

Package ‘CopernicusClimate’

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Title Search Download and Handle Data from Copernicus Climate Data Service

Version 0.0.2

Description Subset and download data from EU Copernicus Climate Data Service: [<https://cds.climate.copernicus.eu/>](https://cds.climate.copernicus.eu/). Import information about the Earth's past, present and future climate from Copernicus into R without the need of external software.

Depends R (\geq 4.1.0)

Imports dplyr, httr2, jsonlite, methods, purrr, rlang, stringr, tibble, tidyr

Suggests ggplot2, knitr, RefManageR, rmarkdown, stars, testthat (\geq 3.0.0)

License GPL (\geq 3)

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Config/testthat/edition 3

URL <https://pepijn-devries.github.io/CopernicusClimate/>,
<https://github.com/pepijn-devries/CopernicusClimate/>

BugReports <https://github.com/pepijn-devries/CopernicusMarine/issues>

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cds_accepted_licences	<i>List accepted licences</i>
-----------------------	-------------------------------

Description

In order to use specific features of the Climate Data Service, you may first need to accept specific licences. This function will list all licenses you have accepted.

Usage

```
cds_accepted_licences(  
  scope = c("all", "dataset", "portal"),  
  ...,  
  token = cds_get_token()  
)
```

Arguments

scope	Scope of the licenses to be listed should be one of "all" (default), "dataset" or "portal".
...	Ignored
token	An API key to be used for authentication. Will use cds_get_token() by default.

Value

Returns a `data.frame` listing the accepted licenses.

Examples

```
if (interactive() && cds_token_works()) {  
  cds_accepted_licences("portal")  
}
```

cds_accept_licence	<i>Accept a specific licence</i>
--------------------	----------------------------------

Description

Call this function if you wish to accept a specific license.

Usage

```
cds_accept_licence(license, revision, ..., token = cds_get_token())
```

Arguments

license	The license id you wish to accept.
revision	The revision number of the license you are accepting. Should always be the latest revision.
...	Ignored
token	An API key to be used for authentication. Will use <code>cds_get_token()</code> by default.

Value

Returns a `data.frame` containing the accepted license

Examples

```
if (interactive() && cds_token_works()) {  
  cds_accept_licence("cc-by", 1)  
}
```

cds_account_metrics	<i>Get Prometheus metrics for account</i>
---------------------	---

Description

Obtain account metrics that can be interpreted with **prometheus**

Usage

```
cds_account_metrics(token = cds_get_token(), ...)
```

Arguments

token	An API key to be used for authentication. Will use cds_get_token() by default.
...	Ignored

Value

Returns text that can be interpreted with **prometheus**

Examples

```
if (interactive() && cds_token_works()) {
  cds_account_metrics()
}
```

cds_build_request	<i>Prepare a request for downloading a dataset</i>
-------------------	--

Description

This function is used by cds_estimate_costs() and cds_submit_job() to subset a dataset before downloading. It will also help you to explore which parameters are available for subsetting.

Usage

```
cds_build_request(dataset, ...)
```

Arguments

dataset	The dataset name to be used for setting up a request.
...	Parameters for subsetting the dataset. Use cds_dataset_form() to inquiry which parameters and parameter values are available for a specific dataset. If left blank it will take default parameter values.

Value

Returns a named list, which can be used to submit a job (`cds_submit_job()`) or inquiry its cost (`cds_estimate_costs()`).

Examples

```
if (interactive()) {
  cds_build_request(
    dataset      = "reanalysis-era5-pressure-levels",
    variable     = "geopotential",
    product_type = "reanalysis",
    area         = c(n = 55, w = -1, s = 50, e = 10),
    year         = "2024",
    month        = "03",
    day          = "01",
    pressure_level = "1000",
    data_format  = "netcdf"
  )
}
```

cds_catalogue_vocabulary

List catalogue vocabulary

Description

The catalogue uses a specific vocabulary for keywords. This function produces an overview.

Usage

```
cds_catalogue_vocabulary(...)
```

Arguments

... Ignored

Value

Returns a data.frame of keyword vocabulary used by the catalogue.

Examples

```
if (interactive()) {
  cds_catalogue_vocabulary()
}
```

cds_check_authentication

Check if authentication works with a specific token

Description

Checks if the specified API key can be used for authentication at the Climate Data Service.

Usage

```
cds_check_authentication(token = cds_get_token(), ...)
```

```
cds_token_works(token = cds_get_token(), ...)
```

Arguments

token	An API key to be used for authentication. Will use cds_get_token() by default.
...	Ignored

Value

cds_check_authentication() will return some account information when successful but throws an error if it is not. In contrast cds_token_works() returns a logical value and will not throw an error upon failure.

Examples

```
if (interactive() && cds_token_works()) {
  cds_check_authentication()
}
```

cds_cite_dataset

Cite a dataset

Description

Use this function to obtain citation details for a specific dataset

Usage

```
cds_cite_dataset(dataset, ...)
```

Arguments

dataset	The name of a dataset to be cited.
...	Ignored

Value

Returns a BibEntry-class object, with citation details for the requested dataset

Examples

```
if (interactive()) {  
  cds_cite_dataset("reanalysis-era5-pressure-levels")  
}
```

cds_dataset_form

Obtain an overview of options to subset a dataset

Description

This function provides an overview of parameters that can be used to subset a dataset. It can help you set up a request with `cds_submit_job()` or `cds_build_request()`.

Usage

```
cds_dataset_form(dataset, ...)
```

Arguments

dataset	A name of a dataset to explore
...	Ignored

Value

A `data.frame` with aspects of the dataset that can be subsetted, when defining a job. See also `cds_submit_job()` and `cds_build_request()`

Examples

```
if (interactive() && cds_token_works()) {  
  cds_dataset_form("reanalysis-era5-pressure-levels")  
}
```

cds_delete_job	<i>Delete/cancel jobs submitted to the Climate Data Service</i>
----------------	---

Description

When you regret submitting a job, you can cancel it by calling this function.

Usage

```
cds_delete_job(job_id, ..., token = cds_get_token())
```

Arguments

job_id	Hexadecimal code used as identifier of a job. Identifies the job to be cancelled.
...	Ignored
token	An API key to be used for authentication. Will use cds_get_token() by default.

Value

Returns a data.frame with information about the cancelled job.

Examples

```
if (interactive() && cds_token_works()) {
  job <- cds_submit_job(
    dataset      = "reanalysis-era5-pressure-levels",
    variable     = "geopotential",
    product_type = "reanalysis",
    area         = c(n = 55, w = -1, s = 50, e = 10),
    year         = "2024",
    month        = "03",
    day          = "01",
    pressure_level = "1000",
    data_format  = "netcdf"
  )
  cds_delete_job(job$jobID, tempdir())
}
```

cds_download_jobs	<i>Download specific jobs</i>
-------------------	-------------------------------

Description

After submitting one or more jobs with `cds_submit_job()`, you can download the resulting files with `cds_download_jobs()`. See `vignette("download")` for more details.

Usage

```
cds_download_jobs(job_id, destination, names, ..., token = cds_get_token())
```

Arguments

<code>job_id</code>	If a specific job identifier is listed here, only the files resulting from those jobs are downloaded. If left blank, all successful jobs are downloaded.
<code>destination</code>	Destination path to store downloaded files.
<code>names</code>	File names for the downloaded files. If missing, the cryptic hexadecimal file name is taken from the job.
<code>...</code>	Ignored
<code>token</code>	An API key to be used for authentication. Will use <code>cds_get_token()</code> by default.

Value

A data.frame of all downloaded files. Contains a column `local` with the path to the locally stored files.

Examples

```
if (interactive() && cds_token_works()) {
  job <- cds_submit_job(
    dataset      = "reanalysis-era5-pressure-levels",
    variable     = "geopotential",
    product_type = "reanalysis",
    area         = c(n = 55, w = -1, s = 50, e = 10),
    year         = "2024",
    month        = "03",
    day          = "01",
    pressure_level = "1000",
    data_format  = "netcdf"
  )
  cds_download_jobs(job$jobID, tempdir())
}
```

cds_estimate_costs	<i>Check the cost of a request against your quota</i>
--------------------	---

Description

Each account has a limit to the amount of data that can be downloaded. Use this function to check if a request exceeds your quota.

Usage

```
cds_estimate_costs(dataset, ..., token = cds_get_token())
```

Arguments

dataset	A dataset name to be inspected
...	Parameters passed on to cds_build_request()
token	An API key to be used for authentication. Will use cds_get_token() by default.

Value

Returns a named list indicating the available quota and the estimated cost for a request specified with ...-arguments.

Examples

```
if (interactive() && cds_token_works()) {
  cds_estimate_costs(
    dataset      = "reanalysis-era5-pressure-levels",
    variable     = "geopotential",
    product_type = "reanalysis",
    area         = c(n = 55, w = -1, s = 50, e = 10),
    year         = "2024",
    month        = "03",
    day          = "01",
    pressure_level = "1000",
    data_format  = "netcdf"
  )

  cds_estimate_costs(dataset = "reanalysis-era5-pressure-levels")
}
```

cds_get_account	<i>Get account details</i>
-----------------	----------------------------

Description

Retrieve account details associated with the provided token

Usage

```
cds_get_account(token = cds_get_token(), ...)
```

Arguments

token	An API key to be used for authentication. Will use cds_get_token() by default.
...	Ignored

Value

Returns a named list with account details.

Examples

```
if (interactive() && cds_token_works()) {
  cds_get_account()
}
```

cds_get_token	<i>Get or set a Climate Data Service API key</i>
---------------	--

Description

Many of the Climate Data Services features require a personal Application Programming Interface (API) key. This function will get a token that was previously stored (cds_set_token()), and can be used throughout the R session.

Usage

```
cds_get_token(...)
```

```
cds_set_token(token, method = c("option", "sysenv"), ...)
```

Arguments

...	Ignored
token	The API key you wish to set as an R option or to an environment variable.
method	Method to store the API key. Should be either "option" (default) or "sysenv".

Details

To use an API key, you first need to get one from the Climate Data Service. You can do so, by creating an account and then initialise the key at <https://cds.climate.copernicus.eu/profile>.

There are different locations where the key can be stored and where `cds_get_token()` will look. It will look for the first successful value of (in order): the environment variable named "CDSAPI_KEY", the R `getOption()` named "CDSAPI_KEY", the environment variable named "ECMWF_DATASTORES_KEY", and the R `getOption()` named "ECMWF_DATASTORES_KEY".

You can set the key at the start of each R session with `cds_set_token()`. If you want a persistent solution, you can add the environment variable (with names shown above) to your system. Or you can add the option (with the names shown above) to your ".profile" file. This will help you obscure your sensitive account information in your R script.

Value

`cds_get_token()` will return an API key token if it has been set. If it is not set it will return an empty string: "". `cds_set_token()` will return NULL invisibly.

Examples

```
if (interactive() && !cds_token_works()) {
  cds_set_token("this-is-a-dummy-token", "option")
}

if (interactive()) {
  cds_get_token()
}
```

cds_list_datasets	<i>List or search Climate Data Service datasets</i>
-------------------	---

Description

This will help you decide which datasets you wish to obtain.

Usage

```
cds_list_datasets(dataset, ...)

cds_search_datasets(search, keywords, page = 0, limit = 50, ...)
```

Arguments

dataset	A specific dataset for which to list details. If missing all datasets are listed.
...	Ignored
search	A string containing free text search terms to look for in the available datasets.
keywords	A (vector of) string containing specific keywords. Should be listed in <code>cds_catalogue_vocabulary()</code>

page	When there are more search results than <code>limit</code> , results are paginated. Use <code>page</code> to specify which page to return starting at 0 (default).
limit	Use to limit the number of search results. Defaults to 50.

Value

A `data.frame` listing the datasets from the Climate Data Service. In case of `cds_search_datasets()`, attributes named `SearchMeta` are added containing the number of matching and number of returned datasets.

Examples

```
if (interactive()) {
  cds_list_datasets()
  cds_search_datasets("rain", "Temporal coverage: Future")
}
```

cds_list_jobs	<i>List jobs submitted to the Climate Data Service</i>
---------------	--

Description

Once submitted with `cds_submit_job()` you can check the status of the job with this function. You can list all available jobs, or specific jobs.

Usage

```
cds_list_jobs(
  job_id = NULL,
  status = NULL,
  limit = 50,
  ...,
  token = cds_get_token()
)
```

Arguments

job_id	The id of a specific job, if you want the results for that job. If <code>NULL</code> (default) it is ignored.
status	Only return jobs with the status stated by this argument. Default is <code>NULL</code> meaning that jobs with any status are returned. Should be any of "accepted", "running", "successful", "failed", or "rejected".
limit	Use to limit the number of listed results. Defaults to 50.
...	Ignored
token	An API key to be used for authentication. Will use <code>cds_get_token()</code> by default.

Value

Returns a `data.frame` of submitted jobs.

Examples

```
if (interactive() && cds_token_works()) {
  cds_list_jobs()
}
```

cds_starred	<i>Add or remove a star to a dataset, or list starred datasets</i>
-------------	--

Description

Use stars to keep track of your favourite datasets. Use these functions to add or remove a star.

Usage

```
cds_starred(..., token = cds_get_token())

cds_assign_star(dataset, ..., token = cds_get_token())

cds_remove_star(dataset, ..., token = cds_get_token())
```

Arguments

...	Ignored
token	An API key to be used for authentication. Will use <code>cds_get_token()</code> by default.
dataset	Name of the dataset to assign a star to, or remove it from.

Value

In case of `cds_assign_star()` returns the name of the starred dataset. In case of `cds_starred()` a vector of names of starred datasets. In case of `cds_remove_star()` returns `NULL` invisibly.

Examples

```
if (interactive() && cds_token_works()) {
  cds_assign_star("reanalysis-carra-single-levels")
  cds_starred()
  cds_remove_star("reanalysis-carra-single-levels")
}
```

cds_submit_job	<i>Submit a download job for a dataset</i>
----------------	--

Description

Submit a request to the Copernicus Climate Data Service to download (part of) a dataset. If the request is successful, a job identifier is returned which can be used to actually download the data (`cds_download_jobs()`).

Usage

```
cds_submit_job(
  dataset,
  ...,
  wait = TRUE,
  check_quota = TRUE,
  check_licence = TRUE,
  token = cds_get_token()
)
```

Arguments

<code>dataset</code>	The dataset name to be downloaded
<code>...</code>	Subsetting parameters passed onto <code>cds_build_request()</code> .
<code>wait</code>	A logical value indicating if the function should wait for the submitted job to finish. Set it to <code>FALSE</code> to continue without waiting
<code>check_quota</code>	Each account has a quota of data that can be downloaded. If this argument is set to <code>TRUE</code> (default) it is checked if the request doesn't exceed your quota. Set it to <code>FALSE</code> to skip this step and speed up the submission.
<code>check_licence</code>	Datasets generally require you to accept certain terms of use. If this argument is set to <code>TRUE</code> (default), it will be checked if you have accepted all required licences for the submitted request. Set it to <code>FALSE</code> to skip this step and speed up the submission.
<code>token</code>	An API key to be used for authentication. Will use <code>cds_get_token()</code> by default.

Value

Returns a `data.frame` containing information about the submitted job.

Examples

```
if (interactive() && cds_token_works()) {
  job <- cds_submit_job(
    dataset      = "reanalysis-era5-pressure-levels",
    variable     = "geopotential",
```

```
product_type = "reanalysis",  
area         = c(n = 55, w = -1, s = 50, e = 10),  
year         = "2024",  
month        = "03",  
day          = "01",  
pressure_level = "1000",  
data_format  = "netcdf"  
)  
}
```


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