Package 'whitewater'

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Title Parallel Processing Options for Package 'dataRetrieval'

Version 0.1.3

Description Provides methods for retrieving United States Geological Survey (USGS) water data using sequential and parallel processing (Bengtsson, 2022 <doi:10.32614/RJ-2021-048>). In addition to parallel methods, data wrangling and additional statistical attributes are provided.

URL https://github.com/joshualerickson/whitewater/, https://joshualerickson.github.io/whitewater/

BugReports https://github.com/joshualerickson/whitewater/issues/

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`delay_setup` *Delay*

Description

Delay

Usage

```
delay_setup()
```

Value

a number for amount of time to delay

`pnw_wy` *A subset of USGS stations in HUC 17*

Description

A subset of USGS stations in HUC 17

Usage

```
pnw_wy
```

Format

A data frame with 18934 rows and 30 variables:

Station name of USGS station

site_no station site id number

wy water year

peak_va peak flow value

peak_dt peak flow date

drainage_area drainage area in sq.miles

lat latitude

long longitude

altitude altitude in meters

obs_per_wy observations per water year per site

wy_count water year count per site

Flow_sum Sum of Flow

Flow_max Maximum of Flow

Flow_min Minimum of Flow

Flow_mean Mean of Flow

Flow_median Median of Flow

Flow_stdev Standard Deviation of Flow

Flow_coef_var Coeffiecient of Variation of Flow

Flow_max_dnorm Maximum of Flow normalized by drainage area

Flow_min_dnorm Minimum of Flow normalized by drainage area

Flow_mean_dnorm Mean of Flow normalized by drainage area

Flow_med_dnorm Median of Flow normalized by drainage area

Flow_max_sdnorm Maximum of Flow normalized by drainage area

Flow_min_sdnorm Minimum of Flow normalized by standard deviation

Flow_mean_sdnorm Mean of Flow normalized by standard deviation

Flow_med_sdnorm Median of Flow normalized by standard deviation

Flow_sd_norm Standard Deviation of Flow normalized by standard deviation

decade decade

COMID comid of site

DamIndex dam index

Value

a tibble

wwOptions *Options*

Description

Options

Usage

```
wwOptions(
  date_range = "pfn",
  period = 11,
  dates = NULL,
  site_status = "all",
  floor_iv = "1 hour",
  ...
)
```

Arguments

date_range	A character. Indicating how to call the API. 'pfn' = Period from now, 'date_range' = a date range, "recent" = the most recent value.
period	A numeric. Return all values from a period from now (only if 'pfn' is used).
dates	A vector. Return all values within an absolute date range (start and end dates). Only if 'date_range' is used.
site_status	A character indicating site status. Example, 'all' = both active and inactive, 'active' = only active sites, 'inactive' = only inactive sites.
floor_iv	A character on how to floor the instantaneous values, '1 hour' (default).
...	other options used for options.

Value

A list with API options.

Note

A site is considered active if; it has collected time-series (automated) data within the last 183 days (6 months) or it has collected discrete (manually collected) data within 397 days (13 months).

Examples

```
## Not run:

library(whitewater)
yaak_river_dv <- ww_dvUSGS('12304500',
parameter_cd = '00060',
```

```
wy_month = 10)

yaak_river_iv <- ww_floorIVUSGS(yaak_river_dv)

#change floor method

yaak_river_iv <- ww_floorIVUSGS(yaak_river_dv,
                                options = wwOptions(floor_iv = '6-hour'))

#change number of days

yaak_river_iv <- ww_floorIVUSGS(yaak_river_dv,
                                options = wwOptions(floor_iv = '2-hour',
                                                    period = 365))

# get by date range


yaak_river_wy <- ww_floorIVUSGS(yaak_river_dv,
                                options = wwOptions(date_range = 'date_range',
                                                dates = c('2022-03-01', '2022-05-11')))


# site status as 'active'

yaak_river_wy <- ww_floorIVUSGS(yaak_river_dv,
                                options = wwOptions(site_status = 'active',
                                                    date_range = 'date_range',
                                                dates = c('2022-03-01', '2022-05-11')))

## End(Not run)
```

`ww_current_conditions` *Get Current Conditions*

Description

Get Current Conditions

Usage

```
ww_current_conditions()
```

Value

a `tibble` with current conditions and attributes from USGS dashboard.

Note

The time zone used in the URL call is the R session time zone. Also, the time is 1-hour behind. Here are the attributes that are with the data.frame: AgencyCode,SiteNumber,SiteName,SiteTypeCode,Latitude,Longitude, CurrentConditionID,ParameterCode,TimeLocal,TimeZoneCode,Value, ValueFlagCode,RateOfChangeUnitPerHour,Statistic

Examples

```
## Not run:

current_conditions <- ww_current_conditions()


## End(Not run)
```

`ww_dvUSGS` *Process USGS daily values*

Description

This function is a wrapper around readNWISdv but includes added variables like water year, lat/lon, station name, altitude and tidied dates.

Usage

```
ww_dvUSGS(
  sites,
  parameter_cd = "00060",
  start_date = "",
  end_date = "",
  stat_cd = "00003",
  parallel = FALSE,
  wy_month = 10,
  verbose = TRUE,
  ...
)
```

Arguments

`sites`	A vector of USGS NWIS sites
`parameter_cd`	A USGS code for metric, default is "00060".
`start_date`	A character of date format, e.g. `"1990-09-01"`
`end_date`	A character of date format, e.g. `"1990-09-01"`
`stat_cd`	character USGS statistic code. This is usually 5 digits. Daily mean (00003) is the default.
`parallel`	`logical` indicating whether to use future_map().

wy_month	numeric indicating the start month of the water year. e.g. 10 (default).
verbose	logical for printing information. TRUE (default).
...	arguments to pass on to future_map.

Value

A tibble with daily metrics and added meta-data.

Note

Use it the same way you would use readNWISdv.

Examples

```
## Not run:

library(whitewater)
yaak_river_dv <- ww_dvUSGS('12304500',
parameter_cd = '00060',
wy_month = 10)

#parallel

#get sites

huc17_sites <- dataRetrieval::whatNWISdata(huc = 17,
siteStatus = 'active',
service = 'dv',
parameterCd = '00060')

library(future)
#need to call future::plan()
plan(multisession(workers = availableCores()-1))

pnw_dv <- ww_dvUSGS(huc17_sites$site_no,
parameter_cd = '00060',
wy_month = 10,
parallel = TRUE)


## End(Not run)
```

---

ww_floorIVUSGS *Floor IV USGS*

Description

This function generates instantaneous NWIS data from https://waterservices.usgs.gov/ and then floors to a user defined interval with wwOptions ('1 hour' is default) by taking the mean.

Usage

```
ww_floorIVUSGS(
  procDV,
  sites = NULL,
  parameter_cd = NULL,
  options = wwOptions(),
  parallel = FALSE,
  verbose = TRUE,
  ...
)
```

Arguments

procDV	A previously created ww_dvUSGS object.
sites	A vector of USGS NWIS sites (optional).
parameter_cd	A USGS code parameter code, only if using sites argument.
options	A wwOptions call.
parallel	logical indicating whether to use future_map().
verbose	logical for printing information. TRUE (default).
...	arguments to pass on to future_map.

Value

A tibble with a user defined interval time step.

Note

For performance reasons, with multi-site retrievals you may retrieve data since October 1, 2007 only. If a previously created ww_dvUSGS object is not used then the user needs to provide a sites vector. This will run ww_dvUSGS in the background.

Examples

```
## Not run:

library(whitewater)
yaak_river_dv <- ww_dvUSGS('12304500',
parameter_cd = '00060',
wy_month = 10)

yaak_river_iv <- ww_floorIVUSGS(yaak_river_dv)

#change floor method

yaak_river_iv <- ww_floorIVUSGS(yaak_river_dv,
                                options = wwOptions(floor_iv = '6-hour'))

#change number of days
```

```
yaak_river_iv <- ww_floorIVUSGS(yaak_river_dv,
                                options = wwOptions(floor_iv = '2-hour',
                                                    period = 365))

# get by date range


yaak_river_wy <- ww_floorIVUSGS(yaak_river_dv,
                                options = wwOptions(date_range = 'date_range',
                                                    dates = c('2022-03-01', '2022-05-11')))

#parallel

#get sites

huc17_sites <- dataRetrieval::whatNWISdata(huc = 17,
siteStatus = 'active',
service = 'dv',
parameterCd = '00060')

library(future)
#need to call future::plan()
plan(multisession(workers = availableCores()-1))

pnw_dv <- ww_dvUSGS(huc17_sites$site_no,
parameter_cd = '00060',
wy_month = 10,
parallel = TRUE)

pnw_iv <- ww_floorIVUSGS(pnw_dv,
                    parallel = TRUE)

## End(Not run)
```

`ww_instantaneousUSGS` *Instantaneous USGS*

Description

This function generates Instantaneous NWIS data from https://waterservices.usgs.gov/.

Usage

```
ww_instantaneousUSGS(
  procDV,
  sites = NULL,
  parameter_cd = NULL,
  options = wwOptions(),
  parallel = FALSE,
```

```
  verbose = TRUE,
  ...
)
```

Arguments

procDV	A previously created ww_dvUSGS object.
sites	A vector of USGS NWIS sites. optional
parameter_cd	A USGS code parameter code, only if using sites argument.
options	A wwOptions call.
parallel	logical indicating whether to use future_map().
verbose	logical for printing information. TRUE (default).
...	arguments to pass on to future_map.

Value

A tibble with instantaneous values.

Note

For performance reasons, with multi-site retrievals you may retrieve data since October 1, 2007 only. If a previously created ww_dvUSGS object is not used then the user needs to provide a sites vector. This will run ww_dvUSGS in the background.

Examples

```
## Not run:

library(whitewater)
yaak_river_dv <- ww_dvUSGS('12304500',
parameter_cd = '00060',
wy_month = 10)

yaak_river_iv <- ww_instantaneousUSGS(yaak_river_dv)

#change number of days

yaak_river_iv <- ww_instantaneousUSGS(yaak_river_dv,
                                options = wwOptions(period = 365))

# get by date range

yaak_river_wy <- ww_instantaneousUSGS(yaak_river_dv,
                                options = wwOptions(date_range = 'date_range',
                                                dates = c('2022-03-01', '2022-05-11')))

# get most recent

yaak_river_wy <- ww_instantaneousUSGS(yaak_river_dv,
                                options = wwOptions(date_range = 'recent'))
```

```
#parallel

#get sites

huc17_sites <- dataRetrieval::whatNWISdata(huc = 17,
siteStatus = 'active',
service = 'dv',
parameterCd = '00060')

library(future)
#need to call future::plan()
plan(multisession(workers = availableCores()-1))

pnw_dv <- ww_dvUSGS(huc17_sites$site_no,
parameter_cd = '00060',
wy_month = 10,
parallel = TRUE)

pnw_iv <- ww_instantaneousUSGS(pnw_dv,
                    parallel = TRUE)

## End(Not run)
```

`ww_monthUSGS` *Month-Only Stats (USGS)*

Description

This function uses the results of the ww_dvUSGS object to generate mean, maximum, median, standard deviation and coefficient of variation for month only.

Usage

```
ww_monthUSGS(procDV, sites = NULL, parallel = FALSE, verbose = TRUE, ...)
```

Arguments

`procDV`	A previously created ww_dvUSGS object.
`sites`	A `character` vector with NWIS site numbers (optional).
`parallel`	`logical` indicating whether to use future_map().
`verbose`	`logical` for printing information. TRUE (default).
`...`	arguments to pass on to future_map and ww_dvUSGS.

Value

A `tibble` filtered by month and added meta-data.

Note

If a previously created ww_dvUSGS object is not used then the user needs to provide a `sites` vector. This will run ww_dvUSGS in the background.

Examples

```
## Not run:

library(whitewater)
yaak_river_dv <- ww_dvUSGS('12304500',
parameter_cd = '00060',
wy_month = 10)

yaak_river_month <- ww_monthUSGS(yaak_river_dv)


## End(Not run)
```

`ww_peakUSGS` *Get Peak Flows*

Description

Get Peak Flows

Usage

```
ww_peakUSGS(sites, parallel = FALSE, wy_month = 10, verbose = TRUE, ...)
```

Arguments

`sites`	A vector of USGS NWIS sites
`parallel`	`logical` indicating whether to use future_map().
`wy_month`	`numeric` indicating the start month of the water year. e.g. 10 (default).
`verbose`	`logical` for printing information. TRUE (default).
`...`	arguments to pass on to future_map.

Value

a `tibble` with peaks by water year

`ww_statsUSGS` *USGS stats*

Description

This function uses the readNWISstat to gather daily, monthly or yearly percentiles.

Usage

```
ww_statsUSGS(
  procDV,
  sites = NULL,
  temporalFilter = "daily",
  parameter_cd = NULL,
  days = 10,
  parallel = FALSE,
  verbose = TRUE,
  ...
)
```

Arguments

`procDV`	A previously created ww_dvUSGS object.
`sites`	A `character` USGS NWIS site.
`temporalFilter`	A `character` for the stat summary window, e.g. 'daily' (default), 'monthly', 'yearly'.
`parameter_cd`	A USGS code parameter code, only if using `sites` argument.
`days`	A `numeric` input of days to go back from today (only needed if using .temporalFilter = 'daily').
`parallel`	`logical` indicating whether to use future_map().
`verbose`	`logical` for printing information. TRUE (default).
`...`	arguments to pass on to future_map.

Value

a tibble with associated site statistics.

Note

Be aware, the parameter values ('Flow', 'Wtemp', etc) are calculated from the ww_floorIVUSGS function by taking the daily mean of the hourly data. Thus, the instantaneous values will look different than the daily mean values, as it should. The `.temporalFilter` argument is used to generate the window of percentiles.

Examples

```
## Not run:
# get by date range

yaak_river_dv <- ww_dvUSGS('12304500')

#daily
yaak_river_stats <- ww_statsUSGS(yaak_river_dv,
                                 temporalFilter = 'daily',
                                 days = 10)
#monthly
yaak_river_stats <- ww_statsUSGS(yaak_river_dv,
                                 temporalFilter = 'monthly',
                                 days = 10)
#yearly
yaak_river_stats <- ww_statsUSGS(yaak_river_dv,
                                 temporalFilter = 'yearly',
                                 days = 10)

## End(Not run)
```

`ww_wymUSGS` *Water Year & Monthly Stats (USGS)*

Description

This function uses the results of the ww_dvUSGS object to generate mean, maximum, median, standard deviation and coefficient of variation per water year per month.

Usage

```
ww_wymUSGS(procDV, sites = NULL, parallel = FALSE, verbose = TRUE, ...)
```

Arguments

`procDV`	A previously created ww_dvUSGS object.
`sites`	A `character` vector with NWIS site numbers (optional).
`parallel`	`logical` indicating whether to use future_map().
`verbose`	`logical` for printing information. TRUE (default).
`...`	arguments to pass on to future_map and ww_dvUSGS.

Value

A `tibble` filtered by water year and month with added meta-data.

Note

If a previously created ww_dvUSGS object is not used then the user needs to provide a `sites` vector. This will run ww_dvUSGS in the background.

Examples

```
## Not run:

library(whitewater)
yaak_river_dv <- ww_dvUSGS('12304500',
parameter_cd = '00060',
wy_month = 10)

yaak_river_wym <- ww_wymUSGS(yaak_river_dv)


## End(Not run)
```

`ww_wyUSGS` *Water Year Stats (USGS)*

Description

This function uses the results of the ww_dvUSGS object to generate mean, maximum, median, standard deviation and some normalization methods (drainage area, scaled by log and standard deviation) per water year.

Usage

```
ww_wyUSGS(procDV, sites = NULL, parallel = FALSE, verbose = TRUE, ...)
```

Arguments

`procDV`	A previously created ww_dvUSGS object.
`sites`	A `character` vector with NWIS site numbers (optional).
`parallel`	`logical` indicating whether to use future_map().
`verbose`	`logical` for printing information. TRUE (default).
`...`	arguments to pass on to future_map and/or ww_dvUSGS.

Value

A `tibble` filtered by water year with added meta-data.

Note

If a previously created ww_dvUSGS object is not used then the user needs to provide a `sites` vector. This will run ww_dvUSGS in the background.

Examples

```
## Not run:

library(whitewater)
yaak_river_dv <- ww_dvUSGS('12304500',
parameter_cd = '00060',
wy_month = 10)

yaak_river_wy <- ww_wyUSGS(yaak_river_dv)

#parallel

#get sites

huc17_sites <- dataRetrieval::whatNWISdata(huc = 17,
siteStatus = 'active',
service = 'dv',
parameterCd = '00060')

library(future)
#need to call future::plan()
plan(multisession(workers = availableCores()-1))

pnw_dv <- ww_dvUSGS(huc17_sites$site_no,
parameter_cd = '00060',
wy_month = 10,
parallel = TRUE)

pnw_wy <- ww_wyUSGS(pnw_dv,
                    parallel = TRUE)

## End(Not run)
```

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