Package ‘Rwtss’

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Title Client for Web Time-Series Service
Version 0.9.2
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Description Allows remote access to satellite image time series provided by the web time series service (WTSS) available at servers such as <https://brazildatacube.dpi.inpe.br/wtss/>. The functions include 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.
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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)

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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

<table>
<thead>
<tr>
<th>URL</th>
<th>URL of the coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>cov</td>
<td>coverage response provided by WTSS service</td>
</tr>
</tbody>
</table>
.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
... additional parameters that can be added in httr.

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 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 function checks and removes it, if present.

**Usage**

```r
.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**

```r
.wtss_send_request(request, ...)
```

**Arguments**

- **request**
  - valid request according to the WTSS protocol
- **...**
  - additional parameters that can be added in `httr`

**Value**

- response from the server
### .wtss_tibble

Create a sits tibble to store the time series information

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>This function returns an empty tibble that contains the satellite image time series and its metadata. The columns are &lt;longitude, latitude, start_date, end_date, label, cube, time_series&gt;. WTSS functions produce a tibble as output.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>.wtss_tibble()</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A tibble.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gilberto Camara, <a href="mailto:gilberto.camara@inpe.br">gilberto.camara@inpe.br</a></td>
</tr>
</tbody>
</table>

### .wtss_time_series_processing

Processing a Time Series Result from WTSS

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing a Time Series Result from WTSS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>.wtss_time_series_processing(items)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td>items</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tibble with a time series</td>
</tr>
</tbody>
</table>
.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  
Retrieves the list of cubes from the URL server

Description
Contacts the WTSS server to describe one coverage

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

Arguments
<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>URL</td>
<td>URL of the server</td>
</tr>
<tr>
<td>name</td>
<td>name of coverage</td>
</tr>
<tr>
<td>.print</td>
<td>Print the coverage description</td>
</tr>
</tbody>
</table>

Value
tibble with coverage description

Examples
```r
## Not run:
# Using external server
describe_coverage("https://brazildatacube.dpi.inpe.br/wtss/",
                 "LC8_30_16D_STK-1")
## End(Not run)
```

list_coverages  
List the coverages available in the WTSS service

Description
Lists coverages available in the WTSS service

Usage
list_coverages(URL)

Arguments
<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>URL</td>
<td>URL of the server</td>
</tr>
</tbody>
</table>
Value

vector with coverage name

Examples

```r
## Not run:
# Using external server
list_coverages("https://brazildatacube.dpi.inpe.br/wtss/")
## End(Not run)
```

ndvi_ts  

Example time series from MOD13Q1 product.

Description

A dataset containing a wtss tibble, with extracted time series.

Usage

```r
data("ndvi_ts")
```

Format

A wtss tibble with 388 samples. A wtss tibble contains data and metadata. The first six columns contain the metadata: satellite, sensor, spatial and temporal information, and the coverage from where the data has been extracted. The spatial location is given in longitude and latitude coordinates for the "WGS84" ellipsoid. The ‘time_series’ column contains the time series data for each spatiotemporal location.

plot

Generic interface for plotting time series

Description

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

Usage

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

Arguments

x  object of class "wtss"

y  ignored

... further specifications for plot.

colors  Color pallete 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

## Not run:
# Access to external service
# Read one time series from the WTSS server
# plot one time series
wtss_service <- "https://brazildatacube.dpi.inpe.br/wtss/

# wtss::time_series(
#   wtss_service = wtss_service,
#   name = "MOD13Q1-6",
#   attributes = c("NDVI","EVI"),
#   longitude = -45.00,
#   latitude = -12.00,
#   start_date = "2000-02-18",
#   end_date = "2016-12-18",
#   token = "YOUR-BDC-TOKEN")

plot(ts)

## End(Not run)

Description

Retrieves the time series for a pair of coordinates

Usage

time_series(
URL,
name,
attributes = NULL,
longitude,
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.
token A character with token to be add in URL.
... Additional parameters that can be added in httr.

Value
time series in a tibble format (NULL)

Author(s)
Gilberto Camara

Examples

```r
## Not run:
# connect to a WTSS server
wtss_server <- "https://brazildatacube.dpi.inpe.br/wtss/"
# retrieve a time series
ndvi_ts <- Rwtss::time_series(wtss_server,
   "LC8_30_16D_STK-1",
   attributes = "NDVI",
   latitude = -14.31,
   longitude = -51.16,
   token = "YOUR-BDC-TOKEN")

# plot the time series
plot(ndvi_ts)
## End(Not run)
```
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

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

Value

A time series in the ts format.

Author(s)

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

Examples

```r
## Not run:
# connect to a WTSS server
wtss_service <- "https://brazildatacube.dpi.inpe.br/wtss/"
# retrieve a time series
ts_wtss <- Rwtss::time_series(
  wtss_service,
  "MOD13Q1-6",
  c("NDVI","EVI"),
  longitude = -45.00,
  latitude = -12.00,
  start_date = "2000-02-18",
  end_date = "2016-12-18",
  token = "YOUR-BDC-TOKEN")
```
# wtss_to_zoo

## 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

```r
## Not run:
# retrieve a time series
wtss_service <- "https://brazildatacube.dpi.inpe.br/wtss/"
ts_wtss <- Rwtss::time_series(
  wtss_service,
  "MOD13Q1-6",
  c("NDVI","EVI"),
  longitude = -45.00,
  latitude = -12.00,
  start_date = "2000-02-18",
  end_date = "2016-12-18",
  token = "YOUR-BDC-TOKEN")

# convert to zoo
zoo.lst <- Rwtss::wtss_to_zoo(ts_wtss)

## End(Not run)
```
Description

Magrittr compound assignment pipe-operator.

Arguments

lhs, rhs  A visualisation and a function to apply to it.
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  - wtss_list_coverages, 5
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  - wtss_process_request, 6
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