

Package ‘blackmarbler’

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Title Black Marble Data and Statistics

Version 0.2.7

Description Geographically referenced data and statistics of nighttime lights from NASA Black Marble <<https://blackmarble.gsfc.nasa.gov/>>.

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URL <https://worldbank.github.io/blackmarbler/>

BugReports <https://github.com/worldbank/blackmarbler/issues>

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bm_extract

*Extract and Aggregate Black Marble Data***Description**

Extract and aggregate nighttime lights data from [NASA Black Marble data](#)

Usage

```
bm_extract(
  roi_sf,
  product_id,
  date,
  bearer,
  aggregation_fun = c("sum"),
  add_n_pixels = TRUE,
  variable = NULL,
  quality_flag_rm = NULL,
  check_all_tiles_exist = TRUE,
  interpol_na = FALSE,
  output_location_type = "memory",
  file_dir = NULL,
  file_prefix = NULL,
  file_skip_if_exists = TRUE,
  file_return_null = FALSE,
  h5_dir = NULL,
  download_method = "httr",
  httr_timeout = 60,
  quiet = FALSE,
  ...
)
```

Arguments

roi_sf	Region of interest; sf polygon. Must be in the WGS 84 (epsg:4326) coordinate reference system.
product_id	One of the following: "VNP46A1": Daily (raw) "VNP46A2": Daily (corrected) "VNP46A3": Monthly "VNP46A4": Annual
date	Date of raster data. Entering one date will produce a SpatRaster object. Entering multiple dates will produce a SpatRaster object with multiple bands; one band per date. For product_ids "VNP46A1" and "VNP46A2", a date (eg, "2021-10-03").

	• For product_id "VNP46A3", a date or year-month (e.g., "2021-10-01", where the day will be ignored, or "2021-10"). • For product_id "VNP46A4", year or date (e.g., "2021-10-01", where the month and day will be ignored, or 2021).
bearer	NASA bearer token. For instructions on how to create a token, see here .
aggregation_fun	Function used to aggregate nighttime lights data to polygons; this values is passed to the fun argument in <code>exactextractr::exact_extract</code> (Default: <code>sum</code>).
add_n_pixels	Whether to add a variable indicating the number of nighttime light pixels used to compute nighttime lights statistics (eg, number of pixels used to compute average of nighttime lights). When TRUE, it adds three values: <code>n_non_na_pixels</code> (the number of non-NA pixels used for computing nighttime light statistics); <code>n_pixels</code> (the total number of pixels); and <code>prop_non_na_pixels</code> the proportion of the two. (Default: TRUE).
variable	Variable to used to create raster (default: NULL). If NULL, uses the following default variables: • For product_id :VNP46A1", uses <code>DNB_At_Sensor_Radiance_500m</code>. • For product_id "VNP46A2", uses <code>Gap_Filled_DNB_BRDF-Corrected_NTL</code>. • For product_ids "VNP46A3" and "VNP46A4", uses <code>NearNadir_Composite_Snow_Free</code>. To see all variable choices, set <code>variable = ""</code> (this will create an error message that lists all valid variables). For additional information on variable choices, see here; for VNP46A1, see Table 3; for VNP46A2 see Table 6; for VNP46A3 and VNP46A4, see Table 9.
quality_flag_rm	Quality flag values to use to set values to NA. Each pixel has a quality flag value, where low quality values can be removed. Values are set to NA for each value in the <code>quality_flag_rm</code> vector. Note that <code>quality_flag_rm</code> does not apply for VNP46A1. (Default: NULL). For VNP46A2 (daily data): • 0: High-quality, Persistent nighttime lights • 1: High-quality, Ephemeral nighttime Lights • 2: Poor-quality, Outlier, potential cloud contamination, or other issues For VNP46A3 and VNP46A4 (monthly and annual data): • 0: Good-quality, The number of observations used for the composite is larger than 3 • 1: Poor-quality, The number of observations used for the composite is less than or equal to 3 • 2: Gap filled NTL based on historical data
check_all_tiles_exist	Check whether all Black Marble nighttime light tiles exist for the region of interest. Sometimes not all tiles are available, so the full region of interest may not be covered. If TRUE, skips cases where not all tiles are available. (Default: TRUE).

<code>interpol_na</code>	When data for more than one date is downloaded, whether to interpolate NA values in rasters using the <code>terra::approximate</code> function. Additional arguments for the <code>terra::approximate</code> function can also be passed into <code>bm_extract</code> (eg, <code>method</code> , <code>rule</code> , <code>f</code> , <code>ties</code> , <code>z</code> , <code>NA_rule</code>). (Default: <code>FALSE</code>).
<code>output_location_type</code>	Where to produce output; either memory or file. If memory, functions returns a dataframe in R. If file, function exports a .csv file and returns <code>NULL</code> .
<code>file_dir</code>	(If <code>output_location_type = file</code>). The directory where data should be exported (default: <code>NULL</code> , so the working directory will be used)
<code>file_prefix</code>	(If <code>output_location_type = file</code>). Prefix to add to the file to be saved. The file will be saved as the following: <code>[file_prefix][product_id]_t[date].csv</code>
<code>file_skip_if_exists</code>	(If <code>output_location_type = file</code>). Whether the function should first check wither the file already exists, and to skip downloading or extracting data if the data for that date if the file already exists (default: <code>TRUE</code>).
<code>file_return_null</code>	Whether to return <code>NULL</code> instead of a dataframe. When <code>output_location_type = 'file'</code> , the function will export data to the <code>file_dir</code> directory. When <code>file_return_null = FALSE</code> , the function will also return a dataframe of the queried data—so the data is available in R memory. Setting <code>file_return_null = TRUE</code> , data will be saved to <code>file_dir</code> but no data will be returned by the function to R memory (default: <code>FALSE</code>).
<code>h5_dir</code>	Black Marble data are originally downloaded as h5 files. If <code>h5_dir = NULL</code> , the function downloads to a temporary directory then deletes the directory. If <code>h5_dir</code> is set to a path, h5 files are saved to that directory and not deleted. The function will then check if the needed h5 file already exists in the directory; if it exists, the function will not re-download the h5 file.
<code>download_method</code>	Method to download data (h5 files) from NASA LAADS Archive: "httr" or "wget". If <code>httr</code> , uses the <code>httr2</code> R package to download data. If <code>wget</code> , uses the <code>wget</code> command line tool. <code>httr</code> is fully integrated in R, while <code>wget</code> requires the <code>wget</code> system command. <code>wget</code> can be more efficient and can help avoid network issues. (Default: "httr").
<code>httr_timeout</code>	When <code>download_method</code> is set to "httr", time limit for request in seconds. (Default: 60).
<code>quiet</code>	Suppress output that show downloading progress and other messages. (Default: <code>FALSE</code>).
<code>...</code>	Additional arguments for <code>terra::approximate</code> , if <code>interpol_na = TRUE</code>

Value

Raster

Author(s)Robert Marty rmarty@worldbank.org

Examples

```
## Not run:
# Define bearer token
bearer <- "BEARER-TOKEN-HERE"

# sf polygon of Ghana
library(geodata)
roi_sf <- gadm(country = "GHA", level=1, path = tempdir()) %>% st_as_sf()

# Daily data: raster for October 3, 2021
ken_20210205_r <- bm_extract(roi_sf = roi_sf,
                             product_id = "VNP46A2",
                             date = "2021-10-03",
                             bearer = bearer)

# Monthly data: raster for March 2021
ken_202103_r <- bm_extract(roi_sf = roi_sf,
                             product_id = "VNP46A3",
                             date = "2021-03-01",
                             bearer = bearer)

# Annual data: raster for 2021
ken_2021_r <- bm_extract(roi_sf = roi_sf,
                             product_id = "VNP46A4",
                             date = 2021,
                             bearer = bearer)

## End(Not run)
```

bm_raster

Make Black Marble Raster

Description

Make a raster of nighttime lights from [NASA Black Marble data](#)

Usage

```
bm_raster(
  roi_sf,
  product_id,
  date,
  bearer,
  variable = NULL,
  quality_flag_rm = NULL,
  check_all_tiles_exist = TRUE,
  interpol_na = FALSE,
  output_location_type = "memory",
```

```

    file_dir = NULL,
    file_prefix = NULL,
    file_skip_if_exists = TRUE,
    file_return_null = FALSE,
    h5_dir = NULL,
    download_method = "httr",
    httr_timeout = 60,
    quiet = FALSE,
    ...
)

```

Arguments

roi_sf	Region of interest; sf polygon. Must be in the WGS 84 (epsg:4326) coordinate reference system.
product_id	One of the following: • "VNP46A1": Daily (raw) • "VNP46A2": Daily (corrected) • "VNP46A3": Monthly • "VNP46A4": Annual
date	Date of raster data. Entering one date will produce a SpatRaster object. Entering multiple dates will produce a SpatRaster object with multiple bands; one band per date. • For product_ids "VNP46A1" and "VNP46A2", a date (eg, "2021-10-03"). • For product_id "VNP46A3", a date or year-month (e.g., "2021-10-01", where the day will be ignored, or "2021-10"). • For product_id "VNP46A4", year or date (e.g., "2021-10-01", where the month and day will be ignored, or 2021).
bearer	NASA bearer token. For instructions on how to create a token, see here .
variable	Variable to used to create raster (default: NULL). If NULL, uses the following default variables: • For product_id :VNP46A1", uses DNB_At_Sensor_Radiance_500m. • For product_id "VNP46A2", uses Gap_Filled_DNB_BRDF-Corrected_NTL. • For product_ids "VNP46A3" and "VNP46A4", uses NearNadir_Composite_Snow_Free. To see all variable choices, set variable = "" (this will create an error message that lists all valid variables). For additional information on variable choices, see here ; for VNP46A1, see Table 3; for VNP46A2 see Table 6; for VNP46A3 and VNP46A4, see Table 9.
quality_flag_rm	Quality flag values to use to set values to NA. Each pixel has a quality flag value, where low quality values can be removed. Values are set to NA for each value in the quality_flag_rm vector. Note that quality_flag_rm does not apply for VNP46A1. (Default: NULL). For VNP46A2 (daily data): • 0: High-quality

- 1: Poor-quality - Main Algorithm (Outlier, Potential cloud contamination or other issues)
- 2: Poor-quality - Main Algorithm (high solar zenith angle 102-108 degrees)
- 3: Poor-quality - Main Algorithm (Lunar eclipse)
- 4: Poor-quality - Main Algorithm (Aurora)
- 5: Poor-quality - Main Algorithm (Glint)

For VNP46A3 and VNP46A4 (monthly and annual data):

- 0: Good-quality, The number of observations used for the composite is larger than 3
- 1: Poor-quality, The number of observations used for the composite is less than or equal to 3
- 2: Gap filled NTL based on historical data

check_all_tiles_exist

Check whether all Black Marble nighttime light tiles exist for the region of interest. Sometimes not all tiles are available, so the full region of interest may not be covered. If TRUE, skips cases where not all tiles are available. (Default: TRUE).

interpol_na

When data for more than one date is downloaded, whether to interpolate NA values using the `terra::approximate` function. Additional arguments for the `terra::approximate` function can also be passed into `bm_raster` (eg, `method`, `rule`, `f`, `ties`, `z`, `NA_rule`). (Default: FALSE).

output_location_type

Where to produce output; either memory or file. If memory, functions returns a raster in R. If file, function exports a .tif file and returns NULL. For `output_location_type = file`:

file_dir

The directory where data should be exported (default: NULL, so the working directory will be used)

file_prefix

Prefix to add to the file to be saved. The file will be saved as the following: `[file_prefix][product_id]_t[date].tif`

file_skip_if_exists

Whether the function should first check whether the file already exists, and to skip downloading or extracting data if the data for that date if the file already exists (default: TRUE).

file_return_null

Whether to return NULL instead of a `SpatRaster`. When `output_location_type = 'file'`, the function will export data to the `file_dir` directory. When `file_return_null = FALSE`, the function will also return a `SpatRaster` of the queried data—so the data is available in R memory. Setting `file_return_null = TRUE`, data will be saved to `file_dir` but no data will be returned by the function to R memory (default: FALSE).

h5_dir

Black Marble data are originally downloaded as h5 files. If `h5_dir = NULL`, the function downloads to a temporary directory then deletes the directory. If `h5_dir` is set to a path, h5 files are saved to that directory and not deleted. The function will then check if the needed h5 file already exists in the directory; if it exists, the function will not re-download the h5 file.

download_h5_files	<i>Download h5 files</i>
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Description

Download h5 files from from **NASA Black Marble data** using wget. The `wget_h5_files()` function requires the wget command line tool to be installed on your system. If you do not have wget installed, please install it from <https://www.gnu.org/software/wget/>.

Usage

```
download_h5_files(
  roi_sf = NULL,
  product_id,
  date,
  h5_dir,
  bearer,
  download_method = "httr",
  httr_timeout = 60
)
```

Arguments

<code>roi_sf</code>	Region of interest; sf polygon. Must be in the WGS 84 (epsg:4326) coordinate reference system. If NULL, all h5 files for the inputted date(s) are downloaded.
<code>product_id</code>	One of the following: • "VNP46A1": Daily (raw) • "VNP46A2": Daily (corrected) • "VNP46A3": Monthly • "VNP46A4": Annual
<code>date</code>	Date(s) to download h5 files. • For product_ids "VNP46A1" and "VNP46A2", a date (eg, "2021-10-03"). • For product_id "VNP46A3", a date or year-month (e.g., "2021-10-01", where the day will be ignored, or "2021-10"). • For product_id "VNP46A4", year or date (e.g., "2021-10-01", where the month and day will be ignored, or 2021).
<code>h5_dir</code>	Path to download h5 files to.
<code>bearer</code>	NASA bearer token. For instructions on how to create a token, see here .
<code>download_method</code>	Method to download data (h5 files) from NASA LAADS Archive: "httr" or "wget". If httr, uses the httr2 R package to download data. If wget, uses the wget command line tool. httr is fully integrated in R, while wget requires the wget system command. wget can be more efficient and can help avoid network issues. (Default: "httr").
<code>httr_timeout</code>	When download_method is set to "httr", time limit for request in seconds. (Default: 60).

Value

NULL

Author(s)Robert Marty rmarty@worldbank.org**Examples**

```
## Not run:
# Define bearer token
bearer <- "BEARER-TOKEN-HERE"

# sf polygon of Ghana
library(geodata)
roi_sf <- gadm(country = "GHA", level=0, path = tempdir()) %>% st_as_sf()

# h5 files for Ghana for October 3, 2021
wget_h5_files(roi_sf = roi_sf,
              product_id = "VNP46A2",
              date = "2021-10-03",
              h5_dir = getwd(),
              bearer = bearer)

# Make raster using h5_files
ken_202103_r <- bm_raster(roi_sf = roi_sf,
                        product_id = "VNP46A3",
                        date = "2021-03-01",
                        bearer = bearer,
                        h5_dir = getwd())

## End(Not run)
```

get_nasa_token

*Get a NASA Earthdata bearer token***Description**

Fetch a NASA Earthdata bearer token from using the Earthdata API. If none exist, this will create one, or if one already exists it will fetch that one instead.

Usage

```
get_nasa_token(username, password)
```

get_nasa_token

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Arguments

username	character. NASA Earthdata username
password	character. NASA Earthdata password

Value

character

Author(s)

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