Package 'cmsaf'

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Title Tools for CM SAF NetCDF Data

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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 EUMETSATs Satellite Application
Facilities. The CM SAF contributes to the sustainable observing of the climate
system by providing essential climate variables related to the energy and water
cycle of the atmosphere (<http://www.cmsaf.eu>). It is a joint cooperation of seven
National Meteorological and Hydrological Services.
The 'cmsaf' R-package provides a collection of R-operators for the analysis and
manipulation of CM SAF NetCDF formatted data. The 'cmsaf' R-package is tested
for CM SAF NetCDF data, which are structured in three-dimensional arrays
(longitude, latitude, time) on a rectangular grid. Layered CM SAF data have to
be converted with the provided levbox_mergetime() function. The 'cmsaf' R-package
operators have only minor checks for deviations from the recommended data structure,
and give only few specific error messages.
Scripts for an easy application of the 'cmsaf' package operators and the preparation
and visualization of CM SAF NetCDF data are provided at the CM SAF webpage
(<http://www.cmsaf.eu/EN/Products/Tools/Tools_node.html>).

License GPL (>= 3)

Depends ncdf4, sp, raster, fields

NeedsCompilation no

R topics documented:

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cmsaf-package *cmsaf*

Description

The 'cmsaf' package provides a collection of functions for basic analysis and manipulation of CM SAF NetCDF formatted data.

Details

Package:	cmsaf
Type:	Package
Version:	1.9.4
Date:	2018-08-06
License:	GPL (>= 3)

The 'cmsaf' functions are manipulating NetCDF input files and write the result in a separate output file. The functions were designed and tested for CM SAF NetCDF data, but most of the funtions can be applied to other NetCDF data, which use the CF convention and a rectangular lon-lat-time grid. As interface to NetCDF data the 'ncdf4' package is used.

Author(s)

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References

<http://www.cmsaf.eu>

Schulz, J., W. Thomas, R. Mueller, H.-D. Behr, D. Caprion, H. Deneke, S. Dewitte, B. Duerr, P. Fuchs, A. Gratzki, R. Hollmann, K.-G. Karlsson, T. Manninen, M. Reuter, A. Riihela, R. Roebeling, N. Selbach, A. Tetzlaff, E. Wolters, A. Zelenka, M. Werscheck, 2008: Operational climate monitoring from space: the EUMETSAT satellite application facility on climate monitoring (CM SAF), Atmos. Chem. Phys. Discuss., 8, 8517-8563, 2008, SRef-ID: 1680-7375/acpd/2008-8-8517

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box_mergetime   *Function to combine NetCDF files and simultaneously cut a region.*

Description

This function selects a region from a bunch of CM SAF NetCDF files that match the same pattern of the filename, and writes the output to a new file. If no longitude and latitude values are given, files are only merged. All input files have to have the same rectangular grid and the same variable. The reference time of the output file is determined by the first input file.

Usage

```
box_mergetime(var, path, pattern, outfile,
    lon1, lon2, lat1, lat2, nc34)
```

Arguments

var	Name of NetCDF variable (character).
path	The directory of input NetCDF files without / at the end (character).
pattern	A part of the filename, which is the same for all desired input files (character). The pattern has to be a character string containing a regular expression.
outfile	Filename of output NetCDF file. This may include the directory (character).
lon1	Longitude of lower left corner (numeric).
lon2	Longitude of upper right corner (numeric).
lat1	Latitude of lower left corner (numeric).
lat2	Latitude of upper right corner (numeric).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the merged timeseries of the selected region is written. The resulting file uses the meta data of the first input file.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
```

```
  lat <- seq(45,55,0.5)
  time <- c(as.Date('2000-01-01'), as.Date('2001-02-01'))
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data1 <- array(250:350,dim=c(21,21,1))
  data2 <- array(230:320,dim=c(21,21,1))

## create two simple example NetCDF files

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[1],unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file_n1.nc',vars)
  ncvar_put(ncnew,var1,data1)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[2],unlim=TRUE)
  ncnew <- nc_create('CMSAF_example_file_n2.nc',vars)
  ncvar_put(ncnew,var1,data2)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Cut a region and merge both example CM SAF NetCDF files into one output file.
## Get path information of working directory with getwd() command.
  wd <- getwd()
  box_mergetime('SIS',wd,'CMSAF_example_file_n',
  'CMSAF_example_file_box_mergetime.nc',8,12,48,52)
```

---

change_att   *Change attributes of a NetCDF variable.*

Description

This function can change the name, standard_name, long_name, units, _FillValue and missing_value of a variable. There is no separate outfile, thus use this function with care. The values for v_name, s_name, l_name, u_name, F_val and m_val are optional and will only be changed if they are given. If an attribute is not defined yet, it is added by the function.

Usage

```
change_att(var, infile, v_name, s_name, l_name, u_name, F_val, m_val,
val_prec='double')
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).

`v_name`	New variable name (character).
`s_name`	New standard name (character).
`l_name`	New long name (character).
`u_name`	New units name (character).
`F_val`	New fill value (numeric).
`m_val`	New missing value (numeric).
`val_prec`	Precision of the FillValue and missing value (character). Default is double.

Details

The function uses the ncdf4 package to change information of the infile.

Value

The function change_att changes variable information within the infile NetCDF.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('Data1','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Change the variable and standard name of the example CM SAF NetCDF file:
  change_att('Data1','CMSAF_example_file.nc', v_name='SIS',
  s_name='surface_downwelling_shortwave_flux_in_air')
```

---

checkfile	*Check the filename and directory.*

Description

There is the possibility to work with a given folder structure (CMSAF-R-TOOLBOX). This function is only for internal use within other cmsaf-package functions. To use this option the variable 'ptt' (path to toolbox) has to be defined.

The CM SAF R TOOLBOX consists of the 'cmsaf' R-package and a set of R-scripts, which are helpful to work with CM SAF NetCDF data. There are R-scripts, which can be used to analyse and plot CM SAF NetCDF data. The TOOLBOX includes also R-scripts, which help unexperienced R-users to apply the functions of the cmsaf R-package. The CM SAF R TOOLBOX is freely available on request and in the near future via the CM SAF homepage (<http://www.cmsaf.eu>).

Usage

```
checkfile(infile, outfile)
```

Arguments

infile	Filename of input NetCDF file. This may include the directory.
outfile	Filename of output NetCDF file. This may include the directory.

Value

The infile name and outfile name are returned.

Author(s)

Steffen Kothe

---

cmsaf.add	*Add the fields of two input NetCDF files.*

Description

The function adds the fields of infile1 to the fields of infile2. Infiles have to have the same spatial and temporal dimension or one infile can contain only one timestep. The outfile uses the meta data of infile1.

Usage

```
cmsaf.add(vari1, vari2, infile1, infile2, outfile, nc34)
```

Arguments

vari1	Name of variable in infile1 (character).
vari2	Name of variable in infile2 (character).
infile1	Filename of first input NetCDF file. This may include the directory (character).
infile2	Filename of second input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the added fields of infile1 and infile2 is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- c(as.Date('2000-01-01'), as.Date('2001-02-01'))
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data1 <- array(250:350,dim=c(21,21,1))
  data2 <- array(230:320,dim=c(21,21,1))

## create two example NetCDF files

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[1],unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file_1.nc',vars)
  ncvar_put(ncnew,var1,data1)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[2],unlim=TRUE)
  ncnew <- nc_create('CMSAF_example_file_2.nc',vars)
```

```
    ncvar_put(ncnew,var1,data2)
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Add the fields of both example CM SAF NetCDF files and write the result
## into one output file.
    cmsaf.add('SIS','SIS','CMSAF_example_file_1.nc',
    'CMSAF_example_file_2.nc','CMSAF_example_file_add.nc')
```

---

cmsaf.addc	*Add a constant to a dataset.*

Description

This function adds a given constant number to each element of a dataset.

Usage

```
cmsaf.addc(var, const, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
const	Constant number (numeric).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the manipulated data fields of infile is written. Standard output precision is 'double'.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
```

```
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Add a given number each dataset element of the example CM SAF NetCDF
## file and write the output to a new file.
  cmsaf.addc('SIS', 10, 'CMSAF_example_file.nc',
  'CMSAF_example_file_cmsaf.addc.nc')
```

---

cmsaf.cat   *Concatenate datasets of several NetCDF input files.*

Description

This function concatenates datasets of an arbitrary number of input files. All input files have to have
the same structure with the same variable and different timesteps.

Usage

```
cmsaf.cat(var, infiles, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infiles	Vector with filenames of input NetCDF files. The file names may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the merged timeseries is written. The resulting file uses the meta data of
the first input file.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- c(as.Date('2000-01-01'), as.Date('2001-02-01'))
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data1 <- array(250:350,dim=c(21,21,1))
  data2 <- array(230:320,dim=c(21,21,1))

## create two simple example NetCDF files

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[1],unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file_n1.nc',vars)
  ncvar_put(ncnew,var1,data1)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[2],unlim=TRUE)
  ncnew <- nc_create('CMSAF_example_file_n2.nc',vars)
  ncvar_put(ncnew,var1,data2)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Cut a region and merge both example CM SAF NetCDF files into one output file.
## Get path information of working directory with getwd() command.
  wd <- getwd()
  cmsaf.cat('SIS',c('CMSAF_example_file_n1.nc','CMSAF_example_file_n2.nc'),
  'CMSAF_example_file_cmsaf.cat.nc')
```

---

cmsaf.div	*Divide the fields of two input NetCDF files.*

Description

The function divides the fields of infile1 by the fields of infile2. Infiles have to have the same spatial
and temporal dimension or one infile can contain only one timestep. The outfile uses the meta data
of infile1.

Usage

```
cmsaf.div(vari1, vari2, infile1, infile2, outfile, nc34)
```

Arguments

vari1	Name of variable in infile1 (character).
vari2	Name of variable in infile2 (character).
infile1	Filename of first input NetCDF file. This may include the directory (character).
infile2	Filename of second input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the divided fields of infile1 and infile2 is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- c(as.Date('2000-01-01'), as.Date('2001-02-01'))
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data1 <- array(250:350,dim=c(21,21,1))
  data2 <- array(230:320,dim=c(21,21,1))

## create two example NetCDF files

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[1],unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file_1.nc',vars)
  ncvar_put(ncnew,var1,data1)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)
```

```
    t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
    vals=time[2],unlim=TRUE)
    ncnew <- nc_create('CMSAF_example_file_2.nc',vars)
    ncvar_put(ncnew,var1,data2)
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

 ## Divide the fields of both example CM SAF NetCDF files and write the result
 ## into one output file.
    cmsaf.div('SIS','SIS','CMSAF_example_file_1.nc', 'CMSAF_example_file_2.nc',
    'CMSAF_example_file_div.nc')
```

---

cmsaf.divc	*Divide data by a constant.*

Description

This function divides each element of a dataset by a given constant number.

Usage

```
cmsaf.divc(var, const, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
const	Constant number (numeric).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the manipulated data fields of infile is written. Standard output precision is 'double'.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)
```

```
## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Divide each dataset element of the example CM SAF NetCDF file by
## a given number and write the output to a new file.
  cmsaf.divc('SIS', 100, 'CMSAF_example_file.nc',
  'CMSAF_example_file_cmsaf.divc.nc')
```

---

cmsaf.mul   *Multiply the fields of two input NetCDF files.*

Description

The function multiplies the fields of infile1 and infile2. Infiles have to have the same spatial and temporal dimension or one infile can contain only one timestep. The outfile uses the meta data of infile1.

Usage

```
cmsaf.mul(vari1, vari2, infile1, infile2, outfile, nc34)
```

Arguments

vari1	Name of variable in infile1 (character).
vari2	Name of variable in infile2 (character).
infile1	Filename of first input NetCDF file. This may include the directory (character).
infile2	Filename of second input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the multiplied fields of infile1 and infile2 is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- c(as.Date('2000-01-01'), as.Date('2001-02-01'))
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data1 <- array(250:350,dim=c(21,21,1))
  data2 <- array(230:320,dim=c(21,21,1))

## create two example NetCDF files

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[1],unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file_1.nc',vars)
  ncvar_put(ncnew,var1,data1)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[2],unlim=TRUE)
  ncnew <- nc_create('CMSAF_example_file_2.nc',vars)
  ncvar_put(ncnew,var1,data2)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Multiply the fields of both example CM SAF NetCDF files and write the
## result into one output file.
  cmsaf.mul('SIS','SIS','CMSAF_example_file_1.nc',
  'CMSAF_example_file_2.nc','CMSAF_example_file_mul.nc')
```

---

cmsaf.mulc   *Multiply data with a constant.*

Description

This function multiplies each element of a dataset with a given constant number.

Usage

```
cmsaf.mulc(var, const, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
const	Constant number (numeric).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the manipulated data fields of infile is written. Standard output precision is 'double'.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
```

```
    vals=time,unlim=TRUE)
    var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
    vars <- list(var1)
    ncnew <- nc_create('CMSAF_example_file.nc',vars)
    ncvar_put(ncnew,var1,data)
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Multiply each dataset element of the example CM SAF NetCDF file by
## a given number and write the output to a new file.
    cmsaf.mulc('SIS', 10, 'CMSAF_example_file.nc',
    'CMSAF_example_file_cmsaf.mulc.nc')
```

| cmsaf.sub | *Subtract the fields of two input NetCDF files.* |

Description

The function subtracts the fields of infile2 from the fields of infile1. Infiles have to have the same spatial and temporal dimension or one infile can contain only one timestep. The outfile uses the meta data of infile1.

Usage

```
cmsaf.sub(vari1, vari2, infile1, infile2, outfile, nc34)
```

Arguments

vari1   Name of variable in infile1 (character).

vari2   Name of variable in infile2 (character).

infile1   Filename of first input NetCDF file. This may include the directory (character).

infile2   Filename of second input NetCDF file. This may include the directory (character).

outfile   Filename of output NetCDF file. This may include the directory (character).

nc34   NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the subtracted fields of infile1 and infile2 is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- c(as.Date('2000-01-01'), as.Date('2001-02-01'))
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data1 <- array(250:350,dim=c(21,21,1))
  data2 <- array(230:320,dim=c(21,21,1))

## create two example NetCDF files

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[1],unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file_1.nc',vars)
  ncvar_put(ncnew,var1,data1)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[2],unlim=TRUE)
  ncnew <- nc_create('CMSAF_example_file_2.nc',vars)
  ncvar_put(ncnew,var1,data2)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Subtract the fields of both example CM SAF NetCDF files and write the
## result into one output file.
  cmsaf.sub('SIS','SIS','CMSAF_example_file_1.nc', 'CMSAF_example_file_2.nc',
  'CMSAF_example_file_sub.nc')
```

---

cmsaf.subc	*Subtract a constant from a dataset.*

Description

This function subtracts a given constant number from each element of a dataset.

Usage

```
cmsaf.subc(var, const, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`const`	Constant number (numeric).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the manipulated data fields of infile is written. Standard output precision is 'double'.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Subtract a given number from each dataset element of the example CM SAF
## NetCDF file and write the output to a new file.
  cmsaf.subc('SIS', 10, 'CMSAF_example_file.nc',
  'CMSAF_example_file_cmsaf.subc.nc')
```

`dayrange`   *This function determines the diurnal range.*

Description

The function calculates the difference of maximum and minimum values of hourly data from a single CM SAF NetCDF input file.

Usage

```
dayrange(var, infile, outfile, nc34)
```

Arguments

`var`	Variable name.
`infile`	Filename of input NetCDF file (character). This may include the directory. There should be at least two values per day.
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of the diurnal range is written (character).

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(ISOdate(2000,1,1), ISOdate(2000,1,6), 'hours')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,121))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
```

```
    vals=time,unlim=TRUE)
    var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
    vars <- list(var1)
    ncnew <- nc_create('CMSAF_example_file.nc',vars)
    ncvar_put(ncnew,var1,data)
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

  ## Determine the diurnal range of the example CM SAF NetCDF file and write
  ## the output to a new file.
    dayrange('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_dayrange.nc')
```

---

divdpm   *Divide by days per month.*

Description

This function divides each timestep of a timeseries by the number of days of the corresponding
month. This can be useful to convert units, such as millimeters (mm) to monthly millimeters per
day (mm/d). Leap-years are included.

Usage

```
divdpm(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of the lenght of infile is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data
```

```
  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Divide each timestep of the example CM SAF NetCDF file by the
## number of days per month and write the output to a new file.
  divdpm('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_divdpm.nc')
```

---

extract.level   *Extract levels from 4-dimensional NetCDF files.*

Description

This function extracts one or all levels of a 4-dimensional NetCDF file. A level is defined as a dimension, which does not correspond to longitude, latitude or time. The user can choose either one specific level (given by an integer) or all levels (level = "all").

Usage

```
extract.level(var, infile, outfile, level, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
level	Number of level (default = 1) or all levels (level = "all") (numeric or character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the selected level is written. In case of level = "all" all levels are written in separate NetCDF files and outfile names are expanded by "_level" and the level number.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  height <- seq(0,1000,100)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,11,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  z <- ncdim_def(name='height',units='m',vals=height)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,z,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  ncatt_put(ncnew,'height','standard_name','height',prec='text')
  nc_close(ncnew)

## Extract the first level of the example CM SAF NetCDF file and write
## the output to a new file.
  extract.level('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_extract.level.nc')
## Extract all levels of the example CM SAF NetCDF file and write
## the output to a new file.
  extract.level('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_extract.level.nc',"all")
```

---

extract.period   *Remove a time period.*

Description

This function deletes a time period between a given start and end date from a timeseries. If start and end are the same, only this date will be removed.

Usage

```
extract.period(var, start, end, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`start`	Startdate as character in form of 'YYYY-MM-DD' (e.g., '2001-12-31').
`end`	Enddate as character in form of 'YYYY-MM-DD' (e.g., '2014-01-01').
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file excluding the selected time period is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Remove a 13-months period of the example CM SAF NetCDF file and write
```

```
## the output to a new file.
   extract.period('SIS','2001-01-01','2002-01-01',
   'CMSAF_example_file.nc','CMSAF_example_file_extract.period.nc')
```

---

fldmax   *Determine the field maximum.*

Description

The function determines the maximum value of each timestep from data of a single NetCDF file. The input file should conatin a timeseries of 2D-data.

Usage

```
fldmax(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of maximum values is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

   x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
```

```
    y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
    t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
    vals=time,unlim=TRUE)
    var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
    vars <- list(var1)
    ncnew <- nc_create('CMSAF_example_file.nc',vars)
    ncvar_put(ncnew,var1,data)
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Determine the maximum values of the example CM SAF NetCDF file and
## write the output to a new file.
    fldmax('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_fldmax.nc')
```

---

fldmean	*Determine the field mean.*

Description

The function determines the mean value of each timestep from data of a single NetCDF file. The input file should conatin a timeseries of 2D-data.

Usage

```
fldmean(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of spatial means is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data
```

```
  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the spatial means of the example CM SAF NetCDF file and
## write the output to a new file.
  fldmean('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_fldmean.nc')
```

---

fldmin   *Determine the field minimum.*

Description

The function determines the minimum value of each timestep from data of a single NetCDF file.
The input file should conatin a timeseries of 2D-data.

Usage

```
fldmin(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of minimum values is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the minimum values of the example CM SAF NetCDF file and
## write the output to a new file.
  fldmin('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_fldmin.nc')
```

---

get_time   *Convert time steps to POSIXct.*

Description

Times in NetCDF data are generally given in form of a time step and a time unit. This functions uses both information to convert them to POSIXct time values.

Usage

```
get_time(time.unit,time.step)
```

Arguments

time.unit	Time unit, which is conform to the CF convention (character).
time.step	Time steps in form of a numeric or integer vector.

Value

Time in form of POSIXct is returned. Default time zone is UTC.

Author(s)

Steffen Kothe

---

levbox_mergetime	*Function to combine NetCDF files and simultaneously cut a region and level.*

Description

This function selects a region and a level from a bunch of layered CM SAF NetCDF files that match the same pattern of the filename, and writes the output to a new file. If no longitude and latitude values are given, files are only merged. All input files have to have the same rectangular grid, level and variable. The reference time of the output file is determined by the first input file.

Usage

```
levbox_mergetime(var,level,path,pattern,outfile,lon1,lon2,lat1,lat2,nc34)
```

Arguments

var	Name of NetCDF variable (character).
level	Number of level that should be extracted (integer).
path	The directory of input NetCDF files without / at the end (character).
pattern	A part of the filename, which is the same for all desired input files (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
lon1	Longitude of lower left corner (numeric).
lon2	Longitude of upper right corner (numeric).
lat1	Latitude of lower left corner (numeric).
lat2	Latitude of upper right corner (numeric).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the merged timeseries of the selected region is written. The output NetCDF file contains only the selected level.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- c(as.Date('2000-01-01'), as.Date('2001-02-01'))
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  level <- c(1:5)
  data1 <- array(250:350,dim=c(21,21,5,1))
  data2 <- array(230:320,dim=c(21,21,5,1))

## create two example NetCDF files

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  l <- ncdim_def(name='level',units='1',vals=level)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[1],unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,l,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file_n1.nc',vars)
  ncvar_put(ncnew,var1,data1)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  ncatt_put(ncnew,'level','standard_name','level',prec='text')
  nc_close(ncnew)

  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time[2],unlim=TRUE)
  ncnew <- nc_create('CMSAF_example_file_n2.nc',vars)
  ncvar_put(ncnew,var1,data2)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  ncatt_put(ncnew,'level','standard_name','level',prec='text')
  nc_close(ncnew)

## Cut a region and levl, and merge both example CM SAF NetCDF files
## into one output file. First get path information of working directory.
  wd <- getwd()
  levbox_mergetime('SIS',1,wd,'CMSAF_example_file_n',
  'CMSAF_example_file_box_mergetime.nc',8,12,48,52)
```

---

mon.anomaly   *Determine monthly anomalies.*

Description

The function subtracts from a each timestep of a timeseries the corresponding multi-year monthly mean. To get monthly anomalies, the input file should contain monthly mean values.

Usage

```
mon.anomaly(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of differences is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)
```

```
## Determine the monthly anomalies of the example CM SAF NetCDF file
## and write the output to a new file.
   mon.anomaly('SIS','CMSAF_example_file.nc',
   'CMSAF_example_file_mon.anomaly.nc')
```

---

monmax   *Determine monthly maxima.*

Description

The function determines monthly maximum values from data of a single CM SAF NetCDF input file.This function is applicable to 3-dimensional (lon,lat,time) NetCDF data.

Usage

```
monmax(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of monthly maxima is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2000-03-31'), 'days')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,91))

## create example NetCDF
```

```
    x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
    y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
    t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
    vals=time,unlim=TRUE)
    var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
    vars <- list(var1)
    ncnew <- nc_create('CMSAF_example_file.nc',vars)
    ncvar_put(ncnew,var1,data)
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Determine the monthly maximum of the example CM SAF NetCDF file and
## write the output to a new file.
    monmax('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_monmax.nc')
```

---

monmean	*Determine monthly means.*

Description

The function determines monthly mean values from data of a single CM SAF NetCDF input file.

Usage

```
monmean(var, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of monthly means is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)
```

```
## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2000-03-31'), 'days')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,91))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the monthly mean of the example CM SAF NetCDF file and
## write the output to a new file.
  monmean('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_monmean.nc')
```

---

monmin	*Determine monthly minima.*

Description

The function determines monthly minimum values from data of a single CM SAF NetCDF input file.This function is applicable to 3-dimensional (lon,lat,time) NetCDF data.

Usage

```
monmin(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of monthly minima is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2000-03-31'), 'days')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,91))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the monthly minimum of the example CM SAF NetCDF file and
## write the output to a new file.
  monmin('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_monmin.nc')
```

---

monsd	*Determine monthly standard deviation.*

Description

The function determines monthly standard deviation values from data of a single CM SAF NetCDF input file. The application can be slow for large matrices.

Usage

```
monsd(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of monthly minima is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2000-03-31'), 'days')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,91))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the monthly standard deviation of the example CM SAF NetCDF
## file and write the output to a new file.
  monsd('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_monsd.nc')
```

---

monsum	*Determine monthly sums.*

Description

The function determines monthly sums from data of a single CM SAF NetCDF input file.

Usage

```
monsum(var, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of monthly sums is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2000-03-31'), 'days')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,91))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the monthly sums of the example CM SAF NetCDF file and write
## the output to a new file.
  monsum('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_monsum.nc')
```

---

muldpm   *Multiply by days per month.*

Description

This function multiplies each timestep of a timeseries by the number of days of the corresponding month. This can be useful to convert units, such as monthly millimeters per day (mm/d) to millimeters (mm). Leap-years are included.

Usage

```
muldpm(var, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of the lenght of infile is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
```

```
        vals=time,unlim=TRUE)
     var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
     vars <- list(var1)
     ncnew <- nc_create('CMSAF_example_file.nc',vars)
     ncvar_put(ncnew,var1,data)
     ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
     ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
     nc_close(ncnew)

   ## Multiply each timestep of the example CM SAF NetCDF file with the
   ## number of days per month and write the output to a new file.
     muldpm('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_muldpm.nc')
```

---

multimonmean	*Determine multi-monthly means.*

Description

The function determines multi-monthly mean values from data of a single CM SAF NetCDF input
file. The months are given as a vector of integers from 1 to 12. This allows means of user-defined
seasons.

Usage

```
multimonmean(var, month, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
month	Months, which should be averaged, in form of a comma seperated vector of integer values from 1 to 12 (integer).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-monthly means is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)
```

```
## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the mean of the monsoon seas from June to September of
## the example CM SAF NetCDF file and write the output to a new file.
  multimonmean('SIS',c(6,7,8,9),'CMSAF_example_file.nc',
  'CMSAF_example_file_multimonmean.nc')
```

| multimonsum | *Determine multi-monthly sums.* |

Description

The function determines multi-monthly sums from data of a single CM SAF NetCDF input file. The months are given as a vector of integers from 1 to 12. This allows sums of user-defined seasons.

Usage

```
multimonsum(var, month, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
month	Months, which should be summed, in form of a comma seperated vector of integer values from 1 to 12 (integer).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-monthly sums is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(0:150,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('rain','mm',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the sum of the monsoon seas from June to September of
## the example CM SAF NetCDF file and write the output to a new file.
  multimonsum('rain',c(6,7,8,9),'CMSAF_example_file.nc',
  'CMSAF_example_file_multimonsum.nc')
```

---

ncinfo	*Get information about the content of a NetCDF file.*

Description

Shows the content of a NetCDF file in three different detail levels.

Usage

```
ncinfo(infile, info)
```

Arguments

`infile`	Name of input NetCDF file (character).
`info`	The output can be: long ('l'), medium ('m') and short ('s') (character). Default is short ('s'). The option 'l' additionally returns a list object with file information.

Details

The function uses the ncdf4 package to get information of the content of infile.

Value

The function ncinfo prints the content of the infile NetCDF.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Get information on a medium detail level of the example CM SAF NetCDF file:
  ncinfo('CMSAF_example_file.nc', 'm')
```

---

read_ncvar *Read NetCDF variable.*

Description

This simple function reads a variable of a NetCDF file into R.

Usage

```
read_ncvar(var,infile)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).

Value

The output is a list object including the variable and the corressponding time variable. The dimension of the chosen variable is most commonly a two or three dimensional array.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
```

```
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Load the data of variable 'SIS' of the example file into R.
## To access the data use e.g., my.data$SIS
    my.data <- read_ncvar('SIS','CMSAF_example_file.nc')
```

---

remapbil   *Bilinear grid interpolation.*

Description

The function interpolates the data of infile1 to the grid of infile2. From infile2 only the grid information is used. Both grids have to be regular. For interpolation a simple bilinear interpolation is used as provided by the fields-package's interp.surface.grid function.

Usage

```
remapbil(var, infile1, infile2, outfile, nc34)
```

Arguments

var	Name of NetCDF variable in infile1 (character).
infile1	Filename of first input NetCDF file. This may include the directory (character). The data of infile1 are interpolated.
infile2	Filename of second input NetCDF file. This may include the directory (character). The grid information of infile2 are the target grid for the interpolation.
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the interpolated data of infile1 on the grid of infile2 is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
```

```
   lat <- seq(45,55,0.5)
   lon2 <- seq(5,15,1)
   lat2 <- seq(45,55,1)
   time <- c(as.Date('2000-01-01'), as.Date('2001-02-01'))
   origin <- as.Date('1983-01-01 00:00:00')
   time <- as.numeric(difftime(time,origin,units='hour'))
   data1 <- array(250:350,dim=c(21,21,1))
   data2 <- array(230:320,dim=c(21,21,1))

## create two example NetCDF files

   x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
   y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
   t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
   vals=time[1],unlim=TRUE)
   var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
   vars <- list(var1)
   ncnew <- nc_create('CMSAF_example_file_1.nc',vars)
   ncvar_put(ncnew,var1,data1)
   ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
   ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
   nc_close(ncnew)

   x <- ncdim_def(name='lon',units='degrees_east',vals=lon2)
   y <- ncdim_def(name='lat',units='degrees_north',vals=lat2)
   t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
   vals=time[1],unlim=TRUE)
   ncnew <- nc_create('CMSAF_example_file_2.nc',vars)
   ncvar_put(ncnew,var1,data2)
   ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
   ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
   nc_close(ncnew)

## Interpolate the fields of both example CM SAF NetCDF file 1 to the
## coarser grid of file 2 and write the result into one output file.
   remapbil('SIS','CMSAF_example_file_1.nc', 'CMSAF_example_file_2.nc',
   'CMSAF_example_file_remapbil.nc')
```

---

seas.anomaly	*Determine seasonal anomalies.*

Description

The function determines the seasonal means of a timeseries and substracts the corresponding multi-seasonal means to get seasonal anomalies.

Usage

```
seas.anomaly(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).

outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of seasonal anomalies is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the seasonal anomalies of the example CM SAF NetCDF file
## and write the output to a new file.
  seas.anomaly('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_seas.anomaly.nc')
```

---

seasmean	*Determine seasonal means.*

Description

The function determines seasonal mean values from data of a single CM SAF NetCDF input file. The seasonal mean is only determined if all three months of a season are available. For (north-) winter this are January. February and the December of the previous year (DJF). The other seasons are MAM, JJA, and SON.

Usage

```
seasmean(var, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of seasonal means is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
```

```
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Determine the seasonal means of the example CM SAF NetCDF file and
## write the output to a new file.
    seasmean('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_seasmean.nc')
```

---

sellonlatbox	*Select a region by longitude and latitude.*

Description

This function cuts a region from data of a CM SAF NetCDF file. The region is selected by giving
the coordinates of the lower left and upper right edge of a rectangular grid area.

Usage

```
sellonlatbox(var, infile, outfile, lon1, lon2, lat1, lat2, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
lon1	Longitude of lower left corner (numeric).
lon2	Longitude of upper right corner (numeric).
lat1	Latitude of lower left corner (numeric).
lat2	Latitude of upper right corner (numeric).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the selected region is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data
```

```
  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Cut a region of the example CM SAF NetCDF file and write the output
## to a new file.
  sellonlatbox('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_sellonlatbox.nc',8,12,48,52)
```

---

selmon	*Extract a list of months.*

Description

This function selects a given list of months from a timeseries.

Usage

```
selmon(var, month, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
month	Months, which should be selected, in form of a comma seperated vector of integer values from 1 to 12 (integer).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of the selected month is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Select all March and June values of the example CM SAF NetCDF file
## and write the output to a new file.
  selmon('SIS',c(3,6),'CMSAF_example_file.nc',
  'CMSAF_example_file_selmon.nc')
```

---

selperiod	*Extract a list of dates.*

Description

This function selects a time period from a timeseries.

Usage

```
selperiod(var, start, end, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
start	Startdate as character in form of 'YYYY-MM-DD' (e.g., '2001-12-31').
end	Enddate as character in form of 'YYYY-MM-DD' (e.g., '2014-01-01').
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the selected time period is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Select a 13-months period of the example CM SAF NetCDF file and write
## the output to a new file.
  selperiod('SIS','2001-01-01','2002-01-01','CMSAF_example_file.nc',
  'CMSAF_example_file_selperiod.nc')
```

---

selpoint   *Extract data at a given point.*

Description

This function extracts all data at a given point. A point is given by a pair of longitude and latitude coordinates. The function will find the closest grid point to the given coordinates and extracts the data for this point. The output-file can be optional in NetCDF or csv. The outfile is checked for the correct file extension.

Usage

```
selpoint(var, infile, outfile, lon1, lat1, format, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
lon1	Longitude of desired point (numeric).
lat1	Latitude of desired point (numeric).
format	Intended output format. Options are 'nc' or 'csv'. Default is 'nc' (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF or csv file including the selected point is written. The csv-file is tested for use in Excel and includes two coloumns (Time and Data), which are seperated by ';'.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))
```

```
## create example NetCDF

    x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
    y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
    t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
    vals=time,unlim=TRUE)
    var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
    vars <- list(var1)
    ncnew <- nc_create('CMSAF_example_file.nc',vars)
    ncvar_put(ncnew,var1,data)
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Select a point of the example CM SAF NetCDF file and write the output
## to a csv-file.
    selpoint('SIS','CMSAF_example_file.nc',
    'CMSAF_example_file_selpoint.nc',8,48,'csv')
```

---

selpoint.multi   *Extract data at multiple points.*

Description

This function extracts all data at given points. The points are given by a pair of vectors with longitude and latitude coordinates. The function will find the closest grid points to the given coordinates and extracts the data for these points. For each point a separate output file is written. The output-files can be optional in NetCDF or csv. Input can be a single NetCDF file (given by the infile attribute) or a bunch of NetCDF files (given by the path and pattern attributes).

Usage

```
selpoint.multi(var,infile,path,pattern,outpath,lon1,lat1,station_names,format,nc
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character). Infile is not needed if path and pattern are given.
path	Directory of input files (character). Will not be used if infile is given.
pattern	Pattern that all desired files in the 'path' directory have in common (character).
outpath	Directory were output files will be stored (character).
lon1	Longitude vector of desired points (numeric vector). lon1 must have the same length as lat1.
lat1	Latitude vector of desired points (numeric vector). lat1 must have the same length as lon1.
station_names	
	Optional vector of names, which will be used for the output files (character vector). station_names must have the same length as lon1 and lat1.
format	Intended output format. Options are 'nc' or 'csv'. Default is 'nc' (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

For each pair of longitude and latitude coordinates one separate NetCDF or csv file including the selected data is written. The csv-files are tested for use in Excel and include four coloumns (Time ; Data ; Longitude ; Latitude), which are seperated by ';'. If station_names are defined, the output files will be named according to this vector. Otherwise, the output files will be named as selpoint_longitude_latitude.format. Already existing files will be overwritten in case that station_names are given or renamed (e.g., selpoint1_longitude_latitude.nc) in case that no station_names are given.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

   x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
   y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
   t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
   vals=time,unlim=TRUE)
   var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
   vars <- list(var1)
   ncnew <- nc_create('CMSAF_example_file.nc',vars)
   ncvar_put(ncnew,var1,data)
   ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
   ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
   nc_close(ncnew)

## Select two points of the example CM SAF NetCDF file and write the output
## to a csv-file.
   selpoint.multi(var='SIS',infile='CMSAF_example_file.nc',
   outpath=getwd(),lon1=c(8,9),lat1=c(48,49),station_names=c("A","B"),format='csv')
```

---

seltime   *Extract specific timestep.*

Description

This function selects a given list of times from a timeseries.

Usage

```
seltime(var, hour_min, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`hour_min`	Times, which should be selected, in form of a vector of character values in the form of 'HH:MM:SS' (e.g. c('12:00:00')) (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of the selected times is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(ISOdate(2000,1,1), ISOdate(2000,1,6), 'hours')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,121))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
```

```
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Select all 12:00 and 21:00  values of the example CM SAF NetCDF
## file and write the output to a new file.
    seltime('SIS',c('12:00:00','21:00:00'),'CMSAF_example_file.nc',
    'CMSAF_example_file_seltime.nc')
```

---

selyear	*Extract a list of years.*

Description

This function selects a given list of years from a timeseries.

Usage

```
selyear(var, year, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
year	Year in form of a comma separated vector of integer values (e.g. c(2000,2015)) (integer).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of the selected years is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
```

```
   time <- as.numeric(difftime(time,origin,units='hour'))
   data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

   x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
   y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
   t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
   vals=time,unlim=TRUE)
   var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
   vars <- list(var1)
   ncnew <- nc_create('CMSAF_example_file.nc',vars)
   ncvar_put(ncnew,var1,data)
   ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
   ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
   nc_close(ncnew)

## Select all values of the year 2003 and 2006 of the example CM SAF
## NetCDF file and write the output to a new file.
   selyear('SIS',c(2003,2006),'CMSAF_example_file.nc',
   'CMSAF_example_file_selyear.nc')
```

---

timmax	*Determine all-time maxima.*

Description

The function determines all-time maximum values from data of a single CM SAF NetCDF input file.This function is applicable to 3-dimensional (lon,lat,time) NetCDF data.

Usage

```
timmax(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of all-time maxima is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2000-03-31'), 'days')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,91))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the all-time maximum of the example CM SAF NetCDF file and
## write the output to a new file.
  timmax('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_timmax.nc')
```

---

timmean	*Determine mean of a timeseries.*

Description

The function determines the temporal mean from data of a single CM SAF NetCDF input file and is useful to calculate climatological means. The function limits the timesteps, which are read at once, to avoid RAM overflow.

Usage

```
timmean(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).

nc34   NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4
                     format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the temporal mean is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the climatology of the example CM SAF NetCDF file and write
## the output to a new file.
  timmean('SIS','CMSAF_example_file.nc','CMSAF_example_file_timmean.nc')
```

---

timmin   *Determine all-time minima.*

Description

The function determines all-time minimum values from data of a single CM SAF NetCDF input
file.This function is applicable to 3-dimensional (lon,lat,time) NetCDF data.

Usage

```
timmin(var, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of all-time minima is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2000-03-31'), 'days')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,91))

## create example NetCDF

   x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
   y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
   t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
   vals=time,unlim=TRUE)
   var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
   vars <- list(var1)
   ncnew <- nc_create('CMSAF_example_file.nc',vars)
   ncvar_put(ncnew,var1,data)
   ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
   ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
   nc_close(ncnew)

## Determine the all-time minimum of the example CM SAF NetCDF file and
## write the output to a new file.
   timmin('SIS','CMSAF_example_file.nc','CMSAF_example_file_timmin.nc')
```

`timpctl`	*Determine percentile over all timesteps.*

Description

The function determines a given percentile over all timesteps from data of a single CM SAF NetCDF input file.

Usage

```
timpctl(var, p, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`p`	Percentile number given as probability within [0,1] (numeric). Default is 0.95.
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character)..
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of all-time seasonal standard deviations is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
```

```
    vals=time,unlim=TRUE)
    var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
    vars <- list(var1)
    ncnew <- nc_create('CMSAF_example_file.nc',vars)
    ncvar_put(ncnew,var1,data)
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Determine the 90% percentile of the example CM SAF
## NetCDF file and write the output to a new file.
    timpctl('SIS', 0.9,'CMSAF_example_file.nc', 'CMSAF_example_file_timsd.nc')
```

---

timsd	*Determine all-time standard deviations.*

Description

The function determines all-time standard deviation values from data of a single CM SAF NetCDF
input file.

Usage

```
timsd(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character)..
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of all-time standard deviations is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
```

```
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the all-time seasonal standard deviation of the example
## CM SAF NetCDF file and write the output to a new file.
  timsd('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_timsd.nc')
```

---

timsum	*Determine sum of a time series.*

Description

The function determines the temporal sum from data of a single CM SAF NetCDF input file and is useful to calculate climatological sums. The function limits the timesteps, which are read at once, to avoid RAM overflow.

Usage

```
timsum(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including the temporal sum is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the all-time sum of the example CM SAF NetCDF file and write
## the output to a new file.
  timsum('SIS','CMSAF_example_file.nc','CMSAF_example_file_timsum.nc')
```

---

trend	*Determine linear trends.*

Description

The function determines the trend from data of a single CM SAF NetCDF input file basing on a simple linear model. Depending on the file size, this function could be very time consuming, thus there are two available options. Option 1 (default) is using an apply approach and will read the whole data in once. This option is quite fast, but requires enough memory. Option 2 is using the same calculation, but reads the data pixel by pixel, which is very slow, but can also be applied for large data files, which would not fit into the memory at once.

Usage

```
trend(var, infile, outfile, option, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character). The file should include a time series of 2D fields to work in the desired way.
outfile	Filename of output NetCDF file. This may include the directory (character).
option	The way of data handling. Option = 1 is fast but memory consuming (default). Option = 2 is slow, but needs much less memory. Input is either 1 or 2 (numeric).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including three data layers is written. One layer (trend1) contains the linear trend multiplied by the number of time steps. In older versions of the package (<= 1.7) the trend was given in the same way as trend1. Another layer (trend2) contains just the calculated linear trend. An additional layer contains a measure for the significance of the calculated trends, which was derived using the 95

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)
```

```
## Determine the trend of the example CM SAF NetCDF file and write the
## output to a new file.
   trend('SIS','CMSAF_example_file.nc','CMSAF_example_file_trend.nc')
```

---

wfldmean   *Determine the weighted field mean.*

Description

The function determines area weigthed mean values from data of a single file. The calculation is
based on the 'weighted.mean' function of the 'raster' package.

Usage

```
wfldmean(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of area weighted spatial means is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
```

```
      y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
      t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
      vals=time,unlim=TRUE)
      var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
      vars <- list(var1)
      ncnew <- nc_create('CMSAF_example_file.nc',vars)
      ncvar_put(ncnew,var1,data)
      ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
      ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
      nc_close(ncnew)

  ## Determine the spatial means of the example CM SAF NetCDF file and
  ## write the output to a new file.
      wfldmean('SIS','CMSAF_example_file.nc','CMSAF_example_file_wfldmean.nc')
```

---

ydaymean	*Determine multi-year daily means.*

Description

The function determines multi-year daily mean values from data of a single CM SAF NetCDF input file.

Usage

```
ydaymean(var, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character)..
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year daily means is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data
```

```
  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2009-01-01'), as.Date('2010-12-31'), 'day')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,730))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the multi-year daily mean of the example CM SAF NetCDF
## file and write the output to a new file.
  ydaymean('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_ydaymean.nc')
```

---

year.anomaly   *Determine annual anomalies.*

Description

The function determines the annual means of a timeseries and substracts the climatology from each mean to get annual anomalies.

Usage

```
year.anomaly(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of annual anomalies is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the annual anomalies of the example CM SAF NetCDF file
## and write the output to a new file.
  year.anomaly('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_year.anomaly.nc')
```

---

yearmean	*Determine annual means*

Description

The function determines annual mean values from data of a single CM SAF NetCDF input file.

Usage

```
yearmean(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of annual means is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the annual means of the example CM SAF NetCDF file and
## write the output to a new file.
  yearmean('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_yearmean.nc')
```

| yearsum | *Determine annual sums.* |

Description

The function determines annual sums from data of a single CM SAF NetCDF input file.

Usage

```
yearsum(var, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character).
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of annual sums is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

 lon <- seq(5,15,0.5)
 lat <- seq(45,55,0.5)
 time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
 origin <- as.Date('1983-01-01 00:00:00')
 time <- as.numeric(difftime(time,origin,units='hour'))
 data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the annual sums of the example CM SAF NetCDF file and write
## the output to a new file.
  yearsum('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_yearsum.nc')
```

---

ymonmax   *Determine multi-year monthly maxima.*

Description

The function determines multi-year monthly maximum values from data of a single CM SAF NetCDF input file.

Usage

```
ymonmax(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character)..
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year monthly maxima is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
```

```
        var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
        vars <- list(var1)
        ncnew <- nc_create('CMSAF_example_file.nc',vars)
        ncvar_put(ncnew,var1,data)
        ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
        ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
        nc_close(ncnew)

    ## Determine the multi-year monthly maximum of the example CM SAF NetCDF
    ## file and write the output to a new file.
        ymonmax('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_ymonmax.nc')
```

---

ymonmean	*Determine multi-year monthly means.*

Description

The function determines multi-year monthly mean values from data of a single CM SAF NetCDF input file.

Usage

```
ymonmean(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character)..
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year monthly means is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
```

```
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the multi-year monthly mean of the example CM SAF NetCDF
## file and write the output to a new file.
  ymonmean('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_ymonmean.nc')
```

---

ymonmin	*Determine multi-year monthly minima.*

Description

The function determines multi-year monthly minimum values from data of a single CM SAF NetCDF input file.

Usage

```
ymonmin(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character)..
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year monthly minima is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the multi-year monthly minimum of the example CM SAF NetCDF
## file and write the output to a new file.
  ymonmin('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_ymonmin.nc')
```

---

ymonsd   *Determine multi-year monthly standard deviations.*

Description

The function determines multi-year monthly standard deviation values from data of a single CM SAF NetCDF input file.

Usage

```
ymonsd(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character)..
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year monthly standard deviations is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the multi-year monthly standard deviation of the example
## CM SAF NetCDF file and write the output to a new file.
  ymonsd('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_ymonsd.nc')
```

---

ymonsum	*Determine multi-year monthly sums.*

Description

The function determines multi-year monthly sums from data of a single CM SAF NetCDF input file.

Usage

```
ymonsum(var, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character)..
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year monthly sums is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(0:150,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('rain','mm',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the multi-year monthly sum of the example CM SAF NetCDF
## file and write the output to a new file.
  ymonsum('rain','CMSAF_example_file.nc', 'CMSAF_example_file_ymonsum.nc')
```

---

yseasmax   *Determine multi-year seasonal maxima.*

Description

The function determines multi-year seasonal maximum values from data of a single CM SAF NetCDF input file.

Usage

```
yseasmax(var, infile, outfile, nc34)
```

Arguments

`var`	Name of NetCDF variable (character).
`infile`	Filename of input NetCDF file. This may include the directory (character).
`outfile`	Filename of output NetCDF file. This may include the directory (character)..
`nc34`	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year seasonal maxima is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
```

```
    var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
    vars <- list(var1)
    ncnew <- nc_create('CMSAF_example_file.nc',vars)
    ncvar_put(ncnew,var1,data)
    ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
    ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
    nc_close(ncnew)

## Determine the multi-year seasonal maximum of the example CM SAF
## NetCDF file and write the output to a new file.
    yseasmax('SIS','CMSAF_example_file.nc', 'CMSAF_example_file_yseasmax.nc')
```

---

yseasmean   *Determine multi-year seasonal means.*

Description

The function determines multi-year seasonal mean values from data of a single CM SAF NetCDF
input file. The seasonal mean is only determined if all three months of a season are available. For
(north-) winter this are January. February and the December of the previous year (DJF). The other
seasons are MAM, JJA, and SON.

Usage

```
yseasmean(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character).
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year seasonal means is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data
```

```
  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the multi-year seasonal means of the example CM SAF NetCDF
## file and write the output to a new file.
  yseasmean('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_yseasmean.nc')
```

---

yseasmin	*Determine multi-year seasonal minima.*

Description

The function determines multi-year seasonal minimum values from data of a single CM SAF NetCDF input file.

Usage

```
yseasmin(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character)..
nc34	NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4 format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year seasonal minima is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the multi-year seasonal minimum of the example CM SAF
## NetCDF file and write the output to a new file.
  yseasmin('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_yseasmin.nc')
```

---

yseassd   *Determine multi-year seasonal standard deviations.*

Description

The function determines multi-year seasonal standard deviation values from data of a single CM SAF NetCDF input file.

Usage

```
yseassd(var, infile, outfile, nc34)
```

Arguments

var	Name of NetCDF variable (character).
infile	Filename of input NetCDF file. This may include the directory (character).
outfile	Filename of output NetCDF file. This may include the directory (character)..

nc34   NetCDF version of output file. If nc34=4 the output file will be in NetCDFv4
                    format (numeric). Default output is NetCDFv3.

Value

A NetCDF file including a timeseries of multi-year seasonal standard deviations is written.

Author(s)

Steffen Kothe

Examples

```
## Create an example NetCDF file with a similar structure
## as used by CM SAF. The file is created with the ncdf4 package.
## Alternatively example data can be freely downloaded here:
## <https://wui.cmsaf.eu/>

library(ncdf4)

## create some (non-realistic) example data

  lon <- seq(5,15,0.5)
  lat <- seq(45,55,0.5)
  time <- seq(as.Date('2000-01-01'), as.Date('2010-12-31'), 'month')
  origin <- as.Date('1983-01-01 00:00:00')
  time <- as.numeric(difftime(time,origin,units='hour'))
  data <- array(250:350,dim=c(21,21,132))

## create example NetCDF

  x <- ncdim_def(name='lon',units='degrees_east',vals=lon)
  y <- ncdim_def(name='lat',units='degrees_north',vals=lat)
  t <- ncdim_def(name='time',units='hours since 1983-01-01 00:00:00',
  vals=time,unlim=TRUE)
  var1 <- ncvar_def('SIS','W m-2',list(x,y,t),-1,prec='short')
  vars <- list(var1)
  ncnew <- nc_create('CMSAF_example_file.nc',vars)
  ncvar_put(ncnew,var1,data)
  ncatt_put(ncnew,'lon','standard_name','longitude',prec='text')
  ncatt_put(ncnew,'lat','standard_name','latitude',prec='text')
  nc_close(ncnew)

## Determine the multi-year seasonal standard deviation of the example
## CM SAF NetCDF file and write the output to a new file.
  yseassd('SIS','CMSAF_example_file.nc',
  'CMSAF_example_file_yseassd.nc')
```

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