latitude of lower left corner (NULL or numeric). If NULL then the smallest latitude of the infile is used.  |
| lat_max          | Latitude of upper right corner (NULL or numeric). If NULL then the largest latitude of the infile is used.  |
| outfile_name     | Filename of the PNG or MP4 outfile (NULL or character). If NULL then a name is computed from the current configuration. Please match the file ending according to the output_format.  |
| output_format    | Specification of output format (either 'graphic' for PNG or 'animation' for MP4).   |
| animation_pace   | Pace of the animation in seconds (positive numeric). This only has an effect if output_format == 'animation'.   |
| freeze_animation | If TRUE then the animation will freeze at the last frame (logical).   |
| min_value        | Lower values than this are ignored (NULL or numeric). If NULL, no values are ignored.   |
| max_value        | Larger values than this are ignored (NULL or numeric). If NULL, no values are ignored.  |
| nbreaks          | Number of color breaks (NULL or positive integer). A value will be computed if NULL is passed.  |
| language         | Language used for title, legend, etc. in plots (either 'eng' for English or 'deu' for German).  |
| keep_files       | A flag indicating whether all files created in the process of obtaining the output file should be kept (logical). If false, all intermediate results are deleted, otherwise all are kept. Keeping these files could improve performance in further function calls.  |
| states           | Whether to crop/plot administration level of states (logical).  |
| attach           | Whether to temporarily merge the infile to an already existing one. (logical).  |
| infile_attach    | File to attach the infile to. When 'auto', a suitable file will be searched in out_dir. If attach is false, this will be ignored(character).  |
| dwd_logo         | Whether to add the DWD logo (logical).  |
| verbose          | Whether to display progress messages (logical).   |
| nc               | Alternatively to infile you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).  |

## Details

You can pass a YAML config file and/or specify the arguments directly. Argument prioritization is done in the following way: Direct argument > config argument > default argument. Thus, if you pass a existing config file but also want to modify a specific argument you can do that easily.

---

|                |   |
|----------------|---|
| fieldmean_plot | <i>A 'cmsaf' extension for creating spatial mean plots.</i> |
|----------------|---|

---

## Description

This plotting routine generates a graph showing the evolution of the spatial mean of a given variable within the given time range and area. The intended application is for daily accumulated data, such as sunshine duration. Dependent on the output format a PNG or MP4 is created.

## Usage

```
fieldmean_plot(
  config = NULL,
  variable = NULL,
  accumulate = FALSE,
  infile = NULL,
  temp_dir = tempdir(),
  out_dir = getwd(),
  climate_dir = NULL,
  climate_year_start = 1983,
  climate_year_end = 2018,
  show_extreme_climate_years = NULL,
  climatology_until_eoy = FALSE,
  start_date = NULL,
  end_date = NULL,
  country_code = "S_A",
  lon_min = NULL,
  lon_max = NULL,
  lat_min = NULL,
  lat_max = NULL,
  outfile_name = NULL,
  output_format = "animation",
  animation_pace = 0.07,
  freeze_animation = FALSE,
  language = "eng",
  keep_files = TRUE,
  states = FALSE,
  attach = FALSE,
  infile_attach = "auto",
  dwd_logo = FALSE,
  verbose = TRUE,
  nc = NULL
)
```

**Arguments**

|                            |   |
|----------------------------|---|
| config                     | Path to YAML config file (character). The config file does not have to specify all arguments. Each addressed argument has to be formatted according to the example config file: (#TODO: LINK EXAMPLE CONFIG FILE!).   |
| variable                   | Name of variable in infile (NULL or character). If NULL then the first variable from the infile is taken.   |
| accumulate                 | Whether the input file should be accumulated (logical).   |
| infile                     | Path to NetCDF file (NULL or character). If NULL then it needs to be specified in the config file.  |
| temp_dir                   | Path to temporary working directory (character).  |
| out_dir                    | Path to output directory (character).   |
| climate_dir                | Path to directory in which climatology is computed or contained (NULL or character). If NULL then the temp_dir directory is taken.  |
| climate_year_start         | Start year of climatology (integer).  |
| climate_year_end           | End year of climatology (integer).  |
| show_extreme_climate_years | Whether the minimum and maximum of the climate years should be titled in the fieldmean plot (NULL or logical). This is usually only of interest when plotting accumulated data. If the default NULL is chosen, then it will be set to the value of accumulate.  |
| climatology_until_eoy      | Plot the climatology and fieldmeans until the end of year (logical). Only affects fieldmean plots analyzed from January 1st.  |
| start_date                 | Start date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the first date of the infile is used.  |
| end_date                   | End date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the last date of the infile is used.   |
| country_code               | Either a country code in iso3c format or from the following: 'AFR' for Africa, 'EUR' for Europe, 'TOT' for the total disc, or 'S_A' for an arbitrary region selection (character). If a country is passed the data from within this country is extracted, else a rectangular box is visualized. Directly provided latitude and longitude ranges will be ignored in case of 'AFR', 'EUR' or 'TOT'. |
| lon_min                    | Longitude of lower left corner (NULL or numeric). If NULL then the smallest longitude of the infile is used.  |
| lon_max                    | Longitude of upper right left corner (NULL or numeric). If NULL then the largest longitude of the infile is used.   |
| lat_min                    | Latitude of lower left corner (NULL or numeric). If NULL then the smallest latitude of the infile is used.  |
| lat_max                    | Latitude of upper right corner (NULL or numeric). If NULL then the largest latitude of the infile is used.  |

|                  |  |
|------------------|--|
| outfile_name     | Filename of the PNG or MP4 outfile (NULL or character). If NULL then a name is computed from the current configuration. Please match the file ending according to the output_format.   |
| output_format    | Specification of output format (either 'graphic' for PNG or 'animation' for MP4).  |
| animation_pace   | Pace of the animation in seconds (positive numeric). This only has an effect if output_format == 'animation'.  |
| freeze_animation | If TRUE then the animation will freeze at the last frame (logical).  |
| language         | Language used for title, legend, etc. in plots (either 'eng' for English or 'deu' for German).   |
| keep_files       | A flag indicating whether all files created in the process of obtaining the output file should be kept (logical). If false, all intermediate results are deleted, otherwise all are kept. Keeping these files could improve performance in further function calls. |
| states           | Whether to crop/plot administration level of states (logical).   |
| attach           | Whether to temporarily merge the infile to an already existing one. (logical).   |
| infile_attach    | File to attach the infile to. When 'auto', a suitable file will be searched in out_dir. If attach is false, this will be ignored(character).   |
| dwd_logo         | Whether to add the DWD logo (logical).   |
| verbose          | Whether to display progress messages (logical).  |
| nc               | Alternatively to infile you can specify the input as an object of class ncd4 (as returned from ncd4::nc_open).   |

## Details

You can pass a YAML config file and/or specify the arguments directly. Argument prioritization is done in the following way: Direct argument > config argument > default argument. Thus, if you pass a existing config file but also want to modify a specific argument you can do that easily.

---

get\_basename\_vis      *Determine the basename of a NetCDF file*

---

## Description

This function determines the basename of either a file/URL path or an 'nc' object (using nc\$filename).

## Usage

```
get_basename_vis(infile, nc = NULL)
```

## Arguments

|        |  |
|--------|--|
| infile | Filename of input NetCDF file. This may include the directory (character).                                     |
| nc     | Alternatively to infile you can specify the input as an object of class ncd4 (as returned from ncd4::nc_open). |



**Details**

When the origin of the file path is a local .nc file then `get_basename_vis()` is equivalent to `base::basename()`.

`get_basename_vis()` also handles the case of infile/nc originating from a URL.

The value of `get_basename_vis()` always ends in ".nc".

If both `infile` and `nc` are specified, `infile` is ignored.

**Value**

A character string giving the basename.

---

helper\_time\_series\_compare

*Designed for the CM SAF R Toolbox.*

---

**Description**

This function is a helper function for `render_plot_time_series_compare`.

**Usage**

```
helper_time_series_compare(visualizeVariables)
```

**Arguments**

`visualizeVariables`

A data frame containing all meta data for the plotting process (data.frame).

---

monitor\_climate

*A 'cmsaf' extension for creating various climate plots.*

---

**Description**

This plotting routine generates graphical output of the evolution of the given variable within the given time range and area. The intended application is for daily accumulated data, such as sunshine duration. Dependent on the output format a PNG or MP4 is created.

**Usage**

```
monitor_climate(  
  plot_type = "absolute_map",  
  config = NULL,  
  variable = NULL,  
  accumulate = FALSE,  
  mean_value = FALSE,  
  infile = NULL,  
  temp_dir = tempdir(),  
  out_dir = getwd(),  
  climate_dir = NULL,  
  climate_year_start = 1983,  
  climate_year_end = 2018,  
  show_extreme_climate_years = NULL,  
  climatology_until_eoy = FALSE,  
  start_date = NULL,  
  end_date = NULL,  
  country_code = "S_A",  
  lon_min = NULL,  
  lon_max = NULL,  
  lat_min = NULL,  
  lat_max = NULL,  
  outfile_name = NULL,  
  output_format = "animation",  
  animation_pace = 0.07,  
  freeze_animation = FALSE,  
  min_value = NULL,  
  max_value = NULL,  
  nbreaks = NULL,  
  language = "eng",  
  keep_files = TRUE,  
  states = FALSE,  
  attach = FALSE,  
  infile_attach = "auto",  
  analyze_method = TRUE,  
  selected_number = 1,  
  color_pal = 1,  
  relative = FALSE,  
  circ_plot = FALSE,  
  dwd_logo = FALSE,  
  verbose = TRUE,  
  nc = NULL  
)
```

**Arguments**

`plot_type` Specifies the type of the plot ('absolute\_map', 'anomaly\_map', 'climatology\_map', 'fieldmean\_plot', 'fieldmean\_and\_anomaly\_map').

|                            |   |
|----------------------------|---|
| config                     | Path to YAML config file (character). The config file does not have to specify all arguments. Each addressed argument has to be formatted according to the example config file: (#TODO: LINK EXAMPLE CONFIG FILE!).   |
| variable                   | Name of variable in infile (NULL or character). If NULL then the first variable from the infile is taken.   |
| accumulate                 | Whether the input file should be accumulated (logical).   |
| mean_value                 | Whether the input file should be averaged (logical).  |
| infile                     | Path to NetCDF file (NULL or character). If NULL then it needs to be specified in the config file.  |
| temp_dir                   | Path to temporary working directory (character).  |
| out_dir                    | Path to output directory (character).   |
| climate_dir                | Path to directory in which climatology is computed or contained (NULL or character). If NULL then the temp_dir directory is taken.  |
| climate_year_start         | Start year of climatology (integer).  |
| climate_year_end           | End year of climatology (integer).  |
| show_extreme_climate_years | Whether the minimum and maximum of the climate years should be titled in the fieldmean plot (NULL or logical). This is usually only of interest when plotting accumulated data. If the default NULL is chosen, then it will be set to the value of accumulate.  |
| climatology_until_eoy      | Plot the climatology and fieldmeans until the end of year (logical). Only affects fieldmean plots analyzed from January 1st.  |
| start_date                 | Start date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the first date of the infile is used.  |
| end_date                   | End date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the last date of the infile is used.   |
| country_code               | Either a country code in iso3c format or from the following: 'AFR' for Africa, 'EUR' for Europe, 'TOT' for the total disc, or 'S_A' for an arbitrary region selection (character). If a country is passed the data from within this country is extracted, else a rectangular box is visualized. Directly provided latitude and longitude ranges will be ignored in case of 'AFR', 'EUR' or 'TOT'. |
| lon_min                    | Longitude of lower left corner (NULL or numeric). If NULL then the smallest longitude of the infile is used.  |
| lon_max                    | Longitude of upper right left corner (NULL or numeric). If NULL then the largest longitude of the infile is used.   |
| lat_min                    | Latitude of lower left corner (NULL or numeric). If NULL then the smallest latitude of the infile is used.  |
| lat_max                    | Latitude of upper right corner (NULL or numeric). If NULL then the largest latitude of the infile is used.  |

|                  |  |
|------------------|--|
| outfile_name     | Filename of the PNG or MP4 outfile (NULL or character). If NULL then a name is computed from the current configuration. Please match the file ending according to the output_format.   |
| output_format    | Specification of output format (either 'graphic' for PNG or 'animation' for MP4).  |
| animation_pace   | Pace of the animation in seconds (positive numeric). This only has an effect if output_format == 'animation'.  |
| freeze_animation | If TRUE then the animation will freeze at the last frame (logical).  |
| min_value        | Lower values than this are ignored (NULL or numeric). If NULL, no values are ignored.  |
| max_value        | Larger values than this are ignored (NULL or numeric). If NULL, no values are ignored.   |
| nbreaks          | Number of color breaks (NULL or positive integer). A value will be computed if NULL is passed.   |
| language         | Language used for title, legend, etc. in plots (either 'eng' for English or 'deu' for German).   |
| keep_files       | A flag indicating whether all files created in the process of obtaining the output file should be kept (logical). If false, all intermediate results are deleted, otherwise all are kept. Keeping these files could improve performance in further function calls. |
| states           | Whether to crop/plot administration level of states (logical).   |
| attach           | Whether to temporaly merge the infile to an already existing one. (logical).   |
| infile_attach    | File to attach the infile to. When 'auto', a suitable file will be searched in out_dir. If attach is false, this will be ignored(character).   |
| analyze_method   | Two analyze methods: mean == FALSE; accumulate == TRUE (logical) (Warming Stripes Plots, Time Series Plots, Trend Plots)   |
| selected_number  | Timesteps of the same selected time range (Warming Stripes Plots, Time Series Plots, Trend Plots)  |
| color_pal        | Color option for stripe and anomaly plots  |
| relative         | Use relative values for anomaly plots  |
| circ_plot        | Circular stripe plots (logical)  |
| dwd_logo         | Whether to add the DWD logo (logical).   |
| verbose          | Whether to display progress messages (logical).  |
| nc               | Alternatively to infile you can specify the input as an object of class ncd4 (as returned from ncd4::nc_open).   |

## Details

Circular stripe plots are inspired by Emanuele Bevacqua (see [emanuele.bevacqua.eu](http://emanuele.bevacqua.eu))

You can pass a YAML config file and/or specify the arguments directly. Argument prioritization is done in the following way: Direct argument > config argument > default argument. Thus, if you pass a existing config file but also want to modify a specific argument you can do that easily.

---

`quicklook`*Create a quicklook of NetCDF data*

---

## Description

The function creates a plot of the variables in NetCDF file(s) specified in the config file. Only NetCDF files that conform to the **CM SAF naming convention** are supported.

## Usage

```
quicklook(  
  config,  
  filelist,  
  outpath = getwd(),  
  jpeg_quality = 100,  
  dpi = 150,  
  iwidth = 1242,  
  logo = TRUE,  
  copyright = TRUE,  
  bluemarble = FALSE,  
  maxpixels = TRUE,  
  verbose = TRUE  
)
```

## Arguments

|                           |  |
|---------------------------|--|
| <code>config</code>       | filename of configuration file. This may include the directory (character).  |
| <code>filelist</code>     | list of NetCDF file to create plots from (character).  |
| <code>outpath</code>      | directory in which to save the output files. (character).  |
| <code>jpeg_quality</code> | jpeg quality for the image in percent, see <a href="#">grDevices::jpeg()</a>   |
| <code>dpi</code>          | resolution of the image in dots per inch, see <a href="#">grDevices::jpeg()</a>  |
| <code>iwidth</code>       | width of the resulting image in pixels, see <a href="#">grDevices::jpeg()</a>  |
| <code>logo</code>         | logical; should the cmsaf logo be added to the plot?   |
| <code>copyright</code>    | logical; should the copyright text be added to the plot?   |
| <code>bluemarble</code>   | logical; should the data be plotted onto a NASA bluemarble (only available for MSG/Seviri based data)? Due to data size this option is not available for the cmsafvis package on CRAN. Please have a look at our website <a href="https://www.cmsaf.eu/R_toolbox">https://www.cmsaf.eu/R_toolbox</a> |
| <code>maxpixels</code>    | logical; use actual number of pixels or default (100000)   |
| <code>verbose</code>      | logical; if TRUE, progress messages are shown  |

## Details

This operator can be applied using a configuration file (quicklook\_config.yml). An example config file can be found in the extdata folder of this package. The following parameters can be defined:

- logo: color / black
- slot: numeric (e.g., 13)
- invert\_col: TRUE / FALSE
- Dataset: character (e.g., ICDR Seviri Radiation)
- limits: min: numeric; max: numeric
- legend: TRUE / FALSE
- colorscale: character (e.g., Viridis)
- unit: character (e.g., Percent / '%')
- var\_name: character (e.g., Percent / '%')
- bluemarble: TRUE / FALSE
- mirror\_data: TRUE / FALSE / NP / SP
- namin: numeric (e.g., 2e-04), minimum in case of no data
- logmin: numeric (e.g., 0.2), minimum in case of log-scale
- scale\_factor: numeric (e.g., 1)
- smooth\_factor: numeric (e.g., 1)
- aux\_file: path to optional aux-file, including CLAAS level 2 lon/ lat data
- sysd: path to optional sysdata.rda file, which includes bluemarble data
- remap: remap data to regular grid. TRUE / FALSE
- tri\_up: plot upper triangle on colorscale. TRUE / FALSE
- tri\_down: plot lower triangle on colorscale. TRUE / FALSE

## Value

A jpeg file with the same name as the original NetCDF file.

---

recalculateImageDimensions

*Get rectangular image dimensions*

---

## Description

Given regional bounds image width and height are computed in order to display a region without distortion.

**Usage**

```
recalculateImageDimensions(
  visualizeVariables,
  lon_bounds,
  lat_bounds,
  image_def,
  ihsf
)
```

**Arguments**

|                    |   |
|--------------------|---|
| visualizeVariables | A dataframe containing \$lon and \$lat values which will be bounded by lon/lat_bounds (data.frame). |
| lon_bounds         | Array containing two values for longitude min and max (numeric).                                    |
| lat_bounds         | Array containing two values for latitude min and max (numeric).                                     |
| image_def          | Minimal image default size for width and height (numeric).  |
| ihsf               | Image height rescaling factor (numeric).  |

---

|                  |                                     |
|------------------|-------------------------------------|
| render_hist_plot | <i>Creating a simple histogram.</i> |
|------------------|-------------------------------------|

---

**Description**

This routine was implemented for creating histograms in the CM SAF R Toolbox.

**Usage**

```
render_hist_plot(
  dastat,
  shortDescription,
  grid_col,
  bordercolor,
  linesize,
  xlab
)
```

**Arguments**

|                  |   |
|------------------|---|
| dastat           | Statistics given to hist plot (numeric).                                  |
| shortDescription | A title will be generated using "Histogram of" + description (character). |
| grid_col         | Color used for the grid.  |
| bordercolor      | Color used for borders.   |
| linesize         | Line width to be used (positive numeric).                                 |
| xlab             | Label for x axis (character).   |

---

render\_instat\_plot      *Creating a simple instat plot.*

---

**Description**

This function creates a simple r-instat plot.

**Usage**

```
render_instat_plot(  
  co.data,  
  shortDescription,  
  grid_col,  
  bordercolor,  
  linesize,  
  ylab  
)
```

**Arguments**

|                  |  |
|------------------|--|
| co.data          | Statistics given to hist plot (data.frame).                                |
| shortDescription | A title will be generated using "Comparison of" + description (character). |
| grid_col         | Color used for the grid.   |
| bordercolor      | Color used for borders.  |
| linesize         | Line width to be used (positive numeric).                                  |
| ylab             | Label for y axis (character).  |

---

render\_plot      *Plotting routine designed for the CM SAF R Toolbox.*

---

**Description**

This function renders a 2D image usually called by the CM SAF R Toolbox.

**Usage**

```
render_plot(  
  plot_rinstat,  
  outfile = NULL,  
  fileExtension = ".png",  
  visualizeVariables,  
  visualizeDataTimestep,  
  nc_path_visualize,
```



```

visualizeDataMax,
lon_bounds,
lat_bounds,
lon_loc_vec,
lat_loc_vec,
name_loc_vec,
timestep,
num_tick,
num_rmin,
num_rmax,
num_brk,
co.data,
co.data.compare.diff,
proj,
xort,
yort,
rort,
slider1,
slider2,
imagewidth,
imageheight,
location,
int,
text1,
text2,
text3,
textsize,
bordercolor,
linesize,
na.color,
PAL,
palettes,
reverse,
plot_grid,
grid_col
)

```

### Arguments

|                       |  |
|-----------------------|--|
| plot_rinstat          | Whether to create an R-Instat plot (logical).  |
| outfile               | Name of the outfile (NULL or character). Should match the fileExtension. If NULL is passed a file is created in the R session temporary directory. |
| fileExtension         | The file extension of the image (character). Has to be one of the following: 'png', 'jpg', 'tif', 'kml', 'pdf'.                                    |
| visualizeVariables    | A data frame containing all meta data for the plotting process (data.frame).   |
| visualizeDataTimestep | The data to be plotted.  |

|                                   |   |
|-----------------------------------|---|
| <code>nc_path_visualize</code>    | The nc file path of which the plot is generated for.  |
| <code>visualizeDataMax</code>     | Maximal data for computing breaks.  |
| <code>lon_bounds</code>           | Array containing two values for longitude min and max (numeric).  |
| <code>lat_bounds</code>           | Array containing two values for latitude min and max (numeric).   |
| <code>lon_loc_vec</code>          | All longitude entries for points at ( <code>lat_loc_vec</code> , <code>lon_loc_vec</code> ) to be specified on the map (numeric).                     |
| <code>lat_loc_vec</code>          | All latitude entries for points at ( <code>lat_loc_vec</code> , <code>lon_loc_vec</code> ) to be specified on the map (numeric).                      |
| <code>name_loc_vec</code>         | Names for the points at ( <code>lat_loc_vec</code> , <code>lon_loc_vec</code> ) to be specified on the map (numeric).                                 |
| <code>timestep</code>             | The current timestep chosen.  |
| <code>num_tick</code>             | Number of ticks (numeric).  |
| <code>num_rmin</code>             | Color scale range minimum (numeric).  |
| <code>num_rmax</code>             | Color scale range maximum (numeric).  |
| <code>num_brk</code>              | Number of breaks (numeric).   |
| <code>co.data</code>              | Data to be plotted in R-Instat mode (data.frame).   |
| <code>co.data.compare.diff</code> | Data to be plotted in compare data mode (data.frame).   |
| <code>proj</code>                 | The chosen projection (either 'rect' for rectangular or 'ortho' for orthographic).  |
| <code>xort</code>                 | Centering the globe at longitude <code>xort</code> (numeric). Only in orthographic mode.  |
| <code>yort</code>                 | Centering the globe at latitude <code>yort</code> (numeric). Only in orthographic mode.   |
| <code>rort</code>                 | Rotation of the globe (numeric). Only in orthographic mode.   |
| <code>slider1</code>              | Controlling the horizontal plot position as vector of two values min and max (numeric).   |
| <code>slider2</code>              | Controlling the vertical plot position as vector of two values min and max (numeric).   |
| <code>imagewidth</code>           | Width of the image (numeric).   |
| <code>imageheight</code>          | Height of the image (numeric).  |
| <code>location</code>             | Whether points specified by ( <code>lat_loc_vec</code> , <code>lon_loc_vec</code> , <code>name_loc_vec</code> ) should be added to the map (logical). |
| <code>int</code>                  | Whether interior country borders should be added (logical).   |
| <code>text1</code>                | Title text (character).   |
| <code>text2</code>                | Text to be passed to <code>graphics::mtext</code> (character).  |
| <code>text3</code>                | Text to be added to the legend (character).   |
| <code>textsize</code>             | Textsize to be used (cex).  |
| <code>bordercolor</code>          | Color used for borders.   |
| <code>linesize</code>             | Line width to be used (positive numeric).   |
| <code>na.color</code>             | The color to be used for NA values.   |

|           |  |
|-----------|--|
| PAL       | Color palette.   |
| palettes  | Color palettes to be used.                             |
| reverse   | Whether to revert the color palette (logical).         |
| plot_grid | Whether to plot a grid using color grid_col (logical). |
| grid_col  | Color used for the grid.                               |

---

render\_plot\_1d                      *Plotting routine designed for the CM SAF R Toolbox.*

---

### Description

This function renders a 1D plot of data at one single lon / lat point.

### Usage

```
render_plot_1d(
  outfile = NULL,
  fileExtension = ".png",
  visualizeVariables,
  ticknumber,
  dateformat,
  analyze_timeseries,
  addTrend,
  sliderx,
  slidery,
  checkGroup_type,
  imagewidth,
  imageheight,
  text1_1d,
  text2_1d,
  text3_1d,
  text4_1d,
  textsize,
  linesize,
  col
)
```

### Arguments

|                    |  |
|--------------------|--|
| outfile            | Name of the outfile (NULL or character). Should match the fileExtension. If NULL is passed a file is created in the R session temporary directory. |
| fileExtension      | The file extension of the image (character). Has to be one of the following: 'png', 'jpg', 'tif', 'kml', 'pdf'.                                    |
| visualizeVariables | A data frame containing all meta data for the plotting process (data.frame).   |

|                    |  |
|--------------------|--|
| ticknumber         | Number of ticks (numeric).   |
| dateformat         | Date format for constructing a date label.   |
| analyze_timeseries | Whether or not to analyze the timeseries of the given point (logical).   |
| addTrend           | Whether to add a trend line (logical).   |
| sliderx            | Limiting the time series with a two valued vector for min and max (numeric).   |
| slidery            | Limiting the y axis with a two valued vector for min and max (numeric).  |
| checkGroup_type    | An integer between 1 and 5 indicating group type (numeric). 1 for Line, 2 for Points, 3 for Line and Points, 4 for steps, 5 for histogram. |
| imagewidth         | Width of the image (numeric).  |
| imageheight        | Height of the image (numeric).   |
| text1_1d           | Title text (character).  |
| text2_1d           | Text to be passed to graphics::mtext (character).  |
| text3_1d           | X-label (character).   |
| text4_1d           | Y-label (character).   |
| textsize           | Textsize to be used (cex).   |
| linesize           | Line width to be used (positive numeric).  |
| col                | A color chosen via colourpicker::colourInput.  |

---

render\_plot\_1d\_advanced

*Plotting routine designed for the CM SAF R Toolbox.*

---

## Description

This function renders a 1D plot of data at one single lon or one single lat point.

## Usage

```
render_plot_1d_advanced(
  outfile = NULL,
  fileExtension = ".png",
  visualizeVariables,
  ticknumber,
  addTrend,
  sliderx,
  slidery,
  checkGroup_type,
  imagewidth,
  imageheight,
  text1_1d,
```

```

    text2_1d,
    textsize,
    linesize,
    col,
    timestep_1d_visualize
  )

```

### Arguments

|                       |  |
|-----------------------|--|
| outfile               | Name of the outfile (NULL or character). Should match the fileExtension. If NULL is passed a file is created in the R session temporary directory. |
| fileExtension         | The file extension of the image (character). Has to be one of the following: 'png', 'jpg', 'tif', 'kml', 'pdf'.                                    |
| visualizeVariables    | A data frame containing all meta data for the plotting process (data.frame).   |
| ticknumber            | Number of ticks (numeric).   |
| addTrend              | Whether to add a trend line (logical).   |
| sliderx               | Limiting the time series with a two valued vector for min and max (numeric).   |
| slidery               | Limiting the y axis with a two valued vector for min and max (numeric).  |
| checkGroup_type       | An integer between 1 and 5 indicating group type (numeric). 1 for Line, 2 for Points, 3 for Line and Points, 4 for steps, 5 for histogram.         |
| imagewidth            | Width of the image (numeric).  |
| imageheight           | Height of the image (numeric).   |
| text1_1d              | Title text (character).  |
| text2_1d              | Text to be passed to graphics::mtext (character).  |
| textsize              | Textsize to be used (cex).   |
| linesize              | Line width to be used (positive numeric).  |
| col                   | A color chosen via colourpicker::colourInput.  |
| timestep_1d_visualize | The time step to be visualized.  |

---

render\_plot\_hist\_compare

*Plotting routine designed for the CM SAF R Toolbox.*

---

### Description

This function renders a histogram of two variables.

**Usage**

```
render_plot_hist_compare(
  outfile = NULL,
  fileExtension = ".png",
  visualizeVariables,
  imagewidth,
  imageheight,
  text1_1d,
  text2_1d,
  textsize,
  legend_label1,
  legend_label2,
  timestep_1d_visualize
)
```

**Arguments**

|                       |  |
|-----------------------|--|
| outfile               | Name of the outfile (NULL or character). Should match the fileExtension. If NULL is passed a file is created in the R session temporary directory. |
| fileExtension         | The file extension of the image (character). Has to be one of the following: 'png', 'jpg', 'tif', 'kml', 'pdf'.                                    |
| visualizeVariables    | A data frame containing all meta data for the plotting process (data.frame).   |
| imagewidth            | Width of the image (numeric).  |
| imageheight           | Height of the image (numeric).   |
| text1_1d              | Title text (character).  |
| text2_1d              | Text to be passed to graphics::mtext (character).  |
| textsize              | Textsize to be used (cex).   |
| legend_label1         | Legend label of the first data set   |
| legend_label2         | Legend label of the second data set  |
| timestep_1d_visualize | Selected timestep  |

---

render\_plot\_hovmoller *Plotting routine designed for the CM SAF R Toolbox.*

---

**Description**

This function renders a hovmoller plot of two variables.

**Usage**

```
render_plot_hovmoller(  
  outfile = NULL,  
  fileExtension = ".png",  
  visualizeVariables,  
  imagewidth,  
  imageheight,  
  textsize,  
  linesize,  
  title_data1,  
  title_data2,  
  nc = NULL,  
  nc2 = NULL  
)
```

**Arguments**

|                    |  |
|--------------------|--|
| outfile            | Name of the outfile (NULL or character). Should match the fileExtension. If NULL is passed a file is created in the R session temporary directory. |
| fileExtension      | The file extension of the image (character). Has to be one of the following: 'png', 'jpg', 'tif', 'kml', 'pdf'.                                    |
| visualizeVariables | A data frame containing all meta data for the plotting process (data.frame).   |
| imagewidth         | Width of the image (numeric).  |
| imageheight        | Height of the image (numeric).   |
| textsize           | Textsize to be used (cex).   |
| linesize           | Line width to be used (positive numeric).  |
| title_data1        | Title of the first data set  |
| title_data2        | Title of the second data set   |
| nc                 | Alternatively to infile1 you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).                                  |
| nc2                | Alternatively to infile2 you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).                                  |

---

render\_plot\_scatter     *Plotting routine designed for the CM SAF R Toolbox.*

---

**Description**

This function renders a scatter plot of two variables.

**Usage**

```
render_plot_scatter(
  outfile = NULL,
  fileExtension = ".png",
  visualizeVariables,
  dateformat,
  ticknumber,
  imagewidth,
  imageheight,
  text1_1d,
  text2_1d,
  textsize,
  linesize,
  x_axis_label_1d,
  y_axis_label_1d,
  timestep_1d_visualize
)
```

**Arguments**

|                                    |  |
|------------------------------------|--|
| <code>outfile</code>               | Name of the outfile (NULL or character). Should match the <code>fileExtension</code> . If NULL is passed a file is created in the R session temporary directory. |
| <code>fileExtension</code>         | The file extension of the image (character). Has to be one of the following: 'png', 'jpg', 'tif', 'kml', 'pdf'.  |
| <code>visualizeVariables</code>    | A data frame containing all meta data for the plotting process (data.frame).   |
| <code>dateformat</code>            | Date format for constructing a date label.   |
| <code>ticknumber</code>            | Number of ticks (numeric).   |
| <code>imagewidth</code>            | Width of the image (numeric).  |
| <code>imageheight</code>           | Height of the image (numeric).   |
| <code>text1_1d</code>              | Title text (character).  |
| <code>text2_1d</code>              | Text to be passed to <code>graphics::mtext</code> (character).   |
| <code>textsize</code>              | Textsize to be used (cex).   |
| <code>linesize</code>              | Line width to be used (positive numeric).  |
| <code>x_axis_label_1d</code>       | x-label (first data set)   |
| <code>y_axis_label_1d</code>       | y-label (second data set)  |
| <code>timestep_1d_visualize</code> | Selected timestep  |



---

`render_plot_side_by_side`*Plotting routine designed for the CM SAF R Toolbox.*

---

**Description**

This function renders a 2D image of two files usually called by the CM SAF R Toolbox.

**Usage**

```
render_plot_side_by_side(  
  plot_rinstat,  
  outfile = NULL,  
  fileExtension = ".png",  
  visualizeVariables,  
  visualizeDataTimestep,  
  nc_path_visualize,  
  visualizeDataMax,  
  timestep_2d,  
  lon_bounds,  
  lat_bounds,  
  lon_loc_vec,  
  lat_loc_vec,  
  name_loc_vec,  
  timestep,  
  num_tick,  
  num_rmin,  
  num_rmax,  
  num_brk,  
  co.data,  
  proj,  
  xort,  
  yort,  
  rort,  
  slider1,  
  slider2,  
  imagewidth,  
  imageheight,  
  location,  
  int,  
  text1,  
  text2,  
  text3,  
  textsize,  
  bordercolor,  
  linesize,  
  na.color,
```

```

    PAL,
    palettes,
    reverse,
    plot_grid,
    grid_col,
    text1_2,
    text2_2
  )

```

### Arguments

|                                    |  |
|------------------------------------|--|
| <code>plot_rinstat</code>          | Whether to create an R-Instat plot (logical).  |
| <code>outfile</code>               | Name of the outfile (NULL or character). Should match the <code>fileExtension</code> . If NULL is passed a file is created in the R session temporary directory. |
| <code>fileExtension</code>         | The file extension of the image (character). Has to be one of the following: 'png', 'jpg', 'tif', 'kml', 'pdf'.  |
| <code>visualizeVariables</code>    | A data frame containing all meta data for the plotting process (data.frame).   |
| <code>visualizeDataTimestep</code> | The data to be plotted.  |
| <code>nc_path_visualize</code>     | The nc file path of which the plot is generated for.   |
| <code>visualizeDataMax</code>      | Maximal data for computing breaks.   |
| <code>timestep_2d</code>           | The time step to be visualized.  |
| <code>lon_bounds</code>            | Array containing two values for longitude min and max (numeric).   |
| <code>lat_bounds</code>            | Array containing two values for latitude min and max (numeric).  |
| <code>lon_loc_vec</code>           | All longitude entries for points at ( <code>lat_loc_vec</code> , <code>lon_loc_vec</code> ) to be specified on the map (numeric).                                |
| <code>lat_loc_vec</code>           | All latitude entries for points at ( <code>lat_loc_vec</code> , <code>lon_loc_vec</code> ) to be specified on the map (numeric).                                 |
| <code>name_loc_vec</code>          | Names for the points at ( <code>lat_loc_vec</code> , <code>lon_loc_vec</code> ) to be specified on the map (numeric).  |
| <code>timestep</code>              | The current timestep chosen.   |
| <code>num_tick</code>              | Number of ticks (numeric).   |
| <code>num_rmin</code>              | Color scale range minimum (numeric).   |
| <code>num_rmax</code>              | Color scale range maximum (numeric).   |
| <code>num_brk</code>               | Number of breaks (numeric).  |
| <code>co.data</code>               | Data to be plotted in R-Instat mode (data.frame).  |
| <code>proj</code>                  | The chosen projection (either 'rect' for rectangular or 'ortho' for orthographic).   |
| <code>xort</code>                  | Centering the globe at longitude <code>xort</code> (numeric). Only in orthographic mode.   |
| <code>yort</code>                  | Centering the globe at latitude <code>yort</code> (numeric). Only in orthographic mode.  |

|             |  |
|-------------|--|
| rort        | Rotation of the globe (numeric). Only in orthographic mode.  |
| slider1     | Controlling the horizontal plot position as vector of two values min and max (numeric).                    |
| slider2     | Controlling the vertical plot position as vector of two values min and max (numeric).                      |
| imagewidth  | Width of the image (numeric).  |
| imageheight | Height of the image (numeric).   |
| location    | Whether points specified by (lat_loc_vec, lon_loc_vec, name_loc_vec) should be added to the map (logical). |
| int         | Whether interior country borders should be added (logical).  |
| text1       | Title text data set 1 (character).   |
| text2       | Text to be passed to graphics::mtext for data set 1 (character).   |
| text3       | Text to be added to the legend (character).  |
| textsize    | Textsize to be used (cex).   |
| bordercolor | Color used for borders.  |
| linesize    | Line width to be used (positive numeric).  |
| na.color    | The color to be used for NA values.  |
| PAL         | Color palette.   |
| palettes    | Color palettes to be used.   |
| reverse     | Whether to revert the color palette (logical).   |
| plot_grid   | Whether to plot a grid using color grid_col (logical).   |
| grid_col    | Color used for the grid.   |
| text1_2     | Title text data set 2 (character).   |
| text2_2     | Text to be passed to graphics::mtext for data set 2 (character).   |

---

render\_plot\_time\_series\_compare

*Plotting routine designed for the CM SAF R Toolbox.*


---

### Description

This function provides a time series comparison of two data sets.

### Usage

```
render_plot_time_series_compare(
  outfile = NULL,
  fileExtension = ".png",
  visualizeVariables,
  ticknumber,
  dateformat,
```

```

    sliderx,
    slidery,
    checkGroup_type,
    imagewidth,
    imageheight,
    text1_1d,
    text2_1d,
    textsize,
    linesize,
    col,
    legend_label1,
    legend_label2,
    station_number
  )

```

### Arguments

|                                 |  |
|---------------------------------|--|
| <code>outfile</code>            | Name of the outfile (NULL or character). Should match the fileExtension. If NULL is passed a file is created in the R session temporary directory. |
| <code>fileExtension</code>      | The file extension of the image (character). Has to be one of the following: 'png', 'jpg', 'tif', 'kml', 'pdf'.                                    |
| <code>visualizeVariables</code> | A data frame containing all meta data for the plotting process (data.frame).   |
| <code>ticknumber</code>         | Number of ticks (numeric).   |
| <code>dateformat</code>         | Date format for constructing a date label.   |
| <code>sliderx</code>            | Limiting the time series with a two valued vector for min and max (numeric).   |
| <code>slidery</code>            | Limiting the y axis with a two valued vector for min and max (numeric).  |
| <code>checkGroup_type</code>    | An integer between 1 and 5 indicating group type (numeric). 1 for Line, 2 for Points, 3 for Line and Points, 4 for steps, 5 for histogram.         |
| <code>imagewidth</code>         | Width of the image (numeric).  |
| <code>imageheight</code>        | Height of the image (numeric).   |
| <code>text1_1d</code>           | Title text (character).  |
| <code>text2_1d</code>           | Text to be passed to <code>graphics::mtext</code> (character).   |
| <code>textsize</code>           | Textsize to be used (cex).   |
| <code>linesize</code>           | Line width to be used (positive numeric).  |
| <code>col</code>                | A color chosen via <code>colourpicker::colourInput</code> .  |
| <code>legend_label1</code>      | Legend label of the first data set   |
| <code>legend_label2</code>      | Legend label of the second data set  |
| <code>station_number</code>     | For station data compare; which station is selected  |

---

render\_preview\_plot     *Creates a preview plot of a selected area*

---

### Description

This function creates a simple preview plot via maps::map of a given region.

### Usage

```
render_preview_plot(spatial_lon_range, spatial_lat_range, lonRange, latRange)
```

### Arguments

spatial\_lon\_range     Array containing two values for longitude min and max (numeric).

spatial\_lat\_range     Array containing two values for latitude min and max (numeric).

lonRange     Array containing two values for longitude min and max (numeric).

latRange     Array containing two values for latitude min and max (numeric).

---

render\_region\_plot     *Function to create a plot of a selected country.*

---

### Description

This function generates a plot of within a certain region (e.g. a country).

### Usage

```
render_region_plot(
  infile,
  outfile = NULL,
  fileExtension = ".png",
  visualizeVariables,
  visualizeDataMax,
  lon_bounds,
  lat_bounds,
  lon_loc_vec,
  lat_loc_vec,
  name_loc_vec,
  division,
  selectedRegion,
  region_data,
  timestep,
  num_tick,
```

```

num_rmin,
num_rmax,
location,
text1,
text2,
text3,
PAL,
palettes,
num_brk,
reverse,
textsize,
bordercolor,
plot_grid,
grid_col,
image_def,
ihsf,
nc = NULL
)

```

### Arguments

|                                 |  |
|---------------------------------|--|
| <code>infile</code>             | The nc file to be visualized.  |
| <code>outfile</code>            | Name of the outfile (NULL or character). Should match the fileExtension. If NULL is passed a file is created in the R session temporary directory.   |
| <code>fileExtension</code>      | The file extension of the image (character). Has to be one of the following: 'png', 'jpg', 'tif', 'kml', 'pdf'.  |
| <code>visualizeVariables</code> | A data frame containing all meta data for the plotting process (data.frame).   |
| <code>visualizeDataMax</code>   | Maximal data for computing breaks.   |
| <code>lon_bounds</code>         | Array containing two values for longitude min and max (numeric).   |
| <code>lat_bounds</code>         | Array containing two values for latitude min and max (numeric).  |
| <code>lon_loc_vec</code>        | All longitude entries for points at (lat_loc_vec, lon_loc_vec) to be specified on the map (numeric).   |
| <code>lat_loc_vec</code>        | All latitude entries for points at (lat_loc_vec, lon_loc_vec) to be specified on the map (numeric).  |
| <code>name_loc_vec</code>       | Names for the points at (lat_loc_vec, lon_loc_vec) to be specified on the map (numeric).   |
| <code>division</code>           | Division to contain region (either 'COUNTRY' or something coherent to region_data).  |
| <code>selectedRegion</code>     | The region to be cropped according to division. If <code>division == "COUNTRY"</code> , the country's <b>3-character ISO code</b> should be used. Otherwise it has to fit to the passed region data. |
| <code>region_data</code>        | If Division is not 'COUNTRY' then region_data has to contain spatial data of the given division.   |

|             |  |
|-------------|--|
| timestep    | Timestep to visualize at (character).  |
| num_tick    | Number of ticks (numeric).   |
| num_rmin    | Color scale range minimum (numeric).   |
| num_rmax    | Color scale range maximum (numeric).   |
| location    | Whether points specified by (lat_loc_vec, lon_loc_vec, name_loc_vec) should be added to the map (logical).       |
| text1       | Title text (character).  |
| text2       | Text to be passed to graphics::mtext (character).  |
| text3       | Text to be added to the legend (character).  |
| PAL         | Color palette.   |
| palettes    | Color palettes to be used.   |
| num_brk     | Number of breaks (numeric).  |
| reverse     | Whether to revert the color palette (logical).   |
| textsize    | Textsize to be used (cex).   |
| bordercolor | Color used for borders.  |
| plot_grid   | Whether to plot a grid using color grid_col (logical).   |
| grid_col    | Color used for the grid.   |
| image_def   | Default size (positive numeric).   |
| ihsf        | Image height scaling factor (positive numeric).  |
| nc          | Alternatively to infile you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open). |

---

time\_series\_plot      *A 'cmsaf' extension for creating time series plots.*

---

### Description

This plotting routine generates graphical output for the given variable within the given time range and area. Dependent on the output format a PNG is created.

### Usage

```
time_series_plot(
  variable = NULL,
  infile = NULL,
  selected_number = 1,
  analyze_method = TRUE,
  temp_dir = tempdir(),
  out_dir = getwd(),
  climate_dir = NULL,
  climate_year_start = 1983,
```

```

climate_year_end = 2018,
start_date = NULL,
end_date = NULL,
country_code = "S_A",
lon_min = NULL,
lon_max = NULL,
lat_min = NULL,
lat_max = NULL,
outfile_name = NULL,
output_format = "graphic",
language = "eng",
keep_files = TRUE,
states = FALSE,
attach = FALSE,
infile_attach = "auto",
title = "",
verbose = TRUE,
nc = NULL
)

```

### Arguments

|                    |   |
|--------------------|---|
| variable           | Name of variable in infile (NULL or character). If NULL then the first variable from the infile is taken.   |
| infile             | Path to NetCDF file (NULL or character). If NULL then it needs to be specified in the config file.  |
| selected_number    | Timesteps of the same selected time range (Warming Stripes Plots, Time Series Plots, Trend Plots)   |
| analyze_method     | Two analyze methods: mean == FALSE; accumulate == TRUE (logical) (Warming Stripes Plots, Time Series Plots, Trend Plots)  |
| temp_dir           | Path to temporary working directory (character).  |
| out_dir            | Path to output directory (character).   |
| climate_dir        | Path to directory in which climatology is computed or contained (NULL or character). If NULL then the temp_dir directory is taken.  |
| climate_year_start | Start year of climatology (integer).  |
| climate_year_end   | End year of climatology (integer).  |
| start_date         | Start date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the first date of the infile is used.  |
| end_date           | End date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the last date of the infile is used.   |
| country_code       | Either a country code in iso3c format or from the following: 'AFR' for Africa, 'EUR' for Europe, 'TOT' for the total disc, or 'S_A' for an arbitrary region selection (character). If a country is passed the data from within this country |



|               |  |
|---------------|--|
|               | is extracted, else a rectangular box is visualized. Directly provided latitude and longitude ranges will be ignored in case of 'AFR', 'EUR' or 'TOT'.  |
| lon_min       | Longitude of lower left corner (NULL or numeric). If NULL then the smallest longitude of the infile is used.   |
| lon_max       | Longitude of upper right left corner (NULL or numeric). If NULL then the largest longitude of the infile is used.  |
| lat_min       | Latitude of lower left corner (NULL or numeric). If NULL then the smallest latitude of the infile is used.   |
| lat_max       | Latitude of upper right corner (NULL or numeric). If NULL then the largest latitude of the infile is used.   |
| outfile_name  | Filename of the PNG or MP4 outfile (NULL or character). If NULL then a name is computed from the current configuration. Please match the file ending according to the output_format.   |
| output_format | Specification of output format (either 'graphic' for PNG or 'animation' for MP4).  |
| language      | Language used for title, legend, etc. in plots (either 'eng' for English or 'deu' for German).   |
| keep_files    | A flag indicating whether all files created in the process of obtaining the output file should be kept (logical). If false, all intermediate results are deleted, otherwise all are kept. Keeping these files could improve performance in further function calls. |
| states        | Whether to crop/plot administration level of states (logical).   |
| attach        | Whether to temporaly merge the infile to an already existing one. (logical).   |
| infile_attach | File to attach the infile to. When 'auto', a suitable file will be searched in out_dir. If attach is false, this will be ignored(character).   |
| title         | Set title (character).   |
| verbose       | Whether to display progress messages (logical).  |
| nc            | Alternatively to infile you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).   |

---

|            |  |
|------------|--|
| trend_plot | <i>A 'cmsaf' extension for creating trend plots.</i> |
|------------|--|

---

### Description

This plotting routine generates graphical output for the given variable within the given time range and area. Dependent on the output format a PNG is created.

**Usage**

```

trend_plot(
  variable = NULL,
  infile = NULL,
  selected_number = 1,
  analyze_method = TRUE,
  temp_dir = tempdir(),
  out_dir = getwd(),
  climate_dir = NULL,
  climate_year_start = 1983,
  climate_year_end = 2018,
  start_date = NULL,
  end_date = NULL,
  country_code = "S_A",
  lon_min = NULL,
  lon_max = NULL,
  lat_min = NULL,
  lat_max = NULL,
  outfile_name = NULL,
  output_format = "graphic",
  language = "eng",
  keep_files = TRUE,
  states = FALSE,
  attach = FALSE,
  infile_attach = "auto",
  verbose = TRUE,
  nc = NULL
)

```

**Arguments**

|                    |  |
|--------------------|--|
| variable           | Name of variable in infile (NULL or character). If NULL then the first variable from the infile is taken.                          |
| infile             | Path to NetCDF file (NULL or character). If NULL then it needs to be specified in the config file.                                 |
| selected_number    | Timesteps of the same selected time range (Warming Stripes Plots, Time Series Plots, Trend Plots)                                  |
| analyze_method     | Two analyze methods: mean == FALSE; accumulate == TRUE (logical) (Warming Stripes Plots, Time Series Plots, Trend Plots)           |
| temp_dir           | Path to temporary working directory (character).   |
| out_dir            | Path to output directory (character).  |
| climate_dir        | Path to directory in which climatology is computed or contained (NULL or character). If NULL then the temp_dir directory is taken. |
| climate_year_start | Start year of climatology (integer).   |

|                  |   |
|------------------|---|
| climate_year_end | End year of climatology (integer).  |
| start_date       | Start date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the first date of the infile is used.  |
| end_date         | End date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the last date of the infile is used.   |
| country_code     | Either a country code in iso3c format or from the following: 'AFR' for Africa, 'EUR' for Europe, 'TOT' for the total disc, or 'S_A' for an arbitrary region selection (character). If a country is passed the data from within this country is extracted, else a rectangular box is visualized. Directly provided latitude and longitude ranges will be ignored in case of 'AFR', 'EUR' or 'TOT'. |
| lon_min          | Longitude of lower left corner (NULL or numeric). If NULL then the smallest longitude of the infile is used.  |
| lon_max          | Longitude of upper right left corner (NULL or numeric). If NULL then the largest longitude of the infile is used.   |
| lat_min          | Latitude of lower left corner (NULL or numeric). If NULL then the smallest latitude of the infile is used.  |
| lat_max          | Latitude of upper right corner (NULL or numeric). If NULL then the largest latitude of the infile is used.  |
| outfile_name     | Filename of the PNG or MP4 outfile (NULL or character). If NULL then a name is computed from the current configuration. Please match the file ending according to the output_format.  |
| output_format    | Specification of output format (either 'graphic' for PNG or 'animation' for MP4).   |
| language         | Language used for title, legend, etc. in plots (either 'eng' for English or 'deu' for German).  |
| keep_files       | A flag indicating whether all files created in the process of obtaining the output file should be kept (logical). If false, all intermediate results are deleted, otherwise all are kept. Keeping these files could improve performance in further function calls.  |
| states           | Whether to crop/plot administration level of states (logical).  |
| attach           | Whether to temporaly merge the infile to an already existing one. (logical).  |
| infile_attach    | File to attach the infile to. When 'auto', a suitable file will be searched in out_dir. If attach is false, this will be ignored(character).  |
| verbose          | Whether to display progress messages (logical).   |
| nc               | Alternatively to infile you can specify the input as an object of class ncdf4 (as returned from ncdf4::nc_open).  |

---

warming\_stripes\_plot    A 'cmsaf' extension for creating warming stripes plots.

---

### Description

This plotting routine generates graphical output for the given variable within the given time range and area. Dependent on the output format a PNG is created.

### Usage

```
warming_stripes_plot(
  variable = NULL,
  infile = NULL,
  selected_number = 1,
  color_pal = 1,
  analyze_method = TRUE,
  temp_dir = tempdir(),
  out_dir = getwd(),
  climate_dir = NULL,
  climate_year_start = 1983,
  climate_year_end = 2018,
  start_date = NULL,
  end_date = NULL,
  country_code = "S_A",
  lon_min = NULL,
  lon_max = NULL,
  lat_min = NULL,
  lat_max = NULL,
  outfile_name = NULL,
  output_format = "graphic",
  language = "eng",
  keep_files = TRUE,
  states = FALSE,
  attach = FALSE,
  infile_attach = "auto",
  pointsTF = FALSE,
  lineTF = FALSE,
  circ_plot = FALSE,
  title = "",
  verbose = TRUE,
  nc = NULL
)
```

### Arguments

|          |   |
|----------|---|
| variable | Name of variable in infile (NULL or character). If NULL then the first variable from the infile is taken. |
|----------|---|

|                    |   |
|--------------------|---|
| infile             | Path to NetCDF file (NULL or character). If NULL then it needs to be specified in the config file.  |
| selected_number    | Timesteps of the same selected time range (Warming Stripes Plots, Time Series Plots, Trend Plots)   |
| color_pal          | Color option for stripe and anomaly plots   |
| analyze_method     | Two analyze methods: mean == FALSE; accumulate == TRUE (logical) (Warming Stripes Plots, Time Series Plots, Trend Plots)  |
| temp_dir           | Path to temporary working directory (character).  |
| out_dir            | Path to output directory (character).   |
| climate_dir        | Path to directory in which climatology is computed or contained (NULL or character). If NULL then the temp_dir directory is taken.  |
| climate_year_start | Start year of climatology (integer).  |
| climate_year_end   | End year of climatology (integer).  |
| start_date         | Start date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the first date of the infile is used.  |
| end_date           | End date in format of 'YYYY-MM-DD' (NULL or character). If NULL then the last date of the infile is used.   |
| country_code       | Either a country code in iso3c format or from the following: 'AFR' for Africa, 'EUR' for Europe, 'TOT' for the total disc, or 'S_A' for an arbitrary region selection (character). If a country is passed the data from within this country is extracted, else a rectangular box is visualized. Directly provided latitude and longitude ranges will be ignored in case of 'AFR', 'EUR' or 'TOT'. |
| lon_min            | Longitude of lower left corner (NULL or numeric). If NULL then the smallest longitude of the infile is used.  |
| lon_max            | Longitude of upper right left corner (NULL or numeric). If NULL then the largest longitude of the infile is used.   |
| lat_min            | Latitude of lower left corner (NULL or numeric). If NULL then the smallest latitude of the infile is used.  |
| lat_max            | Latitude of upper right corner (NULL or numeric). If NULL then the largest latitude of the infile is used.  |
| outfile_name       | Filename of the PNG or MP4 outfile (NULL or character). If NULL then a name is computed from the current configuration. Please match the file ending according to the output_format.  |
| output_format      | Specification of output format (either 'graphic' for PNG or 'animation' for MP4).   |
| language           | Language used for title, legend, etc. in plots (either 'eng' for English or 'deu' for German).  |
| keep_files         | A flag indicating whether all files created in the process of obtaining the output file should be kept (logical). If false, all intermediate results are deleted, otherwise all are kept. Keeping these files could improve performance in further function calls.  |

|                            |   |
|----------------------------|---|
| <code>states</code>        | Whether to crop/plot administration level of states (logical).  |
| <code>attach</code>        | Whether to temporaly merge the infile to an already existing one. (logical).  |
| <code>infile_attach</code> | File to attach the infile to. When 'auto', a suitable file will be searched in <code>out_dir</code> . If <code>attach</code> is false, this will be ignored(character). |
| <code>pointsTF</code>      | Show data points (logical).   |
| <code>lineTF</code>        | Show trend line (logical).  |
| <code>circ_plot</code>     | Circular stripe plots (logical)   |
| <code>title</code>         | Set title (character).  |
| <code>verbose</code>       | Whether to display progress messages (logical).   |
| <code>nc</code>            | Alternatively to <code>infile</code> you can specify the input as an object of class <code>ncdf4</code> (as returned from <code>ncdf4::nc_open</code> ).                |

**Details**

Circular stripe plots are inspired by Emanuele Bevacqua (see [emanuele.bevacqua.eu](http://emanuele.bevacqua.eu))

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