Package 'climodr'

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Type Package

Title Climate Modeling with Point Data from Climate Stations

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Description An automated and streamlined workflow for predictive climate mapping using climate station data. Works within an environment the user provides a destined path to - otherwise it's tempdir(). Quick and relatively easy creation of resilient and reproducible climate models, predictions and climate maps, shortening the usually long and complicated work of predictive modelling. For more information, please find the provided URL. Many methods in this package are new, but the main method is based on a workflow from Meyer (2019) <doi:10.1016/j.ecolmodel.2019.108815> and Meyer (2022) <doi:10.1038/s41467-022-29838-9> , however, it was generalized and adjusted in the context of this package.

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Encoding UTF-8

LazyData true

Imports caret, CAST, corrplot, doParallel, dplyr, grDevices, lares, magrittr, parallel, rlang, stats, stringr, terra, tidyr, utils

Depends R (>= 2.10)

Suggests knitr, rmarkdown, testthat (>= 3.0.0), pls, randomForest, sp

VignetteBuilder knitr

RoxygenNote 7.3.2

Config/testthat/edition 3

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BugReports https://github.com/envima/climodr/issues

NeedsCompilation no

Repository CRAN

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Contents

autocorr *Autocorrelation*

Description

Tests the final.csv created with ‘fin.csv‘ on autocorrelation to produce reliable models.

Usage

```
autocorr(
  envrmt = .GlobalEnv$envrmt,
  method = "monthly",
  resp,
  pred,
  plot.corrplot = TRUE,
  corrplot = "coef"
)
```

Arguments

envrmt	variable name of your envrmt list created using climodr's ‘envi.create‘ function. Default = envrmt.
method	character. Choose the time scale your data is preserved in. Either "annual", "monthly" or "daily".
resp	numerical. Vector or single input of the columns in the final.csv that contain your sensor data ("response variables"). The function will create one file per variable.
pred	numerical. Vector or single input. The columns of your predictor variables, that you want to test for autocorrelation with the response variables.
plot.corrplot	logical. Should correlation matrices be plotted?
corrplot	character. Vector or single input. If plot.corrplot is true, you can choose the design of the correlation plot. You can choose from "coef", "crossout", "blank". Default is "coef".

Value

One .csv file per response variable. These will later be used when ‘autocorrelation‘ is set ‘TRUE‘ during ‘calc.model‘.

See Also

‘calc.model‘

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

#prepare csv-files
prep.csv(envrmt = envrmt,
         method = "proc",
         save_output = TRUE)

#process csv-files
csv_data <- proc.csv(envrmt = envrmt,
                     method = "monthly",
                     rbind = TRUE,
                     save_output = TRUE)

# Crop all raster bands
crop.all(envrmt = envrmt,
         method = "MB_Timeseries",
         overwrite = TRUE)

# Calculate Indices from cropped raster bands
calc.indices(envrmt = envrmt,
             vi = "all",
             bands = c("blue", "green", "red",
                       "nir", "nirb",
                       "re1", "re2", "re3",
                       "swir1", "swir2"),
             overwrite = TRUE)

#extract station coordinates
csv_spat <- spat.csv(envrmt = envrmt,
                     method = "monthly",
                     des_file = "plot_description.csv",
                     save_output = TRUE)


#extract predictor values from raster files
csv_fin <- fin.csv(envrmt = envrmt,
                   method = "monthly",
                   save_output = TRUE)

# Test data for autocorrelation after running fin.csv
autocorr(envrmt = envrmt,
         method = "monthly",
         resp = 5,
         pred = c(8:23),
         plot.corrplot = FALSE)
```

calc.indices *Calculate spectral indices*

Description

Calculates a set of spectral indices to have more predictor variables available when further modeling.

Usage

```
calc.indices(
  envrmt = .GlobalEnv$envrmt,
  vi = "all",
 bands = c("blue", "green", "red", "nir", "nirb", "re1", "re2", "re3", "swir1", "swir2"),
  overwrite = FALSE
)
```

Arguments

envrmt	variable name of your envrmt list created using climodr's 'envi.create' function. Default = envrmt.
vi	Character. Either "all" or vector containing the preferred spectral indices. See 'Details' for more information.
bands	Character. Vector with lenght(bands) = 10. Contains the names of the bands in the Raster Stack. If bands from the *Usage* example vector dont exist, use "NA" in their position. See 'Details' for more information.
overwrite	logical. Argument passed down from 'terra'-package. Overwrite existing files?

Value

SpatRaster-Stack

See Also

'crop.all', 'fin.csv'

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

# Crop all raster bands
crop.all(envrmt = envrmt,
```

```
          method = "MB_Timeseries",
          overwrite = TRUE)

# Calculate Indices from cropped raster bands
calc.indices(envrmt = envrmt,
             vi = "all",
             bands = c("blue", "green", "red",
                       "nir", "nirb",
                       "re1", "re2", "re3",
                       "swir1", "swir2"),
             overwrite = TRUE)
```

`calc.model` *Modelling*

Description

Creates Models for each climate value

Usage

```
calc.model(
  envrmt = .GlobalEnv$envrmt,
  method = "monthly",
  timespan,
  climresp,
  classifier = c("rf", "pls", "lm", "glm"),
  seed = NULL,
  p = 0.8,
  folds = "all",
  predrows,
  mnote = NULL,
  k = NULL,
  tc_method = "cv",
  metric = "RMSE",
  doParallel = FALSE,
  autocorrelation = FALSE,
  ...
)
```

Arguments

`envrmt`	variable name of your envrmt list created using climodr's 'envi.create' function. Default = envrmt.
`method`	character. Time period of your desired model. Default: "monthly"
`timespan`	numeric. Vector or single input. Should contain all years to be modeled. The years have to be the same format as in the tabular data.

climresp	numeric. Vector or single input. Should contain all column's in the tabular data that contain response variables.
classifier	vector or character. Model variants to be used. Supported models: Random Forest = "rf", Partial-Least-Squares = "pls", Neural Networks = "nnet", Linear Regression = "lm" or generalized boosted regression = "gbm".
seed	integer. Seed to reproduce the same model over and over.
p	numeric. Between 0 and 1. Percentage of data used for cross validation. Default = 0.8
folds	character. Vector or single input. Either folding over location only "LLO", over time only "LTO", or over both "LLTO". Use "all" to use all possibilitys.
predrows	numeric. Vector or single input. Should contain the rows where all the predictor values are stored in.
mnote	character. Model note for special modifications used. Default: "normal"
k	integer. When 'fold' = "LLO" or "LTO". Set k to the number of unique spatial or temporal units. Leave out to use preset values.
tc_method	character. Method for train control function from caret package. Default = "cv".
metric	character. See 'train'.
doParallel	logical. Parallelization accelerates the modelling process. Warning: Your PC will slow down drastically. Make sure to not run any other heavy processes during this.
autocorrelation	logical. Should autocorrelating data in the predictor variables be excluded from the model run? Only works if 'autocorr' has been executed beforehand.
...	arguments passed down from other functions.

Value

data frame.

See Also

'autocorr'

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

#prepare csv-files
prep.csv(envrmt = envrmt,
         method = "proc",
         save_output = TRUE)
```

```
#process csv-files
csv_data <- proc.csv(envrmt = envrmt,
                     method = "monthly",
                     rbind = TRUE,
                     save_output = TRUE)

# Crop all raster bands
crop.all(envrmt = envrmt,
         method = "MB_Timeseries",
         overwrite = TRUE)

# Calculate Indices from cropped raster bands
calc.indices(envrmt = envrmt,
             vi = "all",
             bands = c("blue", "green", "red",
                       "nir", "nirb",
                       "re1", "re2", "re3",
                       "swir1", "swir2"),
             overwrite = TRUE)

#extract station coordinates
csv_spat <- spat.csv(envrmt = envrmt,
                     method = "monthly",
                     des_file = "plot_description.csv",
                     save_output = TRUE)


#extract predictor values from raster files
csv_fin <- fin.csv(envrmt = envrmt,
                   method = "monthly",
                   save_output = TRUE)

# Test data for autocorrelation after running fin.csv
autocorr(envrmt = envrmt,
         method = "monthly",
         resp = 5,
         pred = c(8:23),
         plot.corrplot = FALSE)

# Create 36 different models (12 months x 3 classifiers) for every month in 2017
calc.model(envrmt = envrmt,
           method = "monthly",
           timespan = c(2017),
           climresp = 5,
           classifier = c("rf",
                          "pls",
                          "lm"),
           seed = 707,
           p = 0.8,
           folds = "LLO",
           mnote = "normal",
           predrows = c(8:23),
```

```
              tc_method = "cv",
              metric = "RMSE",
              autocorrelation = TRUE,
              doParallel = FALSE)
```

---

clim.sample *Load in Example Data*

Description

Climodr comes with a full set of example data. But since this package runs primarily with data, that is not linked to the global environment, but saved in local folders build via 'envi.create', one can't just load example data. This function will load all the example data used in the vignette into your climodr environment. This way you can run all the code from the vignette.

Usage

```
clim.sample(envrmt = .GlobalEnv$envrmt)
```

Arguments

envrmt	variable name of your envrmt list created using climodr's 'envi.create' function. Default = envrmt.

Value

Multiple files used by the climodr vignette

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)
```

climplot *Create Maps using the 'terra' package graphic parameters*

Description

Plot results of climodr into maps. Right now maps are created using the terra package. The maps created are very basic. Will be updated to run with tidyterra in future.

Usage

```
climplot(
  envrmt = .GlobalEnv$envrmt,
  mnote,
  sensor,
  aoa = FALSE,
  mapcolors = rev(grDevices::terrain.colors(50)),
  scale_position = "bottomleft",
  north_position = "topright"
)
```

Arguments

envrmt	variable name of your envrmt list created using climodr's 'envi.create' function. Default = envrmt.
mnote	character. The modelnote you want to create maps of.
sensor	character. The sensor you want to create maps for.
aoa	logical. Do you want the area of applicability to be added to your map?
mapcolors	The color pallete you want to use for the map. Default is 'rev(grDevices::terrain.colors(50))'
scale_position	character. Graphical parameter. The relative positiion of the Scale for the map. See 'terra::plot' for more details.
north_position	character. Graphical parameter. The relative positiion of the Scale for the map. See 'terra::plot' for more details.

Value

Maps in PNG-Format to your harddrive.

See Also

'terra::plot'

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

#prepare csv-files
prep.csv(envrmt = envrmt,
         method = "proc",
         save_output = TRUE)

#process csv-files
csv_data <- proc.csv(envrmt = envrmt,
                     method = "monthly",
                     rbind = TRUE,
                     save_output = TRUE)

# Crop all raster bands
crop.all(envrmt = envrmt,
         method = "MB_Timeseries",
         overwrite = TRUE)

# Calculate Indices from cropped raster bands
calc.indices(envrmt = envrmt,
             vi = "all",
             bands = c("blue", "green", "red",
                       "nir", "nirb",
                       "re1", "re2", "re3",
                       "swir1", "swir2"),
             overwrite = TRUE)

#extract station coordinates
csv_spat <- spat.csv(envrmt = envrmt,
                     method = "monthly",
                     des_file = "plot_description.csv",
                     save_output = TRUE)


#extract predictor values from raster files
csv_fin <- fin.csv(envrmt = envrmt,
                   method = "monthly",
                   save_output = TRUE)

# Test data for autocorrelation after running fin.csv
autocorr(envrmt = envrmt,
         method = "monthly",
         resp = 5,
         pred = c(8:23),
         plot.corrplot = FALSE)
```

```
# Create 36 different models (12 months x 3 classifiers) for every month in 2017
calc.model(envrmt = envrmt,
           method = "monthly",
           timespan = c(2017),
           climresp = 5,
           classifier = c("rf",
                          "pls",
                          "lm"),
           seed = 707,
           p = 0.8,
           folds = "LLO",
           mnote = "normal",
           predrows = c(8:23),
           tc_method = "cv",
           metric = "RMSE",
           autocorrelation = TRUE,
           doParallel = FALSE)

# Make predictions
climpred(envrmt = envrmt,
         method = "monthly",
         mnote = "normal",
         AOA = TRUE)

# Create a Temperature Map from the vignette model
climplot(envrmt = envrmt,
         mnote = "normal",
         sensor = "Ta_200",
         aoa = TRUE,
         mapcolors = rev(heat.colors(50)),
         scale_position = "bottomleft",
         north_position = "topright")
```

`climpred` *Predict sensor data area wide*

Description

Use the models created using ‘calc.model‘ to predict the modeled data onto a full spatial raster scene.

Usage

```
climpred(envrmt = .GlobalEnv$envrmt, method = "monthly", mnote, AOA = TRUE)
```

Arguments

`envrmt`	variable name of your envrmt list created using climodr's ‘envi.create‘ function. Default = envrmt.

method	Character. Either "daily", monthly" or "annual". Also depends on the available data.
mnote	Character. Model note to filter models for the fitting model run.
AOA	Logical. Should the Area of Applicability be calculated additional to the models?

Value

Multiple models.rds stored in the /workflow/models folder.

See Also

'autocorr', 'predict'

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

#prepare csv-files
prep.csv(envrmt = envrmt,
         method = "proc",
         save_output = TRUE)

#process csv-files
csv_data <- proc.csv(envrmt = envrmt,
                     method = "monthly",
                     rbind = TRUE,
                     save_output = TRUE)

# Crop all raster bands
crop.all(envrmt = envrmt,
         method = "MB_Timeseries",
         overwrite = TRUE)

# Calculate Indices from cropped raster bands
calc.indices(envrmt = envrmt,
             vi = "all",
             bands = c("blue", "green", "red",
                       "nir", "nirb",
                       "re1", "re2", "re3",
                       "swir1", "swir2"),
             overwrite = TRUE)

#extract station coordinates
csv_spat <- spat.csv(envrmt = envrmt,
                     method = "monthly",
                     des_file = "plot_description.csv",
```

```
                      save_output = TRUE)


#extract predictor values from raster files
csv_fin <- fin.csv(envrmt = envrmt,
                   method = "monthly",
                   save_output = TRUE)

# Test data for autocorrelation after running fin.csv
autocorr(envrmt = envrmt,
         method = "monthly",
         resp = 5,
         pred = c(8:23),
         plot.corrplot = FALSE)

# Create 36 different models (12 months x 3 classifiers) for every month in 2017
calc.model(envrmt = envrmt,
           method = "monthly",
           timespan = c(2017),
           climresp = 5,
           classifier = c("rf",
                          "pls",
                          "lm"),
           seed = 707,
           p = 0.8,
           folds = "LLO",
           mnote = "normal",
           predrows = c(8:23),
           tc_method = "cv",
           metric = "RMSE",
           autocorrelation = TRUE,
           doParallel = FALSE)

# Make predictions
climpred(envrmt = envrmt,
         method = "monthly",
         mnote = "normal",
         AOA = TRUE)

predlist <- list.files(envrmt$path_predictions,
                       pattern = ".tif")
head(predlist)
```

`crop.all` *Cropping tiff data*

Description

Crops input data to the extent size and reprojects them into project Coordinate reference system.

Usage

```
crop.all(
  envrmt = .GlobalEnv$envrmt,
  method = "MB_Timeseries",
  crs = NULL,
  ext = NULL,
  overwrite = FALSE,
  ...
)
```

Arguments

envrmt	variable name of your envrmt list created using climodr's 'envi.create' function. Default = envrmt.
method	character. Use "MB_Timeseries" for now. More methods are planned and will be added in future.
crs	Coordinate reference system Used to crop all images in folder_path. If crs it will automatically reprojected into this one. Default: crs of smallest Extent.
ext	SpatRaster, SpatVector or SpatExtent. Extent all data is cropped into. Default: Smallest Extent in folder_path.
overwrite	logical. Should existing files with the same filename be overwritten? Default = FALSE
...	arguments passed down from other functions.

Value

SpatRaster-Stack. Also saved to /workflow/rworkflow

See Also

'fin.csv', 'calc.indices'

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

# Crop all raster bands
crop.all(envrmt = envrmt,
         method = "MB_Timeseries",
         overwrite = TRUE)
```

envi.create *Create climodr environment*

Description

Creates an environment climodr will use during the calculation process. A list is returned with all paths to all folders. After creating the environment, all necessary data should be stored into the depending Input sub-folders. There is also an additional temp-folder, where temporary data is stored, which can be deleted after not being used anymore.

Usage

```
envi.create(proj_path = tempdir(), memfrac = NULL, ...)
```

Arguments

proj_path	character. Path to project directory. Climodr will work exclusively in this folder and create all project folders in here.
memfrac	numeric. Value between 0 and 0.9. The fraction of RAM that may be used by the terra package
...	arguments passed down from other functions.

Value

list. Contains all paths to each folder in the project directory. Necessary for climodr to operate its functions.

Examples

```
# create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)
```

ext_vignette *Extent file for vignette*

Description

A vector file containing the shape and extent of the Area used in the vignette

Usage

```
ext_vignette
```

Format

‘ext_vignette‘

class SpatVector
geometry polygons
dimensions 1, 1 (geometries, attributes)
extent 805737, 812824, 5890352, 5896005 (xmin, xmax, ymin, ymax)
coord. ref. WGS 84 / UTM zone 32N (EPSG:32632)
values 1

Spat Vector

Source

Randomly created in (QGIS)[https://www.qgis.org/download/thank-you/].

`fin.csv` *Final aggregation for CSV-Data*

Description

Extract the raster values of all raster layers from a scene at the station coordinates at each time stamp. The extracted data will be attached to the station data so there is a .csv-file with coordinates, sensor data (response values) and extracted raster data (predictor values). The data is ready to be used for modelling.

Usage

```
fin.csv(
  envrmt = .GlobalEnv$envrmt,
  method = "monthly",
  crs = NULL,
  save_output = TRUE,
  ...
)
```

Arguments

`envrmt`	variable name of your envrmt list created using climodr's ‘envi.create‘ function. Default = envrmt.
`method`	character. Either "daily", monthly" or "annual". Also depends on the available data.
`crs`	character. If null, coordinate reference system from project files will be taken. Otherwise data will be reprojected into this crs.
`save_output`	logical. If cleaned data should be saved permanently in the Environment put save_output = TRUE. Otherwise the output will be saved in the temporary directory. Default: FALSE.
`...`	arguments passed down from other functions.

Value

List

See Also

‘prep.csv‘, ‘proc.csv‘, ‘spat.csv‘, ‘calc.indices‘

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

#prepare csv-files
prep.csv(envrmt = envrmt,
         method = "proc",
         save_output = TRUE)

#process csv-files
csv_data <- proc.csv(envrmt = envrmt,
                     method = "monthly",
                     rbind = TRUE,
                     save_output = TRUE)

# Crop all raster bands
crop.all(envrmt = envrmt,
         method = "MB_Timeseries",
         overwrite = TRUE)

# Calculate Indices from cropped raster bands
calc.indices(envrmt = envrmt,
             vi = "all",
             bands = c("blue", "green", "red",
                       "nir", "nirb",
                       "re1", "re2", "re3",
                       "swir1", "swir2"),
             overwrite = TRUE)

#extract station coordinates
csv_spat <- spat.csv(envrmt = envrmt,
                     method = "monthly",
                     des_file = "plot_description.csv",
                     save_output = TRUE)


#extract predictor values from raster files
csv_fin <- fin.csv(envrmt = envrmt,
                   method = "monthly",
                   save_output = TRUE)
```

```
head(csv_fin)
```

`plot_description` *Plot description file*

Description

Contains made up coordinates for imaginary climate stations for education purposes.

Usage

```
plot_description
```

Format

'plot_description' A data frame with 10 rows and 5 columns

plot imaginary station name and code

general imaginary category of climate station

region location name of climate station

lat Latitude Coordinate of climate station

lon Longitude Coordinate of climate station

elevation elevation of climate station

Source

Randomly created coordinates and stations extracted from a random climate map.

`prep.csv` *Preparing CSV-Data*

Description

Crops input data to the extent size and removes NA-Values

Usage

```
prep.csv(envrmt = .GlobalEnv$envrmt, method = "proc", save_output = TRUE, ...)
```

Arguments

envrmt	variable name of your envrmt list created using climodr's 'envi.create' function. Default = envrmt.
method	character. "proc" for ready-to-use data in separate .csv-files. "tube" for raw-data from the Tube Data Base. Default "proc"-Method.
save_output	logical. If cleaned data should be saved permanently in the Environment put save_output = TRUE. Otherwise the output will be saved in the temporary directory. Default: FALSE.
...	arguments passed down from other functions.

Value

List

See Also

'proc.csv', 'spat.csv', 'fin.csv'

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

#prepare csv-files
prep.csv(envrmt = envrmt,
         method = "proc",
         save_output = TRUE)

#check the created csv files
csv_files <- grep("_no_NAs.csv$",
                  list.files(envrmt$path_tworkflow),
                  value=TRUE)
csv_files
```

---

proc.csv *Processing CSV-Data*

Description

Calculate averaged sensor values aggregated to a given time interval.

Usage

```
proc.csv(
  envrmt = .GlobalEnv$envrmt,
  method = "monthly",
  rbind = TRUE,
  save_output = TRUE,
  ...
)
```

Arguments

envrmt	variable name of your envrmt list created using climodr's 'envi.create' function. Default = envrmt.
method	character. Either "daily", monthly" or "annual". Also depends on the available data.
rbind	logical. Create a single file with all climate stations. If FALSE, every station will be saved in a seperate file.
save_output	logical. If data should be saved permanently in the Environment put save_output = TRUE. Otherwise the output will be saved in the temporary directory. Default: TRUE.
...	arguments passed down from other functions.

Value

List

See Also

'prep.csv', 'spat.csv', 'fin.csv'

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

#prepare csv-files
prep.csv(envrmt = envrmt,
         method = "proc",
         save_output = TRUE)

#process csv-files
csv_data <- proc.csv(envrmt = envrmt,
                     method = "monthly",
                     rbind = TRUE,
                     save_output = TRUE)
```

```
head(csv_data)
```

`res_area` *Resolution and Area*

Description

This raster contains the area of interest as well as the desired model resolution (100 m * 100 m) and the project extent.

Usage

```
res_area
```

Format

'res_area' A binary Raster of pixels with value 1 in extent that belong to example area

class SpatRaster

dimensions 57, 71, 1 (nrow, ncol, nlyr)

resolution 100, 100 (x, y)

extent 805732, 812832, 5890310, 5896010 (xmin, xmax, ymin, ymax)

coord. ref. WGS 84 / UTM zone 32N (EPSG:32632)

name res_area

min/max 0/1

Source

Randomly created binary Spat Raster file with the project resolution of 100 m per pixel. Created in (QGIS)[https://www.qgis.org/download/thank-you/].

`sch_201707` *Spatial Raster File for Vignette*

Description

A spatial Raster file from a random area choose for the Vignette or as dummy data.

Usage

```
sch_201707
```

Format

'sch_201707' A Spat Raster with 8 spectral bands

class SpatRaster

dimensions 86, 151, 10 (nrow, ncol, nlyr)

resolution 100, 100 (x, y)

extent 801522.5, 816622.5, 5888973, 5897573 (xmin, xmax, ymin, ymax)

coord. ref. WGS 84 / UTM zone 32N (EPSG:32632)

names blue, green, red, nir, nirb, re1, re2, re3, swir1, swir2

min/max 33.90298/5479.6602

Source

Randomly created Spat Raster file from (Sentinel-2 Data)[https://browser.dataspace.copernicus.eu/?zoom=10&lat=52.96601&
THEME&visualizationUrl=U2FsdGVkX1

---

sch_dgm *Digital Ground Model for Vignette*

Description

A Digital Ground Model file from a random area choose for the Vignette or as dummy data.

Usage

```
sch_dgm
```

Format

'sch_dgm' A Digital Ground Model

class SpatRaster

dimensions 86, 151, 10 (nrow, ncol, nlyr)

resolution 100, 100 (x, y)

extent 801522.5, 816622.5, 5888973, 5897573 (xmin, xmax, ymin, ymax)

coord. ref. WGS 84 / UTM zone 32N (EPSG:32632)

names elevation

min/max 48.75315/94.67307

Source

Randomly extracted Digital Ground Model.

spat.csv *Spatial aggregation for CSV-Data*

Description

Extract station coordinates from meta-data and reproject the coordinates to the project coordinate reference system.

Usage

```
spat.csv(
  envrmt = .GlobalEnv$envrmt,
  method = "monthly",
  des_file,
  crs = NULL,
  save_output = TRUE,
  ...
)
```

Arguments

envrmt	variable name of your envrmt list created using climodr's 'envi.create' function. Default = envrmt.
method	character. Either "daily", monthly" or "annual". Also depends on the available data.
des_file	character. The filename and data type of the meta-data. (Only reads .csv)
crs	character. EPSG of the Coordinate Reference System, if no **res_area.tif** file is provided.
save_output	logical. If cleaned data should be saved permanently in the Environment put save_output = TRUE. Otherwise the output will be saved in the temporary directory. Default: TRUE
...	arguments passed down from other functions.

Value

Data Frame

See Also

'prep.csv', 'proc.csv', 'fin.csv'

Examples

```
#create climodr environment and allow terra-functions to use 70% of RAM
envrmt <- envi.create(proj_path = tempdir(),
                      memfrac = 0.7)

# Load the climodr example data into the current climodr environment
clim.sample(envrmt = envrmt)

#prepare csv-files
prep.csv(envrmt = envrmt,
         method = "proc",
         save_output = TRUE)

#process csv-files
csv_data <- proc.csv(envrmt = envrmt,
                     method = "monthly",
                     rbind = TRUE,
                     save_output = TRUE)

#extract station coordinates
csv_spat <- spat.csv(envrmt = envrmt,
                     method = "monthly",
                     des_file = "plot_description.csv",
                     save_output = TRUE)
head(csv_spat)
```

`Station_G06` *Station File (G06)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_G06
```

Format

'Station_G06' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

Station_G17 *Station File (G17)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_G17
```

Format

'Station_G17' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

Station_G20 *Station File (G20)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_G20
```

Format

'Station_G20' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

Station_G21 *Station File (G21)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_G21
```

Format

'Station_G21' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

Station_G25 *Station File (G25)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_G25
```

Format

'Station_G25' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

Station_G48 *Station File (G48)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_G48
```

Format

'Station_G48' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

Station_W10 *Station File (W10)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_W10
```

Format

'Station_W10' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

Station_W11 *Station File (W11)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_W11
```

Format

'Station_W11' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

Station_W19 *Station File (W19)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_W19
```

Format

'Station_W19' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

`Station_W20` *Station File (W20)*

Description

Contains made up climate data for imaginary climate stations for education purposes.

Usage

```
Station_W20
```

Format

'Station_W20' A data frame with 10 rows and 5 columns

plotID Plot ID of imaginary climate station

datetime Timestamp of record for station

Ta_200 Imaginary air temperature at 200 cm above ground

Source

Randomly created climate data at random created stations extracted from a random climate map made by climodr.

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