

Package ‘SolarData’

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Title Work with freely available solar data

Version 1.1

Imports raster, httr, textreadr, tiff, fields, geosphere, lubridate,
grDevices, tibble, RCurl

Description Download and manipulate some publicly available solar datasets.

Depends R (>= 3.5.0), ggplot2, insol, dplyr

Suggests

License GPL-2

Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

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BSRN.get

Get BSRN data

Description

Download Baseline Solar Radiation Network(BSRN) data in .dat.gz format.

Usage

```
BSRN.get(station, mmyy, directory, user, pwd)
```

Arguments

station	a three letter character string indicating the station name, e.g., "ale", "asp", "bar", "ber", etc.
mmyy	a vector of character strings indicating the month, e.g., for 2000 June, "0600"
directory	the directory for the downloads, default to current working directory
user	BSRN ftp user name
pwd	BSRN ftp password

Details

One needs to make sure that the station-to-archive files are available. The user name and password can be obtained from Amelie Driemel Amelie.Driemel@awi.de.

Value

A .dat.gz file, or .dat.gz files if `length(mmyy) > 1`, saved into your intended directory

Author(s)

D. Yang

See Also

[BSRN.list](#)

BSRN.list*List the available BSRN files*

Description

This function retrieves the directory listing, i.e., available files from <ftp://ftp.bsrn.awi.de/>.

Usage

```
BSRN.list(station, user, pwd)
```

Arguments

station	a vector of text string indicating the station abbreviations
user	BSRN ftp user name
pwd	BSRN ftp password

Details

BSRN ftp listing is dynamic. This function retrieves the most updated listing of BSRN station-to-archive files. You do not need to use this function very often. It is recommended to use it yearly to check on file updates.

Value

A list of tibbles, indicating the available file names.

Author(s)

D. Yang

See Also

[BSRN.read](#)

BSRN.loc	<i>Location metadata for BSRN</i>
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Description

BSRN location metadata

Usage

```
data("BSRN.loc")
```

Format

A data frame with 76 rows (stations) on the following 19 variables.

stn a character vector for station abbreviation
 full a character vector for station full name
 lat a numeric vector, in degrees
 lon a numeric vector, in degrees
 elev a numeric vector, in meters
 status a character vector showing the status of the stations, which can be either Active, Closed, or Candidate.
 tz a character vector
 LTF.Jan a numeric vector
 LTF.Feb a numeric vector

LTF.Mar a numeric vector
 LTF.Apr a numeric vector
 LTF.May a numeric vector
 LTF.Jun a numeric vector
 LTF.Jul a numeric vector
 LTF.Aug a numeric vector
 LTF.Sep a numeric vector
 LTF.Oct a numeric vector
 LTF.Nov a numeric vector
 LTF.Dec a numeric vector

Details

This dataset contains the metadata of the 76 BSRN stations. To facilitating fast retrieval of Linke turbidity values at these locations, they are preloaded.

BSRN.read	<i>Read and process the BSRN dataset</i>
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Description

This function reads and concatenates the daily BSRN files.

Usage

```
BSRN.read(file, directory, use.qc = TRUE, test = NULL, use.agg = FALSE, agg = 1)
```

Arguments

file	character strings indicating the file names for reading
directory	the directory for files
use.qc	boolean, indicating whether the built-in QC should be used
test	vector of character strings, indicating which QC tests are used. Options include "phy", "ext", "closr", "df", "clim", and "all".
use.agg	boolean, indicating whether aggregation needs to be performed. If TRUE, agg must be stated.
agg	numeric, aggregation interval in minute

Details

BSRN files are monthly station-to-archive files. This function processes one file at a time.

Value

a tibble of the read and aggregated data.

Author(s)

D. Yang

See Also

[BSRN.loc](#)

LTF.get

Read Linke turbidity factor from tiff maps

Description

Read monthly Linke turbidity factor from 12 tiff maps for any location(s) in the world.

Usage

```
LTF.get(lon, lat, directory)
```

Arguments

lon	a number or a numeric array, longitude of the location(s) for downloading
lat	a number or a numeric array, latitude of the location(s) for downloading
directory	the directory of the <i>downloaded</i> .tiff images

Details

Twelve monthly maps of Linke turbidity factor values were created given by latitude and longitude. Latitude is positive North, longitude is positive eastwards of longitude 0. The data are in gridded, raw format, no header (tiff images), 1 byte per value (unsigned int encoding), 2160 rows and 4320 columns. Cell size is 5' (approx. 10 km at mid-latitude). Upper left corner is 90 N, 180 W. Then, point 90 N, 179.5 W etc. Lower right is 90 S, 180 E.

Value

A $n \times 12$ matrix, where n is the number of lat-lon pairs.

Author(s)

D. Yang

OSMG.loc	<i>Location data for the OSMG</i>
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Description

Location metadata for the Oahu Solar Measurement Gird data

Usage

```
data("OSMG.loc")
```

Format

A data frame with 20 observations on the following 4 variables.

Location a factor with levels AP1 AP2 AP3 AP4 AP5 AP6 AP6T AP7 DH1 DH10 DH11 DH1T DH2 DH3 DH4 DH5 DH6 DH7 DH8 DH9

Pakbus a factor with levels 201 202 203 204 205 206 207 208 208T 209 209T 210 211 212 213 214 215 216 217 230

Latitude a numeric vector

Longitude a numeric vector

Details

These metadata include 17 LI-200 horizontal GHI pyranometers, 2 tilted paranometers, as well as a rotating shadowband radiometer that measures all three component, namely, GHI, DNI, and DHI (or DIF, diffuse horizontal irradiance)

Source

https://midcdmz.nrel.gov/oahu_archive/

Examples

```
data(OSMG.loc)
```

OSMG.read	<i>Read and process the OSMG dataset</i>
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Description

This function reads and concatenates the daily OSMG files.

Usage

```
OSMG.read(files, directory.LI200, directory.RSR = NULL,
          clear.sky = FALSE, AP2 = FALSE, agg = 1)
```

Arguments

files	character strings indicating the file names for reading
directory.LI200	the directory for the LI-200 files
directory.RSR	the directory for the LI-200 files
clear.sky	boolean, indicating whether the Ineichen–Perez clera-sky irradiance should be calculated
AP2	boolean, indicating whether 3-second data from AP2 should be joint to the 1-second data from other stations
agg	numeric, aggregation interval in seconds

Details

Since the RSR files and the LI-200 files have the same file names, it is advised to store these two group of files in two separate folders, and thus I define two path variables for this function.

Value

a tibble of the read and aggregated data.

Author(s)

D. Yang

See Also

[OSMG.loc](#)

PSM.get

Get NREL PSM version 3 data

Description

Use API to download NREL Physical Solar Model (PSM) version 3 data in .csv format.

Usage

```
PSM.get(lon, lat, api.key, attributes, name, affiliation, year, leap.year,
interval, utc, reason.for.use, email, mailing.list, directory = "data-raw")
```

Arguments

lon	a number or a numeric array, longitude of the location(s) for downloading
lat	a number or a numeric array, latitude of the location(s) for downloading
api.key	the API key as a character string, can be obtained at https://developer.nrel.gov/signup/

attributes	the parameters to be downloaded, options are: "air_temperature", "clearsky_dhi", "clearsky_dni", "clearsky_ghi", "cloud_type", "dew_point", "dhi", "dni", "fill_flag", "ghi", "relative_humidity", "solar_zenith_angle", "surface_albedo", "surface_pressure", "total_precipitable_water", "wind_direction", "wind_speed". This argument should be passed in as a character string. If more than one, separate them using comma without spaces.
name	your name as a character string, e.g., "John+Smith". Spaces need to be replaced with the + sign
affiliation	your affiliation as a character string, e.g., "National+Renewable+Energy+Lab". Spaces need to be replaced with the + sign.
year	the year to be downloaded, options are: "1998", "1999", ..., "2016", "tmy". This argument should be passed in as a character string. The API only allows downloading one year at a time
leap.year	a character string ("true" or "false") indicating whether you want the data on 29 Feb if it is a leap year
interval	a character string ("30" or "60") indicating whether you want 30 min or 60 min data
utc	a character string ("true" or "false") indicating whether you want the time to be UTC
reason.for.use	a character string indicating your purpose, e.g., "research+development"
email	your email as a character string, e.g., "john.smith@gmail.com"
mailing.list	a character string ("true" or "false") indicating whether you want to be on the NREL mailing list
directory	the directory for the downloads, default to "~/data-raw"

Details

NREL PSM v3 contains half-hourly, regularly-gridded, satellite-derived irradiance and other meteorological parameters.

Value

A .csv file, or .csv files if `length(lat) > 1`, saved into your intended directory

Author(s)

D. Yang

References

Manajit Sengupta, Yu Xie, Anthony Lopez, Aron Habte, Galen Maclaurin, and James Shelby, The National Solar Radiation Data Base (NSRDB), *Renewable and Sustainable Energy Reviews*, Volume 89, 2018, Pages 51-60, <https://doi.org/10.1016/j.rser.2018.03.003>.

SRTM.get	<i>Get NASA SRTM data</i>
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Description

Download NASA Shuttle Radar Topography Mission (SRTM) digital elevation model (DEM) data in .hgt format.

Usage

```
SRTM.get(resolution, files, directory = "data-raw")
```

Arguments

- resolution a number indicating the resolution of the DEM, two options are available: 1 or 3, see [SRTM.list](#)
- files character strings indicating the file names for downloading, see [SRTM.list](#) for available files
- directory the directory for the downloads, default to "~/data-raw"

Details

place holder for now

Value

A .dat file, or .dat files if length(day_of_year) > 1, saved into your intended directory

Author(s)

D. Yang

References

Bernhard Rabus, Michael Eineder, Achim Roth, Richard Bamler, The shuttle radar topography mission—a new class of digital elevation models acquired by spaceborne radar, *ISPRS Journal of Photogrammetry and Remote Sensing*, Volume 57, Issue 4, 2003, Pages 241-262, [https://doi.org/10.1016/S0924-2716\(02\)00124-7](https://doi.org/10.1016/S0924-2716(02)00124-7).

See Also

[SRTM.list](#), [SRTM.read](#)

`SRTM.list`*List the available SRTM files*

Description

This function retrieves the directory listing, i.e., available files from <https://dds.cr.usgs.gov/>.

Usage

```
SRTM.list(resolution, want.plot = TRUE)
```

Arguments

<code>resolution</code>	a number indicating the resolution of the DEM, two options are available: 1 or 3, see details
<code>want.plot</code>	boolean, if TRUE return plot

Details

Source: https://dds.cr.usgs.gov/srtm/version2_1/Documentation/Quickstart.pdf

SRTM data are distributed in two levels: SRTM1 (for the United States and its territories and possessions) with data sampled at 1 arc-second intervals in latitude and longitude (or 30 meters or 98 feet), and SRTM3 (for the world) sampled at 3 arc-seconds (or 90 meters or 295 feet). Three arc-second data are generated by three by three averaging of the one arc-second samples.

File names refer to the latitude and longitude of the lower left corner of the tile - e.g. N37W105 has its lower left corner at 37 degrees north latitude and 105 degrees west longitude. To be more exact, these coordinates refer to the geometric center of the lower left pixel. In addition, the files are separated by geographical zones, i.e., parent directory. For example, SRTM1 contains 7 zones, whereas SRTM3 divides the zones by continent.

SRTM3 files contain 1201 lines and 1201 samples. The rows at the north and south edges as well as the columns at the east and west edges of each cell overlap and are identical to the edge rows and columns in the adjacent cell. SRTM1 files contain 3601 lines and 3601 samples, with similar overlap.

Value

A vector of character strings, indicating the available file names.

Author(s)

D. Yang

See Also

[SRTM.get](#), [SRTM.read](#)

SRTM.read

Read SRTM .hgt files

Description

This function reads SRTM .hgt files and outputs a RasterLayer object or a data.frame (not recommended).

Usage

```
SRTM.read(files, as.data.frame = FALSE)
```

Arguments

`files` a vector of character strings indicating the file names to be read
`as.data.frame` boolean, if TRUE output a data.frame

Details

The SRTM1 has 3601×3601 cells, and SRTM3 has 1201×1201 cells. It is thus not recommended to convert the output into a data.frame. Moreover, the RasterLayer object is easier to work with using the **raster** package.

Value

A RasterLayer object or a data.frame

Author(s)

D. Yang

See Also

[SRTM.list](#), [SRTM.get](#)

SURFRAD.get

Get NOAA SURFRAD data

Description

Download NOAA Surface Radiation (SURFRAD) data in .dat format.

Usage

```
SURFRAD.get(station, year, day.of.year, directory = "data-raw")
```

Arguments

station	a character string indicating the station name, options are "Bondville_IL", "Boulder_CO", "Desert_Rock_NV", "Fort_Peck_MT", "Goodwin_Creek_MS", "Penn_State_PA", "Sioux_Falls_SD". Alternatively, abbreviations of the stations can be used, i.e., "bon", "tbl", "dra", "fpk", "gwn", "psu", "sxf", respectively
year	a character string indicating the four-digit year
day.of.year	days of year to be downloaded, as a numeric array
directory	the directory for the downloads, default to "~/data-raw"

Details

NOAA high-resolution, long-term, ground-based irradiance measurements at 7 locations.

Value

A .dat file, or .dat files if `length(day_of_year) > 1`, saved into your intended directory

Author(s)

D. Yang

References

J.A. Augustine, J.J. DeLuise, and C.N. Long, SURFRAD—A National Surface Radiation Budget Network for Atmospheric Research. *Bull. Amer. Meteor. Soc.*, Volume 81, Pages 2341–2358, [https://doi.org/10.1175/1520-0477\(2000\)081<2341:SANSRB>2.3.CO;2](https://doi.org/10.1175/1520-0477(2000)081<2341:SANSRB>2.3.CO;2)

SURFRAD.loc

Location metadata for SURFRAD

Description

SURFRAD location metadata

Usage

```
data("SURFRAD.loc")
```

Format

A data frame with 7 observations on the following 19 variables.

stn a factor with levels bon dra fpk gcm psu sxf tbl

full a factor with levels Bondville, Illinois Desert Rock, Nevada Fort Peck, Montana Goodwin Creek, Mississippi Penn. State Univ., Pennsylvania Sioux Falls, South Dakota Table Mountain, Boulder, Colorado

lat a numeric vector

lon a numeric vector

elev a numeric vector

tz a numeric vector
 install a factor with levels 1994-04 1994-11 1994-12 1995-07 1998-03 1998-06 2003-06
 LTF.Jan a numeric vector
 LTF.Feb a numeric vector
 LTF.Mar a numeric vector
 LTF.Apr a numeric vector
 LTF.May a numeric vector
 LTF.Jun a numeric vector
 LTF.Jul a numeric vector
 LTF.Aug a numeric vector
 LTF.Sep a numeric vector
 LTF.Oct a numeric vector
 LTF.Nov a numeric vector
 LTF.Dec a numeric vector

Details

This dataset contains the metadata of the 7 SURFRAD stations. To facilitating fast retrieval of Linke turbidity values at these locations, they are preloaded.

SURFRAD.read

Read and process the SURFRAD dataset

Description

This function reads and concatenates the daily SURFRAD files.

Usage

```
SURFRAD.read(files, directory, use.original.qc = FALSE, use.qc = TRUE,
              test = NULL, progress.bar = TRUE, agg = 1, additional.variables = NULL)
```

Arguments

files	character strings indicating the file names for reading
directory	the directory for files
use.original.qc	boolean, indicating whether the SURFRAD QC flags should be used
use.qc	boolean, indicating whether the built-in QC should be used
test	vector of character strings, indicating which QC tests are used. Options include "phy", "ext", "closr", "df", "clim", and "all".
progress.bar	boolean, indicating whether the progress bar should be used
agg	numeric, aggregation interval in minute
additional.variables	four compulsory variables are included, namely, "dw_solar", "direct_n", "diffuse", and "pressure". This function parameter allows the user to set additional variables for extraction, such as "temp" or "windspd". See the code for the available variable list.

Details

It is not recommended to put all files in a same folder. The SURFRAD FTP folder directory is good, keep that, and use a loop (outside of this function) to access all folders.

Value

a tibble of the read and aggregated data.

Author(s)

D. Yang

See Also

[SURFRAD.loc](#), [SURFRAD.get](#)

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