

# Package ‘CDSE’

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**Type** Package

**Title** 'Copernicus Data Space Ecosystem' API Wrapper

**Version** 0.3.2

**Description** Provides interface to the 'Copernicus Data Space Ecosystem' API

<<https://dataspace.copernicus.eu/analyse/apis>>

, mainly for searching the catalog of available data from Copernicus Sentinel missions and obtaining the images for just the area of interest based on selected spectral bands. The package uses the 'Sentinel Hub' REST API interface

<<https://dataspace.copernicus.eu/analyse/apis/sentinel-hub>>

that provides access to various satellite imagery archives. It allows you to access raw satellite data, rendered images, statistical analysis, and other features.

This package is in no way officially related to or endorsed by Copernicus.

**Depends** R (>= 3.6.0)

**Imports** geojsonsf, grDevices, httr2, jsonlite, lubridate, lutz, sf, stats, terra, utils

**URL** <https://zivankaraman.github.io/CDSE/>,

<https://github.com/zivankaraman/CDSE>

**BugReports** <https://github.com/zivankaraman/CDSE/issues>

**License** AGPL-3

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**Suggests** maps, parallel, rsi, tibble

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CDSE

*Package providing interface to the 'Copernicus Data Space Ecosystem' API*

---

## Description

The CDSE package for R was developed to allow access to the 'Copernicus Data Space Ecosystem' <https://dataspace.copernicus.eu/> data and services from R. The 'Copernicus Data Space Ecosystem', deployed in 2023, offers access to the EO data collection from the Copernicus missions, with discovery and download capabilities and numerous data processing tools. In particular, the 'Sentinel Hub' API <https://documentation.dataspace.copernicus.eu/APIs/SentinelHub.html> provides access to the multi-spectral and multi-temporal big data satellite imagery service, capable of fully automated, real-time processing and distribution of remote sensing data and related EO products. Users can use APIs to retrieve satellite data over their AOI and specific time range from full archives in a matter of seconds. When working on the application of EO where the area of interest is relatively small compared to the image tiles distributed by Copernicus (100 x 100 km), it allows to retrieve just the portion of the image of interest rather than downloading the huge tile image file and processing it locally. The goal of the CDSE package is to provide easy access to this functionality from R.

The main functions allow to search the catalog of available imagery from the Sentinel-1, Sentinel-2, Sentinel-3, and Sentinel-5 missions, and to process and download the images of an area of interest and a time range in various formats. Other functions might be added in subsequent releases of the package.

## API authentication

Most of the API functions require OAuth2 authentication. The recommended procedure is to obtain an authentication client object from the `GetOAuthClient` function, and to pass it as the `client` argument to the functions requiring the authentication. For more detailed information, you are invited to consult the "Before you start" document.

## Project homepage

<https://zivankaraman.github.io/CDSE/>, <https://github.com/zivankaraman/CDSE>

## Issues

For bug reports and feature requests please use the tracker <https://github.com/zivankaraman/CDSE/issues>

## Author(s)

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CDSE-deprecated

*Deprecated functions in package CDSE.*

---

## Description

The functions listed below are deprecated and will be defunct in the near future. When possible, alternative functions with similar functionality are also mentioned. Help pages for deprecated functions are available at `help("<function>-deprecated")`.

### GetArchiveImage

For `GetArchiveImage`, use [GetImage](#).

---

GetArchiveImage

*Get image from the archive (deprecated)*

---

## Description

Retrieves the image for the area of interest using the parameters provided.

**Arguments**

aoi	sf or sfc object, typically a (multi)polygon, describing the Area of Interest.
bbox	numeric vector of four elements describing the bounding box of interest. Specify with a coordinate pair on two (opposite) vertices of the bounding box rectangle. Coordinates need to be in longitude, latitude. Only one of either aoi or bbox may be specified.
time_range	scalar or vector (Date or character that can be converted to date) defining the time interval.
collection	character indicating which collection to search. Must be one of the collections returned by GetCollections.
script	a length one character string containing the evaluation script or the name of the file containing the script.
mosaicking_order	character indicating the order in which tiles are overlapped from which the output result is mosaicked. Must be one of "mostRecent", "leastRecent", or "leastCC". Default: "mostRecent"
file	name of the file to save the image. If NULL, a SpatRaster object is returned. Default: NULL
format	character indicating the output file format. Must be one of "image/tiff", "image/png", or "image/jpeg". Default: "image/tiff"
pixels	integer scalar or length-two vector indicating the request image width and height. Values must be integers between 1 and 2500.
resolution	numeric scalar or length-two vector indicating the spatial resolution of the request image in horizontal and vertical direction (in meters). Only one of the arguments "pixels" or "resolution" must be set at the same time. If the argument "pixels" or "resolution" is scalar, the same value is used for horizontal and vertical direction (width and height).
buffer	numeric, width of the buffer to retrieve the image of enlarged area. Default: 0
mask	logical indicating if the image should contain only pixels within Area of Interest. Default: FALSE
client	OAuth client object to use for authentication.
token	OAuth token character string to use for authentication. Exactly one of either client or token must be specified. It is recommended to use client.
url	character indicating the process endpoint. Default: Copernicus Data Space Ecosystem process endpoint

**Details**

If aoi argument is provided, the result is returned in the same coordinate reference system.

**Value**

SpatRaster object (from the package terra) of the requested image (if file is NULL), or the (invisible) name of the file created.

**Source**

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Process.html>

**See Also**

[GetCollections](#), [SearchCatalog](#)

[CDSE-deprecated](#)

**Examples**

```
## Not run:
dsn <- system.file("extdata", "centralpark.geojson", package = "CDSE")
aoi <- sf::read_sf(dsn, as_tibble = FALSE)
script_file <- system.file("scripts", "NDVI_uint8.js", package = "CDSE")
day <- "2023-07-11"
ras <- GetArchiveImage(aoi = aoi, time_range = day, script = script_file,
  collection = "sentinel-2-l2a", format = "image/tiff",
  mosaicking_order = "leastCC", resolution = 10, client = OAuthClient)

## End(Not run)
```

---

GetCollections	<i>List available collections</i>
----------------	-----------------------------------

---

**Description**

Retrieves the list of available imagery collections.

**Usage**

```
GetCollections(as_data_frame = TRUE, url = getOption("CDSE.catalog_url"))
```

**Arguments**

<code>as_data_frame</code>	logical indicating if the result should be returned as data frame. Default: TRUE
<code>url</code>	character indicating the STAC catalog search endpoint. Default: Copernicus Data Space Ecosystem STAC endpoint

**Details**

This function doesn't require authentication.

**Value**

A list or a data.frame of all available imagery collections and their attributes.

**Source**

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Catalog.html>

**See Also**

[GetImage](#), [SearchCatalog](#)

**Examples**

```
## Not run:
GetCollections(as_data_frame = TRUE)

## End(Not run)
```

---

GetImage

*Get image from the archive*

---

**Description**

Retrieves the image for the area of interest using the parameters provided.

**Usage**

```
GetImage(
  aoi,
  bbox,
  time_range,
  collection,
  script,
  file = NULL,
  format = c("image/tiff", "image/png", "image/jpeg"),
  mosaicking_order = c("mostRecent", "leastRecent", "leastCC"),
  pixels,
  resolution,
  buffer = 0,
  mask = FALSE,
  client,
  token,
  url = getOption("CDSE.process_url")
)
```

**Arguments**

aoi	sf or sfc object, typically a (multi)polygon, describing the Area of Interest.
bbox	numeric vector of four elements describing the bounding box of interest. Specify with a coordinate pair on two (opposite) vertices of the bounding box rectangle. Coordinates need to be in longitude, latitude. Only one of either aoi or bbox may be specified.
time_range	scalar or vector (Date or character that can be converted to date) defining the time interval.

collection	character indicating which collection to search. Must be one of the collections returned by GetCollections.
script	a length one character string containing the evaluation script or the name of the file containing the script.
file	name of the file to save the image. If NULL, a SpatRaster object is returned. Default: NULL
format	character indicating the output file format. Must be one of "image/tiff", "image/png", or "image/jpeg". Default: "image/tiff"
mosaicking_order	character indicating the order in which tiles are overlapped from which the output result is mosaicked. Must be one of "mostRecent", "leastRecent", or "leastCC". Default: "mostRecent"
pixels	integer scalar or length-two vector indicating the request image width and height. Values must be integers between 1 and 2500.
resolution	numeric scalar or length-two vector indicating the spatial resolution of the request image in horizontal and vertical direction (in meters). Only one of the arguments "pixels" or "resolution" must be set at the same time. If the argument "pixels" or "resolution" is scalar, the same value is used for horizontal and vertical direction (width and height).
buffer	numeric, width of the buffer to retrieve the image of enlarged area. Default: 0
mask	logical indicating if the image should contain only pixels within Area of Interest. Default: FALSE
client	OAuth client object to use for authentication.
token	OAuth token character string to use for authentication. Exactly one of either client or token must be specified. It is recommended to use client.
url	character indicating the process endpoint. Default: Copernicus Data Space Ecosystem process endpoint

### Details

If aoi argument is provided, the result is returned in the same coordinate reference system.

### Value

SpatRaster object (from the package terra) of the requested image (if file is NULL), or the (invisible) name of the file created.

### Source

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Process.html>

### See Also

[GetCollections](#), [SearchCatalog](#)

**Examples**

```
## Not run:
dsn <- system.file("extdata", "centralpark.geojson", package = "CDSE")
aoi <- sf::read_sf(dsn, as_tibble = FALSE)
script_file <- system.file("scripts", "NDVI_uint8.js", package = "CDSE")
day <- "2023-07-11"
ras <- GetImage(aoi = aoi, time_range = day, script = script_file,
               collection = "sentinel-2-l2a", format = "image/tiff",
               mosaicking_order = "leastCC", resolution = 10, client = OAuthClient)

## End(Not run)
```

---

 GetImageBy...

*Get image from the archive (vectorization ready)*


---

**Description**

These functions retrieve the image for the area of interest using the parameters provided. They are simple wrappers around the 'GetImage' function with arguments organized in a way that facilitates calling the function in a vectorized manner (using 'lapply' or similar function) and thus potentially also the parallelization.

**Usage**

```
GetImageByTimerange(
  time_range,
  aoi,
  bbox,
  collection,
  script,
  file = NULL,
  format = c("image/tiff", "image/png", "image/jpeg"),
  mosaicking_order = c("mostRecent", "leastRecent", "leastCC"),
  pixels,
  resolution,
  buffer = 0,
  mask = FALSE,
  client,
  token,
  url = getOption("CDSE.process_url")
)
```

```
GetImageByAOI(
  aoi,
  time_range,
  collection,
  script,
```

```

file = NULL,
format = c("image/tiff", "image/png", "image/jpeg"),
mosaicking_order = c("mostRecent", "leastRecent", "leastCC"),
pixels,
resolution,
buffer = 0,
mask = FALSE,
client,
token,
url = getOption("CDSE.process_url")
)

```

```

GetImageByBbox(
bbox,
time_range,
collection,
script,
file = NULL,
format = c("image/tiff", "image/png", "image/jpeg"),
mosaicking_order = c("mostRecent", "leastRecent", "leastCC"),
pixels,
resolution,
buffer = 0,
mask = FALSE,
client,
token,
url = getOption("CDSE.process_url")
)

```

### Arguments

time_range	scalar or vector (Date or character that can be converted to date) defining the time interval.
aoi	sf or sfc object, typically a (multi)polygon, describing the Area of Interest.
bbox	numeric vector of four elements describing the bounding box of interest. Specify with a coordinate pair on two (opposite) vertices of the bounding box rectangle. Coordinates need to be in longitude, latitude. Only one of either aoi or bbox may be specified.
collection	character indicating which collection to search. Must be one of the collections returned by GetCollections.
script	a length one character string containing the evaluation script or the name of the file containing the script.
file	name of the file to save the image. If NULL, a SpatRaster object is returned. Default: NULL
format	character indicating the output file format. Must be one of "image/tiff", "image/png", or "image/jpeg". Default: "image/tiff"

mosaicking_order	character indicating the order in which tiles are overlapped from which the output result is mosaicked. Must be one of "mostRecent", "leastRecent", or "leastCC". Default: "mostRecent"
pixels	integer scalar or length-two vector indicating the request image width and height. Values must be integers between 1 and 2500.
resolution	numeric scalar or length-two vector indicating the spatial resolution of the request image in horizontal and vertical direction (in meters). Only one of the arguments "pixels" or "resolution" must be set at the same time. If the argument "pixels" or "resolution" is scalar, the same value is used for horizontal and vertical direction (width and height).
buffer	numeric, width of the buffer to retrieve the image of enlarged area. Default: 0
mask	logical indicating if the image should contain only pixels within Area of Interest. Default: FALSE
client	OAuth client object to use for authentication.
token	OAuth token character string to use for authentication. Exactly one of either client or token must be specified. It is recommended to use client.
url	character indicating the process endpoint. Default: Copernicus Data Space Ecosystem process endpoint

### Details

If aoi argument is provided, the result is returned in the same coordinate reference system.

GetImageByTimeRange is arranged for vectorization on time\_range (time\_range is the first argument).

GetImageByAOI is arranged for vectorization on aoi (aoi is the first argument).

GetImageByBbox is arranged for vectorization on bbox (bbox is the first argument).

### Value

SpatRaster object (from the package terra) of the requested image (if file is NULL), or the (invisible) name of the file created.

### Source

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Process.html>

### See Also

[GetImage](#)

**Examples**

```
## Not run:
dsn <- system.file("extdata", "centralpark.geojson", package = "CDSE")
aoi <- sf::read_sf(dsn, as_tibble = FALSE)
cloudless_images <- SearchCatalog(aoi = aoi, from = "2023-01-01", to = "2023-12-31",
  collection = "sentinel-2-l2a", with_geometry = TRUE,
  filter = "eo:cloud_cover < 0.8", client = OAuthClient)
script_file <- system.file("scripts", "NDVI_float32.js", package = "CDSE")
days <- rev(cloudless_images$acquisitionDate)
lstRast <- lapply(days, GetImageByTimerange, aoi = aoi, collection = "sentinel-2-l2a",
  script = script_file, file = NULL, format = "image/tiff", mosaicking_order = "mostRecent",
  resolution = 10, buffer = 0, mask = TRUE, client = OAuthClient,
  url = getOption("CDSE.process_url"))
par(mfrow = c(3, 4))
sapply(seq_along(days), FUN = function(i) {
  ras <- lstRast[[i]]
  day <- days[i]
  ras[ras < 0] <- 0
  terra::plot(ras, main = paste("Central Park NDVI on", day), range = c(0, 1),
    cex.main = 0.7, pax = list(cex.axis = 0.5), plg = list(cex = 0.5),
    col = colorRampPalette(c("darkred", "yellow", "darkgreen"))(99))
})

## End(Not run)
```

---

 GetOAuthClient

*Get OAuth client*


---

**Description**

Gets an OAuth authentication client (httr2 OAuth client object)

**Usage**

```
GetOAuthClient(id, secret, url = getOption("CDSE.auth_url"))
```

**Arguments**

<code>id</code>	character, user OAuth client id
<code>secret</code>	character, user OAuth client secret
<code>url</code>	character, endpoint for requesting tokens. Default: Copernicus Data Space Ecosystem OAuth endpoint

**Details**

The client can be used in queries requiring the authentication.

**Value**

httr2 OAuth client object

**Source**

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Overview/Authentication.html>

**See Also**

[GetOAuthToken](#)

**Examples**

```
## Not run:  
id <- "..."  
secret <- "..."  
OAuthClient <- GetOAuthClient(id = id, secret = secret)  
  
## End(Not run)
```

---

GetOAuthToken

*Get OAuth token*

---

**Description**

Gets an OAuth authentication token (long character string)

**Usage**

```
GetOAuthToken(id, secret, url = getOption("CDSE.auth_url"))
```

**Arguments**

id	character, user OAuth client id
secret	character, user OAuth client secret
url	character, endpoint for requesting tokens. Default: Copernicus Data Space Ecosystem OAuth endpoint

**Details**

The token can be used in queries requiring the authentication.

**Value**

Long character string containing the authentication token.

**Source**

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Overview/Authentication.html>

**See Also**

[GetOAuthClient](#)

**Examples**

```
## Not run:
id <- "... "
secret <- "... "
token <- GetOAuthToken(id = id, secret = secret)

## End(Not run)
```

---

GetQueryables

*Get CQL2 parameters for a collection*

---

**Description**

Returns a list of variable terms that can be used in CQL2 expressions to filter the collection catalog search.

**Usage**

```
GetQueryables(
  collection,
  as_data_frame = TRUE,
  client,
  token,
  url = getOption("CDSE.catalog_url")
)
```

**Arguments**

collection	character indicating the collection for which the parameters are queried. Must be one of the collections returned by <code>GetCollections</code> .
as_data_frame	logical indicating if the result should be returned as data frame. Default: TRUE
client	OAuth client object to use for authentication.
token	OAuth token character string to use for authentication. Exactly one of either <code>client</code> or <code>token</code> must be specified. It is recommended to use <code>client</code> .
url	character indicating the STAC catalog search endpoint. Default: Copernicus Data Space Ecosystem STAC endpoint

**Details**

If no parameters found, a NULL value or 0-row data.frame is returned.

**Value**

A list or a data.frame.

**Source**

[https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/ApiReference.html#tag/catalog\\_collections/operation/getCatalogCollectionQueryables](https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/ApiReference.html#tag/catalog_collections/operation/getCatalogCollectionQueryables)

**See Also**

[GetCollections](#), [SearchCatalog](#)

**Examples**

```
## Not run:  
GetQueryables("sentinel-2-12a", client = OAuthClient)  
  
## End(Not run)
```

---

GetStatistics

*Get statistical values*

---

**Description**

Retrieves the simple statistics for the area of interest calculated based on satellite imagery without having to download images.

**Usage**

```
GetStatistics(  
  aoi,  
  bbox,  
  time_range,  
  collection,  
  script,  
  mosaicking_order = c("mostRecent", "leastRecent", "leastCC")[1],  
  pixels,  
  resolution,  
  buffer = 0,  
  percentiles = NULL,  
  aggregation_period = 1L,  
  aggregation_unit = c("day", "week", "month", "year")[1],  
  lastIntervalBehavior = c("SKIP", "SHORTEN", "EXTEND")[1],  
  as_data_frame = TRUE,
```

```

    client,
    token,
    url = getOption("CDSE.statistical_url")
)

```

### Arguments

aoi	sf or sfc object, typically a (multi)polygon, describing the Area of Interest.
bbox	numeric vector of four elements describing the bounding box of interest. Specify with a coordinate pair on two (opposite) vertices of the bounding box rectangle. Coordinates need to be in longitude, latitude. Only one of either aoi or bbox may be specified.
time_range	scalar or vector (Date or character that can be converted to date) defining the time interval.
collection	character indicating which collection to search. Must be one of the collections returned by GetCollections.
script	a length one character string containing the evaluation script or the name of the file containing the script.
mosaicking_order	character indicating the order in which tiles are overlapped from which the output result is mosaicked. Must be one of "mostRecent", "leastRecent", or "leastCC". Partial matching is used, that is, only enough initial letters of each string element are needed to guarantee unique recognition. Default: "mostRecent"
pixels	integer scalar or length-two vector indicating the request image width and height. Values must be integers between 1 and 2500.
resolution	numeric scalar or length-two vector indicating the spatial resolution of the request image in horizontal and vertical direction (in meters). Only one of the arguments pixels or resolution must be set at the same time. If the argument pixels or resolution is scalar, the same value is used for horizontal and vertical direction (width and height).
buffer	numeric, width of the buffer to retrieve the image of enlarged area. Default: 0
percentiles	numeric vector indicating which percentile values should be computed. Default: NULL, don't compute any percentiles.
aggregation_period	the length of the aggregation period in aggregation_unit (days by default). Default: 1
aggregation_unit	character indicating the the unit of the aggregation period, must be one of "day", "week", "month", or "year". Partial matching is used, that is, only enough initial letters of each string element are needed to guarantee unique recognition (here just the first letter is enough). Default: "day"
lastIntervalBehavior	character indicating the behavior of the last interval if the given time_range isn't divisible by the provided aggregation_period. Must be one of:

	SKIP - skip the last interval (default behavior)
	SHORTEN - shortens the last interval so that it ends at the end of provided <code>time_range</code>
	EXTEND - extends the last interval over the end of the provided <code>time_range</code> so that all intervals are of equal duration
	Partial matching is used, that is, only enough initial letters of each string element are needed to guarantee unique recognition. Default: "SKIP"
<code>as_data_frame</code>	logical indicating if the result should be returned as data frame. Default: TRUE
<code>client</code>	OAuth client object to use for authentication.
<code>token</code>	OAuth token character string to use for authentication.
	Exactly one of either <code>client</code> or <code>token</code> must be specified. It is recommended to use <code>client</code> .
<code>url</code>	character indicating the process endpoint. Default: Copernicus Data Space Ecosystem process endpoint

## Details

The values are aggregated over the period (number of `aggregation_units`) given by the `aggregation_period` argument. The default values provide daily statistics. The statistics are returned only for the `aggregation_units` (days, weeks, months, years) when the data is available. This can be determined by the days of the satellite overpasses, but also by the calculations done in the evaluation script.

The scripts used for the Statistical API have some additional requirements: the `evaluatePixel()` function must, in addition to other output, always also return `dataMask` output. This output defines which pixels are excluded from calculations. For more information please visit the online documentation <https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Statistical.html>.

If a `time_range` is not divisible by an `aggregation_period`, the last ("not full") time interval will be dismissed by default (SKIP option). The user can instead set the `lastIntervalBehavior` to SHORTEN (shortens the last interval so that it ends at the end of the provided `time_range`) or EXTEND (extends the last interval over the end of the provided `time_range` so that all the intervals are of equal duration).

If percentiles requested are 25, 50, and 75, the columns are renamed 'q1', 'median', and 'q3'.

## Value

`data.frame` or `list` with statistical values.

## Source

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Statistical.html>

## See Also

[GetCollections](#), [SearchCatalog](#)

## Examples

```
## Not run:
dsn <- system.file("extdata", "centralpark.geojson", package = "CDSE")
aoi <- sf::read_sf(dsn, as_tibble = FALSE)
script_file <- system.file("scripts", "NDVI_CLOUDS_STAT.js", package = "CDSE")
daily_stats <- GetStatistics(aoi = aoi, time_range = c("2023-07-01", "2023-07-31"),
  collection = "sentinel-2-l2a", script = script_file, mosaicking_order = "leastCC",
  resolution = 100, aggregation_period = 1, client = OAuthClient)
# specify week as 7 days
weekly_stats <- GetStatistics(aoi = aoi, time_range = c("2023-07-01", "2023-07-31"),
  collection = "sentinel-2-l2a", script = script_file, mosaicking_order = "leastCC",
  resolution = 100, aggregation_period = 7, client = OAuthClient)
# specify week as 1 week
weekly_stats_extended <- GetStatistics(aoi = aoi, time_range = c("2023-07-01", "2023-07-31"),
  collection = "sentinel-2-l2a", script = script_file, mosaicking_order = "leastCC",
  resolution = 100, aggregation_period = 1, aggregation_unit = "w",
  lastIntervalBehavior = "EXTEND", client = OAuthClient)

## End(Not run)
```

---

GetStatisticsBy...      *Get statistical values (vectorization ready)*

---

## Description

These functions retrieve simple statistics for the area of interest calculated based on satellite imagery without having to download images. They are simple wrappers around the `GetStatistics` function with arguments organized in a way that facilitates calling the function in a vectorized manner (using `lapply` or similar function) and thus potentially also the parallelization.

## Usage

```
GetStatisticsByTimerange(
  time_range,
  aoi,
  bbox,
  collection,
  script,
  mosaicking_order = c("mostRecent", "leastRecent", "leastCC")[1],
  pixels,
  resolution,
  buffer = 0,
  percentiles = NULL,
  aggregation_period = 1L,
  aggregation_unit = c("day", "week", "month", "year")[1],
  lastIntervalBehavior = c("SKIP", "SHORTEN", "EXTEND")[1],
  as_data_frame = TRUE,
  client,
```

```

    token,
    url = getOption("CDSE.statistical_url")
)

GetStatisticsByAOI(
  aoi,
  time_range,
  collection,
  script,
  mosaicking_order = c("mostRecent", "leastRecent", "leastCC")[1],
  pixels,
  resolution,
  buffer = 0,
  percentiles = NULL,
  aggregation_period = 1L,
  aggregation_unit = c("day", "week", "month", "year")[1],
  lastIntervalBehavior = c("SKIP", "SHORTEN", "EXTEND")[1],
  as_data_frame = TRUE,
  client,
  token,
  url = getOption("CDSE.statistical_url")
)

GetStatisticsByBbox(
  bbox,
  time_range,
  collection,
  script,
  mosaicking_order = c("mostRecent", "leastRecent", "leastCC")[1],
  pixels,
  resolution,
  buffer = 0,
  percentiles = NULL,
  aggregation_period = 1L,
  aggregation_unit = c("day", "week", "month", "year")[1],
  lastIntervalBehavior = c("SKIP", "SHORTEN", "EXTEND")[1],
  as_data_frame = TRUE,
  client,
  token,
  url = getOption("CDSE.statistical_url")
)

```

### Arguments

<code>time_range</code>	scalar or vector (Date or character that can be converted to date) defining the time interval.
<code>aoi</code>	sf or sfc object, typically a (multi)polygon, describing the Area of Interest.
<code>bbox</code>	numeric vector of four elements describing the bounding box of interest. Specify

	with a coordinate pair on two (opposite) vertices of the bounding box rectangle. Coordinates need to be in longitude, latitude. Only one of either <code>aoi</code> or <code>bbox</code> may be specified.
<code>collection</code>	character indicating which collection to search. Must be one of the collections returned by <code>GetCollections</code> .
<code>script</code>	a length one character string containing the evaluation script or the name of the file containing the script.
<code>mosaicking_order</code>	character indicating the order in which tiles are overlapped from which the output result is mosaicked. Must be one of "mostRecent", "leastRecent", or "leastCC". Partial matching is used, that is, only enough initial letters of each string element are needed to guarantee unique recognition. Default: "mostRecent"
<code>pixels</code>	integer scalar or length-two vector indicating the request image width and height. Values must be integers between 1 and 2500.
<code>resolution</code>	numeric scalar or length-two vector indicating the spatial resolution of the request image in horizontal and vertical direction (in meters). Only one of the arguments "pixels" or "resolution" must be set at the same time. If the argument "pixels" or "resolution" is scalar, the same value is used for horizontal and vertical direction (width and height).
<code>buffer</code>	numeric, width of the buffer to retrieve the image of enlarged area. Default: 0
<code>percentiles</code>	numeric vector indicating which percentile values should be computed. Default: NULL, don't compute any percentiles.
<code>aggregation_period</code>	the length of the aggregation period in <code>aggregation_unit</code> (days by default). Default: 1
<code>aggregation_unit</code>	character indicating the the unit of the aggregation period, must be one of "day", "week", "month", or "year". Partial matching is used, that is, only enough initial letters of each string element are needed to guarantee unique recognition (here just the first letter is enough). Default: "day"
<code>lastIntervalBehavior</code>	character indicating the behavior of the last interval if the given <code>time_range</code> isn't divisible by the provided <code>aggregation_period</code> . Must be one of: SKIP - skip the last interval (default behavior) SHORTEN - shortens the last interval so that it ends at the end of provided <code>time_range</code> EXTEND - extends the last interval over the end of the provided time range so that all intervals are of equal duration  Partial matching is used, that is, only enough initial letters of each string element are needed to guarantee unique recognition. Default: "SKIP"
<code>as_data_frame</code>	logical indicating if the result should be returned as data frame. Default: TRUE
<code>client</code>	OAuth client object to use for authentication.
<code>token</code>	OAuth token character string to use for authentication. Exactly one of either <code>client</code> or <code>token</code> must be specified. It is recommended to use <code>client</code> .

`url` character indicating the process endpoint. Default: Copernicus Data Space Ecosystem process endpoint

### Details

The values are aggregated over the period (number of `aggregation_units`) given by the `aggregation_period` argument. The default values provide daily statistics. The statistics are returned only for the `aggregation_units` (days, weeks, months, years) when the data is available. This can be determined by the days of the satellite overpasses, but also by the calculations done in the evaluation script.

The scripts used for the Statistical API have some additional requirements: the `evaluatePixel()` function must, in addition to other output, always also return `dataMask` output. This output defines which pixels are excluded from calculations. For more information please visit the on-line documentation <https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Statistical.html>.

If a `time_range` is not divisible by an `aggregation_period`, the last ("not full") time interval will be dismissed by default (SKIP option). The user can instead set the `lastIntervalBehavior` to `SHORTEN` (shortens the last interval so that it ends at the end of the provided time range) or `EXTEND` (extends the last interval over the end of the provided time range so that all the intervals are of equal duration).

If percentiles requested are 25, 50, and 75, the columns are renamed 'q1', 'median', and 'q3'.

`GetStatisticsByTimerange` is arranged for vectorization on `time_range` (`time_range` is the first argument).

`GetStatisticsByAOI` is arranged for vectorization on `aoi` (`aoi` is the first argument).

`GetStatisticsByBbox` is arranged for vectorization on `bbox` (`bbox` is the first argument).

### Value

`data.frame` or `list` with statistical values.

### Source

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Statistical.html>

### See Also

[GetStatistics](#)

### Examples

```
## Not run:
dsn <- system.file("extdata", "centralpark.geojson", package = "CDSE")
aoi <- sf::read_sf(dsn, as_tibble = FALSE)
script_file <- "inst/scripts/NDVI_dataMask_float32.js"
seasons <- SeasonalTimerange(from = "2020-06-01", to = "2023-08-31")
lst_stats <- lapply(seasons, GetStatisticsByTimerange, aoi = aoi, collection = "sentinel-2-l2a",
  script = script_file, mosaicking_order = "leastCC", resolution = 100,
  aggregation_period = 7L, client = OAuthClient)
```

```

weekly_stats <- do.call(rbind, lst_stats)
weekly_stats <- weekly_stats[rev(order(weekly_stats$from)), ]
row.names(weekly_stats) <- NULL
head(weekly_stats)

## End(Not run)

```

---

MakeEvalScript

*Create a Sentinel Hub API Evalscript*


---

## Description

Generates a JavaScript evaluation script for calculating a spectral index for Sentinel-1, Sentinel-2 or Landsat-8/9 imagery.

## Usage

```

MakeEvalScript(
  x,
  ...,
  constellation = c("sentinel-1", "sentinel-2", "landsat")
)

```

## Arguments

- `x` A character string with the `short_name` of a spectral index from `rsi::spectral_indices()` or a single-row `data.frame` (or `list`) with the elements `bands`, `formula`, `platforms`, and optionally `long_name`.
- `...` Named arguments providing values for any constants required by the index's formula. The function will stop if a required constant is missing and warn if unused arguments are provided.
- `constellation` character indicating the constellation for which the script should be generated. Must be one of "sentinel-1", "sentinel-2", or "landsat".

## Details

This function takes a spectral index definition and creates a JavaScript evaluation script compatible with the Sentinel Hub API. The index can be specified by its short name from the `rsi` package's spectral index database (see `rsi::spectral_indices()`) or as a custom `list` or `data.frame`.

The function automatically maps common band names (e.g., 'N', 'R', 'G', 'B') to the corresponding Sentinel-1, Sentinel-2 or Landsat-8/9 band names required by the API, based on the value of the `constellation` argument. Any constants in the index formula (e.g., the soil adjustment factor 'L' in SAVI) must be provided as named arguments.

**Value**

A ‘character’ vector containing the JavaScript evalscript. It can be used as ‘script’ argument in functions that require one as shown here:

```
..., script = paste(MakeEvalScript("NDVI"), collapse = "\n"), ...
```

It can also be saved to a file for later use or further modifications.

**Examples**

```
## Not run:

# NDVI
si <- rsi::spectral_indices() # retrieves spectral indices
ndvi <- subset(si, short_name == "NDVI") # creates one-row data.frame
ndvi_script <- MakeEvalScript(ndvi, constellation = "sentinel-2") # generates the script
cat(ndvi_script, sep = "\n")

# SAVI, which requires the constant L
cat(MakeEvalScript("SAVI", L = 0.5), sep = "\n", file = "SAVI.js")

# Using a custom index definition as a data.frame
custom_index <- data.frame(
  short_name = "GNDVI",
  long_name = "Green Normalized Difference Vegetation Index",
  platforms = I(list("Sentinel-2")),
  bands = I(list(c("N", "G"))),
  formula = "(N - G) / (N + G)"
)
cat(MakeEvalScript(custom_index, constellation = "landsat"))

## End(Not run)
```

---

 Point2Bbox

---

*Create bounding box around a point*


---

**Description**

Creates the bounding box (numeric vector of length four) around the input point(s).

**Usage**

```
Point2Bbox(x, y = NULL, size, crs = 4326)
```

**Arguments**

x	an sf, sfc, or SpatialPoints* object, a numeric indicating the longitude/easting of the point(s), or any input accepted by xy.coords
y	numeric, the latitude/northing of the point(s). Default: NULL

`size` numeric indicating the size (in meters) of the bounding box to create  
`crs` coordinate reference system of the input (and the output): object of class `crs`, or input string for `st_crs`. Default: 4326 (WGS 84)

### Details

The function assumes that the `crs` units are either degrees or meters, a warning is issued if not, and the result will probably be incorrect.

### Value

A bounding box (numeric vector of length four), or a list of bounding boxes if the input is not scalar.

### See Also

[xy.coords](#), [st\\_crs](#)

### Examples

```
## Not run:  
Point2Bbox(x = -73.96557, y = 40.78246, size = 1000, crs = 4326)  
  
## End(Not run)
```

---

SearchCatalog

*Search collection for available images*

---

### Description

Searches the specified collection for available images in the given time interval and intersecting with the bounding box or the area of interest.

### Usage

```
SearchCatalog(  
  aoi,  
  bbox,  
  from,  
  to,  
  collection,  
  as_data_frame = TRUE,  
  with_geometry = TRUE,  
  filter = NULL,  
  client,  
  token,  
  url = getOption("CDSE.catalog_url")  
)
```

**Arguments**

<code>aoi</code>	sf or sfc object, typically a (multi)polygon, describing the Area of Interest.
<code>bbox</code>	numeric vector of four elements describing the bounding box of interest. Specify with a coordinate pair on two (opposite) vertices of the bounding box rectangle. Coordinates need to be in longitude, latitude. Only one of either <code>aoi</code> or <code>bbox</code> may be specified.
<code>from</code>	start of the time interval to search.
<code>to</code>	end of the time interval to search. <code>from</code> and <code>to</code> can be either Date or character that can be converted to date by <code>as.Date</code> . Open interval (one side only) can be obtained by providing the NA or NULL value for the corresponding argument.
<code>collection</code>	character indicating which collection to search. Must be one of the collections returned by <code>GetCollections</code> .
<code>as_data_frame</code>	logical indicating if the result should be returned as data frame. Default: TRUE
<code>with_geometry</code>	logical indicating if the granule geometries should be included in the data.frame. Default: TRUE
<code>filter</code>	character, CQL2 text filter. Use the function <code>GetQueryables</code> to find out which filters can be used with the collection. Default: NULL (no filtering)
<code>client</code>	OAuth client object to use for authentication.
<code>token</code>	OAuth token character string to use for authentication. Exactly one of either <code>client</code> or <code>token</code> must be specified. It is recommended to use <code>client</code> .
<code>url</code>	character indicating the STAC catalog search endpoint. Default: Copernicus Data Space Ecosystem STAC endpoint

**Details**

If no images found, a NULL value is returned.

**Value**

A list, `data.frame` or a sf object.

**Source**

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Catalog.html>

**See Also**

[GetCollections](#), [GetQueryables](#), [GetImage](#)

**Examples**

```
## Not run:
dsn <- system.file("extdata", "luxembourg.geojson", package = "CDSE")
aoi <- sf::read_sf(dsn, as_tibble = FALSE)
images <- SearchCatalog(aoi = aoi, from = "2023-07-01", to = "2023-07-31",
  collection = "sentinel-2-l2a", with_geometry = TRUE, client = OAuthClient)
images_cloudless <- SearchCatalog(aoi = aoi, from = "2023-07-01", to = "2023-07-31",
  filter = "eo:cloud_cover < 5",
  collection = "sentinel-2-l2a", with_geometry = TRUE, client = OAuthClient)

## End(Not run)
```

---

SearchCatalogBy...      *Search collection for available images (vectorization ready)*

---

**Description**

These functions search the specified collection for available images using the parameters provided. They are simple wrappers around the 'SearchCatalog' function with arguments organized in a way that facilitates calling the function in a vectorized manner (using 'lapply' or similar function) and thus potentially also the parallelization. The 'from' and 'to' arguments are combined into a single argument 'time\_range'.

**Usage**

```
SearchCatalogByTimerange(
  time_range,
  aoi,
  bbox,
  collection,
  as_data_frame = TRUE,
  with_geometry = TRUE,
  filter = NULL,
  client,
  token,
  url = getOption("CDSE.catalog_url")
)
```

```
SearchCatalogByAOI(
  aoi,
  time_range,
  collection,
  as_data_frame = TRUE,
  with_geometry = TRUE,
  filter = NULL,
  client,
  token,
```

```

url = getOption("CDSE.catalog_url")
)

SearchCatalogByBbox(
  bbox,
  time_range,
  collection,
  as_data_frame = TRUE,
  with_geometry = TRUE,
  filter = NULL,
  client,
  token,
  url = getOption("CDSE.catalog_url")
)

```

### Arguments

<code>time_range</code>	scalar or vector (Date or character that can be converted to date) defining the time interval. Open interval (one side only) can be obtained by providing the NA or NULL value for the corresponding argument.
<code>aoi</code>	sf or sfc object, typically a (multi)polygon, describing the Area of Interest.
<code>bbox</code>	numeric vector of four elements describing the bounding box of interest. Specify with a coordinate pair on two (opposite) vertices of the bounding box rectangle. Coordinates need to be in longitude, latitude. Only one of either <code>aoi</code> or <code>bbox</code> may be specified.
<code>collection</code>	character indicating which collection to search. Must be one of the collections returned by <code>GetCollections</code> .
<code>as_data_frame</code>	logical indicating if the result should be returned as data frame. Default: TRUE
<code>with_geometry</code>	logical indicating if the granule geometries should be included in the data.frame. Default: TRUE
<code>filter</code>	character, CQL2 text filter. Use the function <code>GetQueryables</code> to find out which filters can be used with the collection. Default: NULL (no filtering)
<code>client</code>	OAuth client object to use for authentication.
<code>token</code>	OAuth token character string to use for authentication. Exactly one of either <code>client</code> or <code>token</code> must be specified. It is recommended to use <code>client</code> .
<code>url</code>	character indicating the STAC catalog search endpoint. Default: Copernicus Data Space Ecosystem STAC endpoint

### Details

If no images found, a NULL value is returned.

`SearchCatalogByTimerange` is arranged for vectorization on `time_range` (`time_range` is the first argument).

`SearchCatalogByAOI` is arranged for vectorization on `aoi` (`aoi` is the first argument).

`SearchCatalogByBbox` is arranged for vectorization on `bbox` (`bbox` is the first argument).

**Value**

A list, data.frame or a sf object.

**Source**

<https://documentation.dataspace.copernicus.eu/APIs/SentinelHub/Catalog.html>

**See Also**

[SearchCatalog](#)

**Examples**

```
## Not run:
dsn <- system.file("extdata", "centralpark.geojson", package = "CDSE")
aoi <- sf::read_sf(dsn, as_tibble = FALSE)
seasons <- SeasonalTimerange(from = "2020-06-01", to = "2023-08-31")
lst_images_cloudless <- lapply(seasons, SearchCatalogByTimerange, aoi = aoi,
  collection = "sentinel-2-l2a", with_geometry = FALSE,
  filter = "eo:cloud_cover < 5", client = OAuthClient)
images_cloudless <- do.call(rbind, lst_images_cloudless)
images_cloudless <- images_cloudless[rev(order(images_cloudless$acquisitionDate)), ]
row.names(images_cloudless) <- NULL
head(images_cloudless[, 1:5])

## End(Not run)
```

---

SeasonalFilter

*Filter image catalog for seasonal images*

---

**Description**

Filters image catalog entries that fall in the season of interest - dates between from day/month and to day/month for all years in the from - to time range.

**Usage**

```
SeasonalFilter(catalog, from, to)
```

**Arguments**

catalog      data.frame or sf object as the one produced by a call to SearchCatalog

from          start of the season of interest.

to            end of the season of interest.

The from and to arguments can be either Date or character that can be converted to date by as.Date. Open intervals are not allowed (both from and to must be valid dates).

**Value**

A data.frame or a sf object, depending on the type of the input.

**See Also**

[SearchCatalog](#), [SeasonalTimerange](#)

**Examples**

```
## Not run:
dsn <- system.file("extdata", "centralpark.geojson", package = "CDSE")
aoi <- sf::read_sf(dsn, as_tibble = FALSE)
all_images <- SearchCatalog(aoi = aoi, from = "2021-06-01", to = "2023-08-31",
  collection = "sentinel-2-l2a", with_geometry = TRUE, client = OAuthClient)
seasonal_images <- SeasonalFilter(all_images, from = "2021-06-01", to = "2023-08-31")

## End(Not run)
```

---

SeasonalTimerange	<i>Create seasonal time range</i>
-------------------	-----------------------------------

---

**Description**

Creates list of seasonal filters (one per year) for the season of interest - dates between from day/month and to day/month for all years in the from - to time range.

**Usage**

```
SeasonalTimerange(from, to)
```

**Arguments**

from	start of the season of interest.
to	end of the season of interest.

The from and to arguments can be either Date or character that can be converted to date by as.Date. Open intervals are not allowed (both from and to must be valid dates).

**Value**

A list of time ranges defining the season of interest for each year.

**Examples**

```
## Not run:
seasons <- SeasonalTimerange(from = "2020-05-01", to = "2023-09-30")
seasons <- SeasonalTimerange(from = "2019-11-01", to = "2023-03-30")

## End(Not run)
```

---

SetPathAPI	<i>Set API Path Structure</i>
------------	-------------------------------

---

## Description

Switch between the legacy and the new API path structure for Sentinel Hub services on the Copernicus Data Space Ecosystem.

## Usage

```
SetPathAPI(new = FALSE)
```

## Arguments

new	logical, indicating whether to use the new API path structure. Default is FALSE (uses legacy format).
-----	---

## Details

As of March 2026, the Sentinel Hub APIs on the Copernicus Data Space Ecosystem support an additional format alongside the legacy paths.

- Legacy format: /api/<version>/<service>
- New format: /<service>/<version>

Setting new = TRUE switches the URLs for process and statistics API endpoints to the new format. For more details, see <https://dataspace.copernicus.eu/news/2026-3-9-api-path-structure-updates-sentinel>

## Value

No return value, called for side effects (sets the API endpoints).

## Examples

```
## Not run:  
SetPathAPI(new = TRUE)  
  
## End(Not run)
```

---

 UniqueCatalog

*Produce image catalog without multiple entries per date*


---

### Description

Sometimes several images could be available for the given day. It can be useful to have a list where for any given day there is just one row in the list. This unique row can be selected to represent either the least cloud coverage or the biggest coverage of the are of interest.

### Usage

```
UniqueCatalog(
  imageCatalog,
  by = c("areaCoverage", "tileCloudCover"),
  keep = names(imageCatalog)
)
```

### Arguments

imageCatalog	data.frame as returned by the SearchCatalog function.
by	character indicating which attribute is used to select the best image per date. Can be either "areaCoverage" or "tileCloudCover".
keep	list of columns to keep in output. Default: all columns in input.

### Details

By default, the returned data.frame has the same columns as the input catalog. User can specify a subset of columns to include in the output through the keep parameter.

### Value

data.frame with one row per date.

### See Also

[SearchCatalog](#)

### Examples

```
## Not run:
dsn <- system.file("extdata", "luxembourg.geojson", package = "CDSE")
aoi <- sf::read_sf(dsn, as_tibble = FALSE)
images <- SearchCatalog(aoi = aoi, from = "2023-07-01", to = "2023-07-31",
  collection = "sentinel-2-l2a", with_geometry = TRUE, client = OAuthClient)
best_daily <- UniqueCatalog(images, by = "areaCoverage",
  keep = c("acquisitionDate", "tileCloudCover", "areaCoverage", "satellite"))

## End(Not run)
```

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