

Package ‘Rwtss’

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Title Client for Web Time-Series Service

Version 0.8.0

Maintainer Gilberto Camara <gilberto.camara@inpe.br>

Description Allows remote access to satellite image time series provided by web time series services (WTSS). The WTSS API includes functions for listing the data sets available in WTSS servers, describing the contents of a data set, and retrieving a time series based on spatial location and temporal filters.

URL <https://github.com/e-sensing/Rwtss/>

BugReports <https://github.com/e-sensing/Rwtss/issues>

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LazyData true

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Encoding UTF-8

Depends R (>= 3.6.0)

Imports assertthat, dplyr, geosphere, ggplot2, reshape2, jsonlite, lubridate, magrittr, purrr, httr, stats, stringr, tibble, zoo

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Suggests bfast, knitr, rmarkdown, roxygen2, testthat, spelling, vcr

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Author Gilberto Queiroz [aut] (<<https://orcid.org/0000-0001-7534-0219>>),
Gilberto Camara [aut, cre] (<<https://orcid.org/0000-0002-3681-487X>>),
Pedro Andrade [aut] (<<https://orcid.org/0000-0001-8675-4046>>),
Felipe Souza [aut],
Luiz Assis [aut]

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Rwtss-package	<i>Rwtss</i>
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Description

An R client to the web time series service (WTSS)

Rwtss API

Implements an R interface to a web time series service (WTSS) that offers time series of remote sensing data using a simple API. A WTSS server takes as input an Earth observation data cube, that has a spatial and a temporal dimension and can be multidimensional in terms of its attributes.

The WTSS API has four commands:

- ‘wtss’: given an URL, creates a connection to a WTSS service
- ‘list_coverages’: returns a list of coverages (cubes) available in the WTSS server.
- ‘describe_coverage’: returns the metadata for a given coverage.
- ‘time_series’: returns a time series for a spatio-temporal location.

Author(s)

Maintainer: Gilberto Camara <gilberto.camara@inpe.br> ([ORCID](#))

Authors:

- Gilberto Queiroz <gilberto.queiroz@inpe.br> ([ORCID](#))
- Pedro Andrade <pedro.andrade@inpe.br> ([ORCID](#))
- Felipe Souza <felipe.carvalho@inpe.br>
- Luiz Assis <luiz.assis@inpe.br>

See Also

Useful links:

- <https://github.com/e-sensing/Rwtss/>
- Report bugs at <https://github.com/e-sensing/Rwtss/issues>

.wtss_coverage_description

Decodes the description from a WTSS coverage

Description

creates a tibble to store the description of the WTSS coverage

Usage

```
.wtss_coverage_description(URL, cov)
```

Arguments

URL	URL of the coverage
cov	coverage response provided by WTSS service

`.wtss_get_response` *Get a response to the WTSS server*

Description

Sends a request to the WTSS server and gets a response

Usage

```
.wtss_get_response(request)
```

Arguments

`request` valid request according to the WTSS protocol

Value

response from the server

`.wtss_ggplot_series` *Plot one timeSeries using ggplot*

Description

Plots a set of time series using ggplot. This function is used for showing the same lat/long location in a series of time steps.

Usage

```
.wtss_ggplot_series(row, colors = "Dark2")
```

Arguments

`row` A row of a sits tibble with the time series to be plotted.
`colors` The set of Brewer colors to be used for plotting.

.wtss_guess_satellite *Try a best guess for the type of sensor/satellite*

Description

Based on resolution, tries to guess what is the satellite.

Usage

.wtss_guess_satellite(xres)

Arguments

xres xres of the coverage

Value

Satellite sensor pair

Author(s)

Gilberto Camara, <gilberto.camara@inpe.br>

.wtss_list_coverages *Retrieves the list of cubes from the URL server*

Description

Use the WTSS protocol to find out available coverages

Usage

.wtss_list_coverages(URL)

Arguments

URL URL of the WTSS service

Value

updated WTSS object.

.wtss_parse_json *Parse a JSON response from the WTSS server*

Description

Parse a JSON response from the WTSS service

Usage

`.wtss_parse_json(response)`

Arguments

response valid JSON response from the WTSS service

Value

parsed JSON document

.wtss_process_request *Process a request to the WTSS server*

Description

Process a request

Usage

`.wtss_process_request(request)`

Arguments

request valid request to the WTSS service

Value

parsed JSON document

.wtss_remove_trailing_dash

Remove trailing dashes from a WTSS server address

Description

The WTSS URL cannot have a trailing dash. This functions checks and removes it, if present.

Usage

.wtss_remove_trailing_dash(URL)

Arguments

URL A WTSS URL

Value

URL without trailing dash

.wtss_send_request *Send a request to WTSS server*

Description

Sends a request to the WTSS server and times out after 10 tries

Usage

.wtss_send_request(request)

Arguments

request valid request according to the WTSS protocol

Value

response from the server

`.wtss_tibble`*Create a tibble to store the time series information*

Description

This function returns an empty tibble that contains the satellite image time series and its meta-data. The columns are <longitude, latitude, start_date, end_date, label, cube, time_series>. WTSS functions produce a tibble as output.

Usage

```
.wtss_tibble()
```

Value

A tibble.

Author(s)

Gilberto Camara, <gilberto.camara@inpe.br>

`.wtss_time_series_processing`*Processing a Time Series Result from WTSS*

Description

Processing a Time Series Result from WTSS

Usage

```
.wtss_time_series_processing(items)
```

Arguments

`items` Items retrieved from WTSS server

Value

tibble with a time series

.wtss_to_tibble *Import time series in the zoo format to a tibble*

Description

Converts data from an instance of a zoo series to a sits tibble.

Usage

```
.wtss_to_tibble(  
  ts,  
  name,  
  bands,  
  longitude,  
  latitude,  
  start_date,  
  end_date,  
  cov_desc  
)
```

Arguments

ts	list of time series retrieved by WTSS
name	Name of the coverage where data comes from.
bands	Bands to be retrieved from the time series.
longitude	Longitude of the chosen location.
latitude	Latitude of the chosen location.
start_date	Starting date of the time series
end_date	End date of the time series
cov_desc	Description of the WTSS coverage

Value

Time series in sits tibble format.

Author(s)

Gilberto Camara, <gilberto.camara@inpe.br>

describe_coverage	<i>Retrieves the list of cubes from the URL server</i>
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Description

Contacts the WTSS server to describe one coverage

Usage

```
describe_coverage(URL, name, .print = TRUE)
```

Arguments

URL	URL of the server
name	name of coverage
.print	Print the coverage description

Value

tibble with coverage description

Examples

```
# Using external server  
describe_coverage("http://www.esensing.dpi.inpe.br/wtss", "MOD13Q1")
```

list_coverages	<i>List the coverages available in the WTSS service</i>
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Description

Lists coverages available in the WTSS service

Usage

```
list_coverages(URL)
```

Arguments

URL	URL of the server
-----	-------------------

Value

vector with coverage name

Examples

```
# Using external server
list_coverages("http://www.esensing.dpi.inpe.br/wtss")
```

plot

Generic interface for plotting time series

Description

Given a tibble with a set of time series, plot them.

Usage

```
## S3 method for class 'wtss'
plot(x, y, ..., colors = "Dark2")
```

Arguments

x	object of class "wtss"
y	ignored
...	further specifications for plot .
colors	Color palette to be used (based on Color Brewer - default is "Dark2").

Value

Input tibble (useful for chaining functions).

Author(s)

Gilberto Camara, <gilberto.camara@inpe.br>

Examples

```
# Access to external service
# Read one time series from the WTSS server
# plot one time series
wtss_server <- "http://www.esensing.dpi.inpe.br/wtss"
ts <- Rwtss::time_series(wtss_server, name = "MOD13Q1",
  attributes = c("ndvi", "evi"),
  longitude = -45.00, latitude = -12.00,
  start_date = "2000-02-18", end_date = "2016-12-18")

plot(ts)
```

time_series	<i>Get time series</i>
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Description

Retrieves the time series for a pair of coordinates

Usage

```
time_series(  
  URL,  
  name,  
  attributes = NULL,  
  longitude,  
  latitude,  
  start_date = NULL,  
  end_date = NULL  
)
```

Arguments

URL	URL of the server
name	Coverage name.
attributes	Vector of band names.
longitude	Longitude in WGS84 coordinate system.
latitude	Latitude in WGS84 coordinate system.
start_date	Start date in the format yyyy-mm-dd or yyyy-mm depending on the coverage.
end_date	End date in the format yyyy-mm-dd or yyyy-mm depending on the coverage.

Value

time series in a tibble format (NULL)

Author(s)

Gilberto Camara

Examples

```
# connect to a WTSS server  
wtss_server <- "http://www.esensing.dpi.inpe.br/wtss"  
# retrieve a time series  
ndvi_ts <- Rwtss::time_series(wtss_server, "MOD13Q1", attributes = "ndvi",  
                             latitude = -10.408, longitude = -53.495)  
# plot the time series  
plot(ndvi_ts)
```

`wtss_to_ts`*Export data to be used to the ts format*

Description

Converts data from a wtss tibble to a time series "ts". A WTSS tibble contains data retrieved from a WTSS server. These data sets are time series with irregular intervals. Given that of many functions that use the R "ts" format, this function converts a time series (a tibble with data and metadata) to the "ts" format. Since "ts" requires regular time series, it interpolates the original irregular time series to a regular time series. To do this, the user needs to specify a period which is recognised by the "ts" format. This period can be either "month", "week", "day", "months", "weeks", "days" or 12, 52, 365. This function creates a new time series with the required frequency and interpolates the missing values using spline interpolation from the "zoo" package (`zoo::na.spline`).

Usage

```
wtss_to_ts(data, band = NULL, period = "week")
```

Arguments

<code>data</code>	A sits tibble with time series.
<code>band</code>	Name of the band to be exported (optional if series has only one band)
<code>period</code>	One of <code>c("month", "week", "day")</code> , <code>c("months", "weeks", "days")</code> or <code>c(12, 52, 365)</code>

Value

A time series in the ts format.

Author(s)

Gilberto Camara, <gilberto.camara@inpe.br>

Examples

```
# connect to a WTSS server
wtss <- "http://www.esensing.dpi.inpe.br/wtss"
# retrieve a time series
ts_wtss <- Rwtss::time_series(wtss, "MOD13Q1", c("ndvi", "evi"),
                             longitude = -45.00, latitude = -12.00,
                             start_date = "2000-02-18", end_date = "2016-12-18")
# convert to ts
ts <- Rwtss::wtss_to_ts(ts_wtss, band = "ndvi")
```

 wtss_to_zoo

Export data to be used to the zoo format

Description

Converts data from a tibble to a list of a zoo series.

Usage

```
wtss_to_zoo(data, band = NULL)
```

Arguments

data	A tibble with time series.
band	Name of the band to be exported (if NULL all bands are exported).

Value

List of time series in zoo format.

Author(s)

Gilberto Camara, <gilberto.camara@inpe.br>

Examples

```
# retrieve a time series
ts_wtss <- Rwtss::time_series("http://www.esensing.dpi.inpe.br/wtss",
  "MOD13Q1", c("ndvi", "evi"),
  longitude = -45.00, latitude = -12.00,
  start_date = "2000-02-18", end_date = "2016-12-18")
# convert to zoo
zoo.lst <- Rwtss::wtss_to_zoo(ts_wtss)
```

 %>%

Pipe

Description

Magrittr compound assignment pipe-operator.

Arguments

lhs, rhs	A visualisation and a function to apply to it.
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%>%

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Value

Apply lhs as input to rhs function

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