Package 'CDSim'

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Type Package

Title Simulating Climate Data for Research and Modelling

Version 0.1.1

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Description Generate synthetic station-based monthly climate time-series including temperature and rainfall, export to Network Common Data Form (NetCDF), and provide visualization helpers for climate workflows. The approach is inspired by statistical weather generator concepts described in Wilks (1992) <doi:10.1016/S0168-1923(99)00037-4> and Richardson (1981) <doi:10.1029/WR017i001p00182>.

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Encoding UTF-8

Imports ncdf4, lubridate, readr, dplyr, ggplot2, rlang, tidyr, vroom, tibble, stats

Suggests testthat (>= 3.0.0), knitr, rmarkdown

VignetteBuilder knitr

RoxygenNote 7.3.3

Config/testthat/edition 3

URL https://github.com/ikemillar/CDSim

BugReports https://github.com/ikemillar/CDSim/issues

NeedsCompilation no

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Repository CRAN

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Contents

`CDSim-package` *CDSim: Climate Data Simulation Toolkit*

Description

Tools for generating and exporting synthetic climate observation datasets.

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See Also

Useful links:

- https://github.com/ikemillar/CDSim
- Report bugs at https://github.com/ikemillar/CDSim/issues

`create_stations` *Create or load station metadata*

Description

Create a station metadata table (Station, LON, LAT) either by:

- loading from a CSV file,
- accepting an existing data.frame,
- or auto-generating synthetic stations in a bounding box.

Usage

```
create_stations(
  source = NULL,
  n = 10,
  bbox = c(-3.5, 1.5, 4.5, 11.5),
  seed = NULL
)
```

Arguments

source	Path to CSV file OR a data.frame with Station/LON/LAT OR NULL (to generate synthetic).
n	Integer number of stations to generate when source = NULL. Default 10.
bbox	numeric vector c(min_lon, max_lon, min_lat, max_lat). Default ~ Ghana bounding box.
seed	Optional numeric to make generation reproducible.

Value

A data.frame with columns Station, LON, LAT.

Examples

```
create_stations(n = 5, seed = 42)
create_stations(data.frame(Station="A", LON=0, LAT=5))
```

---

plot_station_timeseries

Plot Station Time Series with Seasonal Detection

Description

Creates a time-series plot for climate variables with automatic hemisphere-based season detection.

Usage

```
plot_station_timeseries(
  df,
  station,
  var = "Avg.Tn",
  smooth = TRUE,
  theme_dark = FALSE
)
```

Arguments

df	A tidy dataset containing columns: Station, Date, LAT, and variables.
station	Station name.
var	Climate variable to plot.
smooth	Add LOESS smoothing line.
theme_dark	Use dark theme.

Value

A ggplot object.

Examples

```
stations <- create_stations(n = 3)
sim <- simulate_climate_series(stations)
plot_station_timeseries(sim, station = "Station_1", var = "Avg.Tn")
```

---

safe_name *Make a safe filename*

Description

Ensures file names contain only safe ASCII characters.

Usage

```
safe_name(x)

safe_name(x)
```

Arguments

x	A character string to clean.

Value

A cleaned filename string.

`simulate_climate_series` *Simulate monthly climate time series for stations*

Description

Simulate monthly Tmin, Tmax, monthly total rainfall (Sum.Rf) and mean daily rainfall (Avg.Rf) for each station across a year range.

Usage

```
simulate_climate_series(
  stations,
  start_year = 1981,
  end_year = 2020,
  seed = NULL
)
```

Arguments

`stations`	data.frame from create_stations() (Station, LON, LAT)
`start_year`	integer (e.g., 1981)
`end_year`	integer (e.g., 2020)
`seed`	optional numeric seed

Details

This function simulates synthetic time-series climate data based on...

Value

A tidy data.frame with one row per station × month containing: Station, LON, LAT, Year, Month, Date, Avg.Tn, Avg.Tx, Sum.Rf, Avg.Rf

See Also

`write_station_csv()`, `write_station_netcdf()`

Examples

```
st <- create_stations(n = 3, seed = 1)
sim <- simulate_climate_series(st, 1981, 1982, seed = 42)
head(sim)
```

visualization *Visualization Functions for Climate Data*

Description

Visualization Functions for Climate Data

write_station_csv *Write station CSV Exports a simulated climate station dataset to a CSV file.*

Description

Write station CSV Exports a simulated climate station dataset to a CSV file.

Usage

```
write_station_csv(df, file = "simulated_station_climate.csv")
```

Arguments

df	A dataframe returned by simulate_climate_series().
file	The output CSV filename.

Value

Returns the file path invisibly.

Examples

```
stations <- create_stations(n = 3)
sim <- simulate_climate_series(stations)
tmp <- tempfile(fileext = ".csv")
write_station_csv(sim, tmp)
```

`write_station_netcdf` *Write station NetCDF (station x time) Exports a simulated climate station dataset to a NetCDF file.*

Description

Write station NetCDF (station x time) Exports a simulated climate station dataset to a NetCDF file.

Usage

```
write_station_netcdf(
  df,
  out_nc = "simulated_station_climate.nc",
  fillvalue = -9999
)
```

Arguments

`df`	station x time long dataframe returned by simulate_climate_series()
`out_nc`	Output NetCDF filename
`fillvalue`	Value used for missing entries

Value

Returns the file path invisibly.

Examples

```
stations <- create_stations(n = 3)
sim <- simulate_climate_series(stations)
tmp <- tempfile(fileext = ".nc")
write_station_netcdf(sim, tmp)
```

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