Package ‘hydrotoolbox’

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### agg_table

**Aggregates a data frame to a larger time period**

**Description**

Aggregates a data frame to a larger time period
Usage

agg_table(
  x,
  col_name,
  fun,
  period,
  out_name = NULL,
  allow_na = 0,
  start_month = 1,
  end_month = 12
)

Arguments

  x  data frame with class Date or POSIXct in the first column.
  col_name  string with column(s) name(s) to aggregate.
  fun  string with supported aggregation function name (one per 'col_name'): 'mean', 'min', 'max', 'sum', 'last' or 'first'.
  period  string with the aggregation time-step: 'hourly', 'daily', 'monthly', 'annually' or 'climatic'. NOTE: the 'climatic' option returns the all series annual statistics ('fun').
  out_name  optional. String with the output column(s) name(s). Default values coerce the original name plus the 'fun' argument (e.g.: tair_max).
  allow_na  optional. Numeric value with the maximum allowed number of NA_real_values. By default the function will not tolerate any NA_real_ (and will return NA_real_ instead).
  start_month  optional. Numeric value defining the first month of the annual period (it just make sense if 'period' is either 'annually' or 'climatic'). Default sets to 1 (January). NOTE: keep in mind that if you choose 'climatic' as period you have to round off a complete year (e.g.: ...start_month = 6,end_month = 5,...)
  end_month  optional. Numeric value defining the last month of the annual period (it just make sense if 'period' is either 'annually' or 'climatic'). Default sets to 12 (December). NOTE: keep in mind that if you choose 'climatic' as period you have to round off a complete year (e.g.: ...start_month = 6,end_month = 5,...)

Value

A data frame with the Date and the aggregated variable(s).

Examples

# set path to file
path <- system.file('extdata', 'snih_qd_guido.xlsx',
                      package = 'hydrotoolbox')
# read and load daily streamflow with default column name
guido_qd <- read_snih(path = path, by = 'day', out_name = 'q(m3/s)')

# aggregate daily to monthly discharge
guido_q_month <- agg_table(x = guido_qd, col_name = 'q(m3/s)',
                           fun = 'mean', period = 'monthly',
                           out_name = 'qm(m3/s)')

# suppose that we are interested on getting the annual maximum
# daily mean discharge for every hydrological year (since this
# station is located at the Mendoza River Basin ~32.9° S, we will
# consider that annual period starts on July)
guido_q_annual <- agg_table(x = guido_qd, col_name = 'q(m3/s)',
                           fun = 'max', period = 'annually',
                           out_name = 'qmax(m3/s)',
                           start_month = 7, end_month = 6)

# now we want the mean, maximum and minimum monthly discharges
guido_q_stats <- agg_table(x = guido_qd, col_name = rep('q(m3/s)', 3),
                           fun = c('mean', 'max', 'min'),
                           period = 'monthly')

---

**cum_sum**

*Cumulative sum*

**Description**

The function supports `NA_real_` values. It could be very useful when dealing with incomplete precipitation series.

**Usage**

```r
cum_sum(x, col_name, out_name = NULL)
```

**Arguments**

- **x**: data frame with class `Date` or `POSIXct` in the first column and numeric on the others.
- **col_name**: string with column(s) name(s) where to apply the function.
- **out_name**: optional. String with new column(s) name(s). If you set it as `NULL`, the function will overwrite the original data frame.

**Value**

The same data frame but with the new series.
Examples

```r
# set path to file
path <- system.file("extdata", 'ianigla_cuevas.csv',
   package = 'hydrotoolbox')

# read the file and add the new column with cumulative precipitation
cuevas <-
   read_ianigla(path = path) %>%
   cum_sum(col_name = 'Precip_Total', out_name = 'p_cum')

# plot it
plot(x = cuevas[, 'date'], y = cuevas[, 'p_cum'],
   col = 'red', type = 'l',
   xlab = 'Date', ylab = 'Pcum(mm)')
```

---

**fill_table**

Find non-reported dates and fill them with NA_real_

**Description**

Automatically finds non recorded date periods and fills them with NA_real_ values.

**Usage**

```r
fill_table(x, col_name = "all", by = NULL)
```

**Arguments**

- **x**
  - data frame with class Date or POSIXct in the first column.

- **col_name**
  - string with column(s) name(s) to fill.

- **by**
  - string with a valid time step (e.g.: 'month', 'day', '6 hour', '3 hour', '1 hour', '15 min').

**Value**

A data frame with the date and the filled numeric variable(s).

**Examples**

```r
# let's use a synthetic example to illustrate the use of the function
dates <- seq.Date(from = as.Date('1980-01-01'),
   to = as.Date('2020-01-01'), by = 'day')
var <- runif(n = length(dates), min = 0, max = 100)
```
\[ \text{met}_\text{var} \leftarrow \text{data.frame}(\text{date} = \text{dates}, \text{random} = \text{var})[-c(50:100, 251, 38),] \]

\[ \text{met}_\text{var}_\text{fill} \leftarrow \text{fill_table}(x = \text{met}_\text{var}, \text{by} = \text{'day'}) \]

---

**hm_agg**

Aggregates the table inside a slot to a larger time period

### Description

This method allows you to get your data temporally aggregated.

### Usage

\[
\text{hm}_\text{agg}( \text{obj}, \text{slot}_\text{name}, \text{col}_\text{name}, \text{fun}, \text{period}, \text{out}_\text{name} = \text{NULL}, \text{allow}_\text{na} = 0, \text{start}_\text{month} = 1, \text{end}_\text{month} = 12, \text{relocate} = \text{NULL} )
\]

### S4 method for signature 'hydromet_station'

\[
\text{hm}_\text{agg}( \text{obj}, \text{slot}_\text{name}, \text{col}_\text{name}, \text{fun}, \text{period}, \text{out}_\text{name} = \text{NULL}, \text{allow}_\text{na} = 0, \text{start}_\text{month} = 1, \text{end}_\text{month} = 12, \text{relocate} = \text{NULL} )
\]

### S4 method for signature 'hydromet_compact'

\[
\text{hm}_\text{agg}( \text{obj}, \text{slot}_\text{name},
\]
hm_agg

col_name,
fun,
period,
out_name = NULL,
allow_na = 0,
start_month = 1,
end_month = 12
)

Arguments

obj a valid hydromet_XXX class object.
slot_name string with the name of the slot to aggregate.
col_name string with column(s) name(s) to aggregate.
fun string with supported aggregation function name (one per ‘col_name’): ‘mean’, ‘min’, ‘max’, ‘sum’, ‘last’ or ‘first’.
period string with the aggregation time-step: ‘hourly’, ‘daily’, ‘monthly’, ‘annually’ or ‘climatic’. NOTE 1: the ‘climatic’ option returns the all series annual statistics (‘fun’). NOTE 2: when using ‘annually’ as period, the method will return the starting dates in the first slot column.
out_name string with the output column(s) name(s). Default values coerce the original name plus the ‘fun’ argument (e.g.: tair_max).
allow_na optional. Numeric value with the maximum allowed number of NA_real_ values. By default the function will not tolerate any NA_real_ (and will return NA_real_ instead).
start_month optional. Numeric value defining the first month of the annual period (it just make sense if ‘period’ is either ‘annually’ or ‘climatic’). Default sets to 1 (January). NOTE: keep in mind that if you choose ‘climatic’ as period you have to round off a complete year (e.g.: ...,start_month = 6,end_month = 5,...)
end_month optional. Numeric value defining the last month of the annual period (it just make sense if ‘period’ is either ‘annually’ or ‘climatic’). Default sets to 12 (December). NOTE: keep in mind that if you choose ‘climatic’ as period you have to round off a complete year (e.g.: ...,start_month = 6,end_month = 5,...)
relocate optional. String with the name of the slot where to allocate the aggregated table. It only make sense for hydromet_station class. When using it you must keep in mind that all aggregated series are allocated in a single slot.

Value

A data frame with the Date and the aggregated variable(s) inside the specified slot.

Functions

• hm_agg, hydromet_station-method: plot method for station class
• hm_agg, hydromet_compact-method: plot method for compact class
Examples

```r
# cuevas station
path <- system.file('extdata', package = 'hydrotoolbox')

# use the build method
hm_cuevas <-
  hm_create() %>%
  hm_build(bureau = 'ianigla', path = path, 
    file_name = 'ianigla_cuevas.csv', 
    slot_name = c('tair', 'rh', 'patm', 
                  'precip', 'wspd', 'wdir', 
                  'kin', 'hsnow', 'tsoil'), 
    by = 'hour', 
    out_name = c('tair(°C)', 'rh(%)', 'patm(mbar)', 
                 'p(mm)', 'wspd(km/hr)', 'wdir(°)', 
                 'kin(kW/m2)', 'hsnow(cm)', 'tsoil(°C)'))

# aggregate air temperature data to mean value
hm_agg(obj = hm_cuevas, slot_name = 'tair', col_name = 'tair(°C)', 
       fun = 'mean', period = 'daily', out_name = 't_mean') %>%
  hm_show(slot_name = 'tair')

# the previous command overwrites the original slot, so now we are going 
# to relocate the agg values
hm_agg(obj = hm_cuevas, slot_name = 'tair', 
       col_name = 'tair(°C)', 
       fun = 'mean', 
       period = 'daily', 
       relocate = 'tmean', 
       out_name = 'tmean(°C)') %>%
  hm_show(slot_name = 'tmean')
```

---

**hm_build**

**Load native data files automatically**

**Description**

The method allows you to automatically load your native data inside the hydromet_station slots.

**Usage**

```r
hm_build(
  obj,
```
hm_build

bureau,
path,
file_name,
slot_name,
by,
out_name = NULL,
sheet = NULL
)

## S4 method for signature 'hydromet_station'

hm_build(
  obj,
bureau,
path,
file_name,
slot_name,
by,
out_name = NULL,
sheet = NULL
)

Arguments

- **obj**: a valid hydromet_station class object.
- **bureau**: string value containing **one** of the available options: 'aic', 'cr2', 'dgi', 'ianigla', 'mnemos' or 'snih'.
- **path**: string vector with the path(s) to the file_name argument. If you set a single string it will be recycled for all the files.
- **file_name**: string vector with the native file(s) name(s).
- **slot_name**: string vector with the slot(s) where to set the file(s) or sheet(s).
- **by**: string vector with the time step of the series (e.g.: 'month', 'day', '6 hour', '3 hour', '1 hour', '15 min'). If you set it as 'none', the function will ignore automatic gap filling. If you set a single string it will be recycled for all the files.
- **out_name**: optional. String vector with user defined variable(s) column(s) name(s).
- **sheet**: optional. Sheet to read. Either a string vector (the name of a sheet), or an integer vector (the position of the sheet). If neither argument specifies the sheet, defaults to the first sheet. This argument just make sense for:
  - 'aic': you must provide a single name or integer indicating the met-station to read.
  - 'dgi': just keep it as NULL.
  - 'mnemos': just keep it as NULL.

Value

A hydromet_station object with the required data loaded inside.
Functions

- `hm_build`, `hydromet_station-method`: build method for hydromet station object

Examples

```r
# path to all example files
path <- system.file('extdata', package = 'hydrotoolbox')

# ianigla file
hm_create() %>%
  hm_build(bureau = 'ianigla', path = path,
           file_name = 'ianigla_cuevas.csv',
           slot_name = c('tair', 'rh', 'patm',
                         'precip', 'wspd', 'wdir',
                         'kin', 'hsnow', 'tsoil'),
           by = 'hour',
           out_name = c('tair(\degree C)', 'rh(\%)', 'patm(mbar)',
                         'p(mm)', 'wspd(km/hr)', 'wdir(^\circ)',
                         'kin(kW/m2)', 'hsnow(cm)', 'tsoil(\degree C)' )
) %>%
  hm_show()

# cr2 file
hm_create() %>%
  hm_build(bureau = 'cr2', path = path,
           file_name = 'cr2_tmax_yeso_embalse.csv',
           slot_name = c('tmax'),
           by = 'day',
           out_name = c('tair(\degree C)' )
) %>%
  hm_show()

# dgi file
hm_create() %>%
  hm_build(bureau = 'dgi', path = path,
           file_name = 'dgi_toscas.xlsx',
           slot_name = c('swe', 'tmax',
                         'tmin', 'tmean', 'rh', 'patm'),
           by = 'day') %>%
  hm_show()

# snih file
hm_create() %>%
  hm_build(bureau = 'snih', path = path,
           file_name = c('snih_hq_guido.xlsx',
                         'snih_qd_guido.xlsx'),
           slot_name = c('hq', 'qd'),
           by = c('none', 'day')) %>%
  hm_show()

# aic  => you have to request for this files to AIC.
```
hm_create

# mnemos => the data are the same of snih but generated
# with MNEMOSIII software.

hm_create

Creates an hydromet object.

Description

This function is the constructor of hydromet class and its subclass.

Usage

hm_create(class_name = "station")

Arguments

class_name       string with the name of the class. Valid arguments are: hydromet, station or compact.

Value

An S4 object of class hydromet.

Examples

# create class 'hydromet'
hym_metadata <- hm_create(class_name = 'hydromet')

# subclass 'station'
hym_station <- hm_create(class_name = 'station')

# subclass 'compact'
hym_compact <- hm_create(class_name = 'compact')
hm_get

**Extract the slot**

**Description**

Get the table (or metadata) that you want from an hydromet or hydromet_XXX class.

**Usage**

hm_get(obj, slot_name = NA_character_)

```r
## S4 method for signature 'hydromet'
hm_get(obj, slot_name = NA_character_)

## S4 method for signature 'hydromet_station'
hm_get(obj, slot_name = NA_character_)

## S4 method for signature 'hydromet_compact'
hm_get(obj, slot_name = NA_character_)
```

**Arguments**

- **obj** an hydromet or hydromet_XXX class object.
- **slot_name** string with slot to extract.

**Value**

The required data frame or metadata.

**Functions**

- `hm_get,hydromet-method`: get method for generic hydromet object
- `hm_get,hydromet_station-method`: get method for station class
- `hm_get,hydromet_compact-method`: get method for compact class

**Examples**

```r
# set path to file
path_file <- system.file('extdata', 'ianigla_cuevas.csv',
                          package = 'hydrotoolbox')

# read file
cuevas <-
  read_ianigla(path = path_file,
               out_name = c('tair(°C)', 'rh(%)', 'patm(mbar)',
                            'p(mm)', 'wspd(km/hr)', 'wdir(°)',
                            'kin(kW/m2)', 'hsnow(cm)', 'tsoil(°C)'))
```
# create and set one the variables
hm_cuevas <-
  hm_create() %>%
  hm_set(tair = cuevas[, c('date', 'tair(°C)')])

# now extract the slot of air temperature
head( hm_get(obj = hm_cuevas, slot_name = 'tair') )

---

hm_melt  

Melt many objects into an hydromet_compact class object

Description

This method allows you merge several tables (inside hydromet_station and/or hydromet_compact class objects) into a single one and set them into the compact slot (hydromet_compact class object).

Usage

hm_melt(obj, melt, slot_name, col_name, out_name = NULL)

## S4 method for signature 'hydromet_compact'
hm_melt(obj, melt, slot_name, col_name, out_name = NULL)

Arguments

- **obj**: a valid hydromet_compact class object.
- **melt**: string vector containing the hydromet_xxx class objects names (as you have in the Global Environment) that you want for melting.
- **slot_name**: list (one element per melt vector name) with the slot(s) to extract per every hydromet_xxx class object (as string vectors).
- **col_name**: string vector with the name of the variables to keep. You must comply the following name convention 'melt_slot_variable' (e.g.: 'guido_qd_Q(m3/s)' - where **guido** is your object name, **qd** is the slot with daily mean river discharge and **Q(m3/s)** is the required column name inside that slot). Another option is to set this argument just with the string 'all' and the method will preserve all the slot(s) columns. Other minimal option is to choose the string 'last': in this case you will get only the last column of each slot(s).
- **out_name**: optional. String vector with the output names of the final table. If you use the default value (NULL) the method will add the object and slot name (provided in melt and slot_name argument) at the beginning of every column (e.g.: 'guido_qd_q(m3/s)').

Value

An hydromet_compact class object with a data frame inside the compact slot with all variables that you provided in col_name.
Functions

- **hm_melt, hydromet_compact-method**: plot method for compact class

Note

Remember that all the chosen variables should have the same temporal resolution. The method itself will not warn you about bad entries.

Examples

```r
# lets say that we want to put together snow water equivalent from Toscas (dgi)
# and daily streamflow discharge from Guido (snih)

# path to all example files
path <- system.file('extdata', package = 'hydrotoolbox')

# on the first place we build the stations
# dgi file
toscas <-
hm_create() %>%
  hm_build(bureau = 'dgi', path = path,
            file_name = 'dgi_toscas.xlsx',
            slot_name = c('swe', 'tmax', 'tmin', 'tmean', 'rh', 'patm'),
            by = 'day',
            out_name = c('swe', 'tmax', 'tmin', 'tmean', 'rh', 'patm'))

# snih file
guido <-
hm_create() %>%
  hm_build(bureau = 'snih', path = path,
            file_name = c('snih_hq_guido.xlsx',
                         'snih_qd_guido.xlsx'),
            slot_name = c('hq', 'qd'),
            by = c('none', 'day'))

# now we melt the required data
hm_create(class_name = 'compact') %>%
  hm_melt(melt = c('toscas', 'guido'),
          slot_name = list(toscas = 'swe', guido = 'qd'),
          col_name = 'all',
          out_name = c('swe(mm)', 'qd(m3/s)')) %>%
  hm_plot(slot_name = 'compact',
          col_name = list( c('swe(mm)', 'qd(m3/s)') ),
          interactive = TRUE,
          line_color = c('dodgerblue', 'red'),
          y_lab = c('q(m3/s)', 'swe(mm)'),
          dual_yaxis = c('right', 'left'))
```
hm_mutate

Create, modify and delete columns inside a slot

Description

This method allows you to modify whatever (except 'date' column) you want inside a slot data frame. Since this package was designed with the aim of providing useful objects to store and track changes in hydro-meteorological series, is not recommend to delete or change the original data, but it is upon to you.

Usage

hm_mutate(obj, slot_name, FUN, ...)

## S4 method for signature 'hydromet_station'
hm_mutate(obj, slot_name, FUN, ...)

## S4 method for signature 'hydromet_compact'
hm_mutate(obj, slot_name, FUN, ...)

Arguments

- **obj**: a valid hydromet_XXX class object.
- **slot_name**: string with the a valid name.
- **FUN**: function name. The function output must be a data frame with the first column being the Date. Note that hydrotoolbox provides common used hydrological functions: see for example mov_avg. An interesting function to use is mutate from dplyr package.
- **...**: FUN arguments to pass.

Value

The same object but with the modified slot’s data frame

Functions

- `hm_mutate,hydromet_station-method`: method for station class.
- `hm_mutate,hydromet_compact-method`: method for compact class.
Examples

```r
# path to all example files
path <- system.file('extdata', package = 'hydrotoolbox')

# build the snih station file
guido <-
  hm_create() %>%
  hm_build(bureau = 'snih', path = path,
           file_name = c('snih_hq_guido.xlsx',
                         'snih_qd_guido.xlsx'),
           slot_name = c('hq', 'qd'),
           by = c('none', 'day')) %>%
  hm_name(slot_name = 'qd',
          col_name = 'q(m3/s)')

# apply a moving average windows to streamflow records
hm_mutate(obj = guido, slot_name = 'qd',
          FUN = mov_avg, k = 10,
          pos = 'c', out_name = 'mov_avg') %>%
hm_plot(slot_name = 'qd',
        col_name = list(c('q(m3/s)', 'mov_avg')),
        interactive = TRUE,
        line_color = c('dodgerblue', 'red3'),
        y_lab = 'Q(m3/s)',
        legend_lab = c('original', 'mov_avg') )
```

---

**hm_name**

### Description

Change slot's column names.

### Usage

```r
hm_name(obj, slot_name, col_name)
```

## S4 method for signature 'hydromet_station'

```r
hm_name(obj, slot_name, col_name)
```

## S4 method for signature 'hydromet_compact'

```r
hm_name(obj, slot_name, col_name)
```
Arguments

obj  a valid hydromet_compact class object.
slot_name  string with the a valid name.
col_name  string vector with new column names.

Value

The same object but with new column names.

Functions

- hm_name,hydromet_station-method: set new column name for station class
- hm_name,hydromet_compact-method: set new column name for compact class

Examples

# path to all example files
path <- system.file('extdata', package = 'hydrotoolbox')

# we first build the snih station file
guido <-
hm_create() %>%
  hm_build(bureau = 'snih', path = path,
           file_name = c('snih_hq_guido.xlsx',
                         'snih_qd_guido.xlsx'),
           slot_name = c('hq', 'qd'),
           by = c('none', 'day'))

guido %>% hm_show(slot_name = 'qd')

# now we can change default names
hm_name(obj = guido, slot_name = 'qd',
        col_name = 'q(m3/s)') %>%
  hm_show(slot_name = 'qd')

Description

This method allows you to make plots (using simple and expressive arguments) of the variables contained inside an hydromet_XXX class object. The plot outputs can be static (ggplot2) or dynamic (plotly).
Usage

hm_plot(
  obj,
  slot_name,
  col_name,
  interactive = FALSE,
  line_type = NULL,
  line_color = NULL,
  line_size = NULL,
  line_alpha = NULL,
  x_lab = "date",
  y_lab = "y",
  title_lab = NULL,
  legend_lab = NULL,
  dual_yaxis = NULL,
  from = NULL,
  to = NULL,
  scatter = NULL
)

## S4 method for signature 'hydromet_station'
hm_plot(
  obj,
  slot_name,
  col_name,
  interactive = FALSE,
  line_type = NULL,
  line_color = NULL,
  line_size = NULL,
  line_alpha = NULL,
  x_lab = "date",
  y_lab = "y",
  title_lab = NULL,
  legend_lab = NULL,
  dual_yaxis = NULL,
  from = NULL,
  to = NULL,
  scatter = NULL
)

## S4 method for signature 'hydromet_compact'
hm_plot(
  obj,
  slot_name,
  col_name,
  interactive = FALSE,
  line_type = NULL,
  line_color = NULL,
Arguments

obj
slot_name
col_name
interactive
line_type
line_color
line_size
line_alpha
x_lab
y_lab
title_lab
legend_lab
dual_yaxis
from
to
scatter
Value

A ggplot2 or plotly object.

Functions

- `hm_plot, hydromet_station-method`: plot method for station class
- `hm_plot, hydromet_compact-method`: plot method for compact class

Examples

```r
## Not run:
# lets work with the cuevas station
path <- system.file("extdata", package = "hydrotoolbox")

# use the build method
hm_cuevas <-
  hm_create() %>%
  hm_build(bureau = "ianigla", path = path, file_name = "ianigla_cuevas.csv",
            slot_name = c("tair", "rh", "patm", "precip", "wspd", "wdir",
                          "kin", "hsnow", "tsoil"),
            by = "hour",
            out_name = c("tair(°C)", "rh(%)", "patm(mbar)",
                          "p(mm)", "wspd(km/hr)", "wdir(°)",
                          "kin(kW/m2)", "hsnow(cm)", "tsoil(°C)"))

# let's start by making a single variable static plot
hm_plot(obj = hm_cuevas, slot_name = "tair",
        col_name = list("tair(°C)"))

# we add labels, change color, line type and we focus
# on specific date range
hm_plot(obj = hm_cuevas, slot_name = "tair",
        col_name = list("tair(°C)",
                        "longdash",
                        "dodgerblue",
                        "Date time", "T(°C)",
                        "Hourly temperature at Cuevas",
                        "Tair",
                        from = ISOdate(2020, 7, 1),
                        to = ISOdate(2020, 7, 5))

# compare air with soil temperature
hm_plot(obj = hm_cuevas, slot_name = c("tair", "tsoil"),
        col_name = list("tair(°C)", "tsoil(C)"),
        line_type = c("longdash", "solid"),
        line_color = c("dodgerblue", "tan4"),
        x_lab = "Date time", y_lab = "T(°C)",
        title_lab = "Hourly temperature at Cuevas",
        legend_lab = c("Tair", "Tsoil"),
```
# let's add relative humidity on the right y-axis
hm_plot(obj = hm_cuevas, slot_name = c('tair', 'tsoil', 'rh'),
col_name = list('tair(°C)', 'tsoil(°C)', 'rh(%)'),
line_type = c('longdash', 'solid', 'solid'),
line_color = c('dodgerblue', 'tan4', 'red'),
x_lab = 'Date time', y_lab = c('T(°C)', 'RH(%)'),
title_lab = 'Hourly meteo data at Cuevas',
legend_lab = c('Tair', 'Tsoil', 'RH'),
dual_yaxis = c('left', 'left', 'right'),
from = ISOdate(2020, 7, 1),
to = ISOdate(2020, 7, 5))

# we decide to analyze the previous variables in detail
# with a dynamic plot
hm_plot(obj = hm_cuevas, slot_name = c('tair', 'tsoil', 'rh'),
col_name = list('tair(°C)', 'tsoil(°C)', 'rh(%)'),
line_type = c('longdash', 'solid', 'solid'),
line_color = c('dodgerblue', 'tan4', 'red'),
x_lab = 'Date time', y_lab = c('T(°C)', 'RH(%)'),
title_lab = 'Hourly meteo data at Cuevas',
legend_lab = c('Tair', 'Tsoil', 'RH'),
dual_yaxis = c('left', 'left', 'right'),
interactive = TRUE)

# click on the Zoom icon and play a little...

# suppose now that we want to make a scatter plot to show
# the negative correlation between air temperature and
# relative humidity
hm_plot(obj = hm_cuevas, slot_name = c('tair', 'rh'),
col_name = list('tair(°C)', 'rh(%)'),
line_color = 'dodgerblue',
x_lab = 'Tair', y_lab = 'RH',
scatter = c('x', 'y'))

## End(Not run)
Usage

hm_report(obj, slot_name, col_name = "all")

## S4 method for signature 'hydromet_station'
hm_report(obj, slot_name, col_name = "all")

## S4 method for signature 'hydromet_compact'
hm_report(obj, slot_name = "compact", col_name = "all")

Arguments

- **obj**: a valid hydromet_XXX class object.
- **slot_name**: string with the name of the slot to report.
- **col_name**: string vector with the column(s) name(s) to report. By default the function will do it in all columns inside the slot.

Value

A list summarizing basic statistics and missing data.

Functions

- `hm_report, hydromet_station-method`: report method for station class
- `hm_report, hydromet_compact-method`: report method for compact class

Examples

```r
# cuevas station
path <- system.file("extdata", package = "hydrotoolbox")

# use the build method
hm_cuevas <-
  hm_create() %>%
  hm_build(bureau = 'ianigla', path = path,
           file_name = 'ianigla_cuevas.csv',
           slot_name = c('tair', 'rh', 'patm',
                         'precip', 'wspd', 'wdir',
                         'kin', 'hsnow', 'tsoil'),
           by = 'hour',
           out_name = c('tair(^\circ C)', 'rh(%)', 'patm(mbar)',
                        'p(mm)', 'wspd(km/hr)', 'wdir(^\circ)',
                        'kin(kW/m2)', 'hsnow(cm)', 'tsoil(^\circ C)')
  )

# report incoming solar radiation
hm_report(obj = hm_cuevas, slot_name = 'kin')
```
hm_set

Set the data of an hydromet object or its subclass

Description

With this method you can set (or change) an specific slot value (change the table).

Usage

hm_set(
  obj = NULL,
  id = NULL,
  agency = NULL,
  station = NULL,
  lat = NULL,
  long = NULL,
  alt = NULL,
  country = NULL,
  province = NULL,
  river = NULL,
  active = NULL,
  basin_area = NULL,
  basin_eff = NULL,
  other_1 = NULL,
  other_2 = NULL,
  ...
)

## S4 method for signature 'hydromet'

hm_set(
  obj = NULL,
  id = NULL,
  agency = NULL,
  station = NULL,
  lat = NULL,
  long = NULL,
  alt = NULL,
  country = NULL,
  province = NULL,
  river = NULL,
  active = NULL,
  basin_area = NULL,
  basin_eff = NULL,
  other_1 = NULL,
  other_2 = NULL,
  ...
)
## S4 method for signature 'hydromet_station'

```r
hm_set(
  obj = NULL,
  id = NULL,
  agency = NULL,
  station = NULL,
  lat = NULL,
  long = NULL,
  alt = NULL,
  country = NULL,
  province = NULL,
  river = NULL,
  active = NULL,
  basin_area = NULL,
  basin_eff = NULL,
  other_1 = NULL,
  other_2 = NULL,
  hq = NULL,
  hw = NULL,
  qh = NULL,
  qd = NULL,
  qm = NULL,
  wspd = NULL,
  wdir = NULL,
  evap = NULL,
  anem = NULL,
  patm = NULL,
  rh = NULL,
  tair = NULL,
  tmax = NULL,
  tmin = NULL,
  tmean = NULL,
  tsoil = NULL,
  precip = NULL,
  rainfall = NULL,
  swe = NULL,
  hsnow = NULL,
  kin = NULL,
  lin = NULL,
  unvar = NULL
)
```

## S4 method for signature 'hydromet_compact'

```r
hm_set(
  obj = NULL,
  id = NULL,
  agency = NULL,
```
hm_set

station = NULL,
l = NULL,
leng = NULL,
alt = NULL,
country = NULL,
province = NULL,
r = NULL,
active = NULL,
basin_area = NULL,
basin_eff = NULL,
other_1 = NULL,
other_2 = NULL,
compact = NULL
)

Arguments

obj an hydromet or hydromet_XXX class object.
id ANY. This is the ID assigned by the agency.
agency character. The name of the agency (or institution) that provides the data of the station.
station character. The name of the (hydro)-meteorological station.
l numeric. Latitude of the station.
leng numeric. Longitude of the station
alt numeric. Altitude of the station.
country character. Country where the station is located. Argentina is set as default value.
province character. Name of the province where the station is located. Mendoza is set as default value.
r = character. Basin river’s name.
active logical. It indicates whether or not the station is currently operated. Default value is TRUE.
basin_area numeric. The basin area (km²) of the catchment upstream of the gauge.
basin_eff numeric. The effective area (km²) of the basin upstream of the gauge. In Canada, many basins have variable contributing fractions. In these basins, the effective area of the basin contributes flow to the outlet at least one year in two.
other_1 ANY. It is the first free-to-fill slot in order to give you the chance to write extra information about your hydro-met station.
other_2 ANY. It is the second free-to-fill slot in order to give you the chance to write extra information about your hydro-met station.
... arguments to be passed to methods. They rely on the slots of the obj subclass.
hq water-height vs stream-discharge measurements.
hw water level records.
qh hourly mean river discharge.
qd         daily mean river discharge.
qm         monthly mean river discharge.
wspd       wind speed.
wdir       wind direction.
evap       pan-evaporation.
anem       anemometer wind speed records (usually installed above the pan-evap tank).
patm       atmospheric pressure.
rh         relative humidity.
tair       air temperature (typically recorded at hourly time-step).
tmax       daily maximum recorded air temperature.
tmin       daily minimum recorded air temperature.
tmean      daily mean air temperature.
tsoil      soil temperature.
precip      total (snow and rain) precipitation records.
rainfall    liquid only precipitation measurements.
swe        snow water equivalent (typically recorded on snow pillows).
hsnow      snow height from ultrasonic devices.
kin        incoming short-wave radiation.
lin        incoming long-wave radiation.
unvar      reserved for non-considered variables.
compact    data frame with Date as first column. All other columns are hydro-meteorological variables.

Value

The hydromet object with the slots set.

Functions

- `hm_set, hydromet-method`: set method for generic object
- `hm_set, hydromet_station-method`: set method for station object
- `hm_set, hydromet_compact-method`: set method for compact object

Examples

```r
# create an hydro-met station
hm_guido <- hm_create(class_name = 'station')

# assign altitude
hm_guido <- hm_set(obj = hm_guido, alt = 2480)

# now we read streamflow - water height measurements
path_file <- system.file('extdata', 'snih_hq_guido.xlsx',
```
```r
package = 'hydrotoolbox')
guido_hq <- read_snih(path = path_file, by = 'none',
  out_name = c('h(m)', 'q(m3/s)',
              'q_coarse_solid(kg/s)',
              'q_fine_solid(kg/s)') )

# set the new data frame
# note: you can do it manually but using the hm_build() method
# is strongly recommended
hm_guido <- hm_set(obj = hm_guido, hq = guido_hq)
hm_show(obj = hm_guido)
```

---

**hm_show**

Easy access to see your data

---

**Description**

This method shows the 'head' or 'tail' of a specific slot.

**Usage**

```
hm_show(obj, slot_name = "fill", show = "head")

# S4 method for signature 'hydromet'
hm_show(obj, slot_name = "fill", show = "head")

# S4 method for signature 'hydromet_station'
hm_show(obj, slot_name = "fill", show = "head")

# S4 method for signature 'hydromet_compact'
hm_show(obj, slot_name = "compact", show = "head")
```

**Arguments**

- **obj** a valid hydromet_XXX class object.
- **slot_name** string vector with the name of the slot(s) to show. Alternatively you can use 'fill' or 'empty' to get the data frames with or without data respectively.
- **show** string with either 'head' or 'tail'.

**Value**

It prints the data inside the required slot.
Functions

- `hm_show,hydromet-method`: plot method for hydromet class
- `hm_show,hydromet_station-method`: plot method for station class
- `hm_show,hydromet_compact-method`: plot method for compact class

Examples

```r
# lets work with the cuevas station
path <- system.file('extdata', package = 'hydrotoolbox')

# use the build method
hm_cuevas <-
  hm_create() %>%
  hm_build(bureau = 'ianigla', path = path,
    file_name = 'ianigla_cuevas.csv',
    slot_name = c('tair', 'rh', 'patm',
      'precip', 'wspd', 'wdir',
      'kin', 'hsnow', 'tsoil'),
    by = 'hour',
    out_name = c('tair(°C)', 'rh(%)', 'patm(mbar)',
      'p(mm)', 'wspd(km/hr)', 'wdir(°)',
      'kin(kW/m2)', 'hsnow(cm)', 'tsoil(°C)'))

# now we want to know which are the slots with data
hm_show(obj = hm_cuevas)

# see the last values of our data
hm_show(obj = hm_cuevas, show = 'tail')

# or maybe we want to know which slot have no data
hm_show(obj = hm_cuevas, slot_name = 'empty')

# focus on specific slots
hm_show(obj = hm_cuevas, slot_name = c('kin', 'rh'))
hm_show(obj = hm_cuevas, slot_name = c('kin', 'rh'), show = 'tail')
```

---

**hm_subset**

*Subset your data by dates*

**Description**

The method will subset the required slot.
hm_subset

Usage

hm_subset(obj, slot_name = "all", from = NULL, to = NULL)

## S4 method for signature 'hydromet_station'
hm_subset(obj, slot_name = "all", from = NULL, to = NULL)

## S4 method for signature 'hydromet_compact'
hm_subset(obj, slot_name = "all", from = NULL, to = NULL)

Arguments

obj a valid hydromet_XXX class object.
slot_name string vector with the name(s) of the slot(s) to subset. If you use 'all' as argument the method will subset all the variables with data.
from string Date or POSIXct value with the starting date. You can use from without to. In this case you will subset your data from till the end.
to string Date or POSIXct value with the starting date. You can use to without from. In this case you will subset your data from the beginning till to.

Value

The same hydromet_XXX class object provided in obj but subsetted.

Functions

• hm_subset,hydromet_station-method: subset method for station class
• hm_subset,hydromet_compact-method: subset method for compact class

Examples

# cuevas station
path <- system.file('extdata', package = 'hydrotoolbox')

# use the build method
hm_cuevas <-
  hm_create(bureau = 'ianigla', path = path,
    file_name = 'ianigla_cuevas.csv',
    slot_name = c('tair', 'rh', 'patm',
      'precip', 'wspd', 'wdir',
      'kin', 'hsnow', 'tsoil'),
    by = 'hour',
    out_name = c('tair(°C)', 'rh(%)', 'patm(mbar)',
      'p(mm)', 'wspd(km/hr)', 'wdir(^o)',
      'kin(kW/m2)', 'hsnow(cm)', 'tsoil(°C)'))

# subset relative humidity and plot it
hm_subset(obj = hm_cuevas, slot_name = 'rh',
          from = ISOdate(2020, 2, 1),
          to = ISOdate(2020, 4, 1)) %>%
hm_plot(slot_name = 'rh',
        col_name = list('rh%'),
        interactive = TRUE,
        y_lab = 'RH(%)')

---

**hydromet-class**

**hydromet superclass object**

**Description**

A suitable object for store basic information about an hydro-meteorological station.

**Value**

A basic hydromet class object. This class is provided in order to set the meta-data of the station.

**Slots**

- **id** ANY. This is the ID assigned by the agency.
- **agency** string. The name of the agency (or institution) that provides the data of the station.
- **station** string. The name of the (hydro)-meteorological station.
- **lat** numeric. Latitude of the station.
- **long** numeric. Longitude of the station.
- **alt** numeric. Altitude of the station.
- **country** string. Country where the station is located. Argentina is set as default value.
- **province** string. Name of the province where the station is located. Mendoza is set as default value.
- **river** string. Basin river's name.
- **active** logical. It indicates whether or not the station is currently operated. Default value is TRUE.
- **basin_area** numeric. The basin area (km2) of the catchment upstream of the gauge.
- **basin_eff** numeric. The effective area (km2) of the basin upstream of the gauge. In Canada, many basins have variable contributing fractions. In these basins, the effective area of the basin contributes flow to the outlet at least one year in two.
- **other_1** ANY. It is the first free-to-fill slot in order to give you the chance to write extra information about your hydro-met station.
- **other_2** ANY. It is the second free-to-fill slot in order to give you the chance to write extra information about your hydro-met station.
**hydromet_compact-class**

**hydromet subclass for compact data**

**Description**

This subclass is useful for storing in a single data frame ready to use hydro-meteorological series or many variables of the same kind (e.g. let's say precipitation series).

**Value**

A hydromet_compact class object.

**Slots**

- compact: data.frame with Date as first column (class 'Date' or 'POSIXct'). All other columns are the numeric hydro-meteorological variables (double). This subclass was though to join in a single table ready to use data (e.g. in modeling). You can also use it to put together variables of the same kind (e.g. precipitation records) to make some regional analysis.

---

**hydromet_station-class**

**hydromet subclass for store hydro-meteorological records.**

**Description**

A suitable object for store your hydro-meteorological data.

**Value**

An hydromet_station class object.

**Slots**

- hq: water-height vs stream-discharge measurements.
- hw: water level records.
- qh: hourly mean river discharge.
- qd: daily mean river discharge.
- qm: monthly mean river discharge.
- wspd: wind speed.
- wdir: wind direction.
- evap: pan-evaporation.
- anem: anemometer wind speed records (usually installed above the pan-evap tank).
interpolate atmospheric pressure.
\( \text{rh} \) relative humidity.
\( \text{tair} \) air temperature (typically recorded at hourly time-step).
\( \text{tmax} \) daily maximum recorded air temperature.
\( \text{tmin} \) daily minimum recorded air temperature.
\( \text{tmean} \) daily mean air temperature.
\( \text{tsoil} \) soil temperature.
\( \text{precip} \) total (snow and rain) precipitation records.
\( \text{rainfall} \) liquid only precipitation measurements.
\( \text{swe} \) snow water equivalent (typically recorded on snow pillows).
\( \text{hsnow} \) snow height from ultrasonic devices.
\( \text{kin} \) incoming short-wave radiation.
\( \text{lin} \) incoming long-wave radiation.
\( \text{unvar} \) reserved for non-considered variables.

---

**interpolate**

**Interpolation**

**Description**

This function applies interpolation to fill in missing (or non-recorded) values.

**Usage**

```r
interpolate(
  x,  # data frame with class Date or POSIXct in the first column and numeric on the others.
  col_name,  # string with column name of the series to interpolate.
  out_name = NULL,  # optional. String with new column name. If you set it as NULL, the function will overwrite the original data frame.
  miss_table,  # data frame with three columns: first and last date of interpolation (first and second column respectively). The last and third column, is of class numeric with the number of steps to interpolate. See report_miss.
  threshold,
  method = "linear"
)
```

**Arguments**

- **x**: data frame with class Date or POSIXct in the first column and numeric on the others.
- **col_name**: string with column name of the series to interpolate.
- **out_name**: optional. String with new column name. If you set it as NULL, the function will overwrite the original data frame.
- **miss_table**: data frame with three columns: first and last date of interpolation (first and second column respectively). The last and third column, is of class numeric with the number of steps to interpolate. See report_miss.
mov_avg

threshold numeric variable with the maximum number of dates in which to apply the interpolation.

method string with the interpolation method. In this version only 'linear' method is allowed.

Value

The same data frame but with interpolated values.

Examples

```r
# read cuevas station file
path <- system.file('extdata', 'ianigla_cuevas.csv',
                     package = 'hydrotoolbox')

cuevas <- read_ianigla(path = path)

# get the miss_table
miss_data <- report_miss(x = cuevas, col_name = 'Irradiancia')[[1]]

# apply interpolation function when gap is less than 3 hours
cuevas_interpo <- interpolate(x = cuevas,
                                col_name = 'Irradiancia',
                                out_name = 'kin_interpo',
                                miss_table = miss_data,
                                threshold = 3)

report_miss(x = cuevas_interpo,
            col_name = c('Irradiancia', 'kin_interpo'))
```

---

mov_avg Moving average windows

Description

Smooth numeric series with a moving average windows.

Usage

```r
mov_avg(
  x,
  col_name = "last",
  k,
  pos = "c",
  out_name = NULL,
  from = NULL,
)```
```r
to = NULL
)

Arguments

x            data frame with class Date or POSIXct in the first column and numeric on the others.
col_name     string vector with the column(s) name(s) of the series to smooth. The default value uses the 'last' column. Another single string choice is to use 'all'. Is important to keep in mind that this argument commands, so if you provide two columns names, k and pos arguments must be of length two; if not the single value will be recycled.
k            numeric vector with the windows size. E.g.: k = 5.
pos         string vector with the position of the windows:
  • 'c': center (default). The output value is in the middle of the window.
  • 'l': left aligned. The output value is on the left, so the function weights the \((k - 1)\) values at the right side.
  • 'r': right aligned. The output value is on the right, so the function weights the \((k - 1)\) values at the left side.
out_name     optional. String vector with new column names. If you set it as NULL the function will overwrite the original series.
from         optional. String value for 'Date' class or POSIXct class for date-time data containing the starting Date.
to           optional. String value for 'Date' class or POSIXct class for date-time data containing the ending Date.

Value

The same data frame but with the smooth series.

Examples

```r
# read guido daily streamflow records
path <- system.file('extdata', 'snih_qd_guido.xlsx',
  package = 'hydrotoolbox')

# read and apply the function
qd_guido <-
  read_snih(path = path, by = 'day', out_name = 'q(m3/s)') %>%
  mov_avg(k = 5, out_name = 'q_smooth')
```
qm_vol

Monthly river discharge [m3/s] to volume [hm3]

Description

Converts mean monthly river discharge [m3/s] to total volume discharge [hm3].

Usage

qm_vol(x, col_name, out_name = NULL)

Arguments

x data frame with class Date in the first column and numeric on the others.

col_name string with column(s) name(s) where to apply the function.

out_name optional. String with new column(s) name(s). If you set it as NULL, the function will overwrite the original data frame.

Value

The same data frame but with the total volume discharge.

Examples

# read guido daily streamflow records
path <- system.file('extdata', 'snih_qd_guido.xlsx',
                      package = 'hydrotoolbox')

# read, aggregate the function to monthly resolution and get the volume
qm_guido <-
    read_snih(path = path, by = 'day', out_name = 'q(m3/s)') %>%
    agg_table(col_name = 'q(m3/s)', fun = 'mean', period = 'monthly',
              out_name = 'qm(m3/s)') %>%
    qm_vol(col_name = 'qm(m3/s)', out_name = 'vm(hm3)')

read_aic

Reads data from AIC

Description

Reads excel files provided by the AIC.
Usage

read_aic(
  path,
  by = "day",
  out_name = NULL,
  sheet = NULL,
  skip = 12,
  get_sheet = FALSE
)

Arguments

path    path to the xlsx file.
by      string with the time step of the series (e.g.: 'month', 'day', '6 hour', '3 hour', '1 hour', '15 min'). By default this argument is set to 'day'. If you set it as 'none', the function will ignore automatic gap filling.
out_name optional. String vector with user defined variable(s) column(s) name(s).
sheet   optional. Sheet to read. Either a string (the name of a sheet), or an integer (the position of the sheet). If neither argument specifies the sheet, defaults to the first sheet.
skip    optional. Minimum number of rows to skip before reading anything, be it column names or data. Leading empty rows are automatically skipped, so this is a lower bound.
get_sheet logical indicating whether you want to print available sheet names (TRUE) in the file or not.

Value

A data frame with the data inside the xlsx file. Gaps between dates are filled with NA_real_ and duplicated rows are eliminated automatically.

Examples

# This files are provided by AIC under legal agreement only.

---

read_cr2       Reads data from Explorador Climático (CR2 - Chile)

Description

Reads csv files downloaded from the CR2 web page as a data frame.

Usage

read_cr2(path, by = "day", out_name = NULL)
Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>path</td>
<td>path to the csv file.</td>
</tr>
<tr>
<td>by</td>
<td>string with the time step of the series (e.g.: 'month', 'day', '6 hour', '3 hour', '1 hour', '15 min'). The default and unique possible value is 'day'.</td>
</tr>
<tr>
<td>out_name</td>
<td>optional. String vector with user defined variable(s) column(s) name(s).</td>
</tr>
</tbody>
</table>

Value

A data frame with the data inside the csv file. Gaps between dates are filled with NA_real_ and duplicated rows are eliminated automatically.

Examples

```r
# list cr2 files
list.files( system.file('extdata', package = 'hydrotoolbox'), pattern = 'cr2' )

# set path to file
path_tmax <- system.file('extdata', 'cr2_tmax_yeso_embalse.csv', package = 'hydrotoolbox')

# read file with default colname
head( read_cr2(path = path_tmax) )

# assign a column name
head( read_cr2(path = path_tmax, out_name = 'tmax(°C)') )
```

Description

Reads excel files provided by the DGI (Hydrological Division).

Usage

```r
read_dgi(path, by = "day", out_name = NULL, sheet = NULL, get_sheet = FALSE)
```

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>path</td>
<td>path to the xlsx file.</td>
</tr>
<tr>
<td>by</td>
<td>string with the time step of the series (e.g.: 'month', 'day', '6 hour', '3 hour', '1 hour', '15 min'). By default this argument is set to 'day'. If you set it as 'none', the function will ignore automatic gap filling.</td>
</tr>
<tr>
<td>out_name</td>
<td>optional. String vector with user defined variable(s) column(s) name(s).</td>
</tr>
</tbody>
</table>
### read_ianigla

**Description**

Reads data from Sistema de Monitoreo Meteorológico de Alta Montaña (IANIGLA - Argentina)

**Usage**

```r
read_ianigla(path, by = "1 hour", out_name = NULL)
```

**Examples**

```r
# set path to file
path_file <- system.file('extdata', 'dgi_toscas.xlsx',
                          package = 'hydrotoolbox')

# because dgi files has multiple sheets we take a look
# on them
read_dgi(path = path_file, get_sheet = TRUE)

# read swe with default column names
head( read_dgi(path = path_file, sheet = 'swe') )

# assign name
head( read_dgi(path = path_file, sheet = 'swe', out_name = 'swe(mm)') )

# now read relative humidity
head( read_dgi(path = path_file, sheet = 'hr', out_name = 'rh(%)') )
```
Arguments

path
  path to the csv file.

by
  string with the time step of the series (e.g. 'month', 'day', '6 hour', '3 hour', '1 hour', '15 min'). The default value is '1 hour'. If you set it as 'none', the function will ignore automatic gap filling.

out_name
  optional. String vector with user defined variable(s) column(s) name(s).

Value

A data frame with the data inside the csv file. Gaps between dates are filled with NA_real_ and duplicated rows are eliminated automatically.

Examples

```
# set path to file
path_file <- system.file('extdata', 'ianigla_cuevas.csv',
                          package = 'hydrotoolbox')

# read with default names
head( read_ianigla(path = path_file) )

# set column names
head(
  read_ianigla(path = path_file,
               out_name = c('tair(°C)', 'rh(%)', 'patm(mbar)',
                            'p(mm)', 'wspd(km/hr)', 'wdir(°)',
                            'kin(kW/m2)', 'hsnow(cm)', 'tsoil(°C)' ) )
)
```

---

**read_mnemos**  
Reads data provided by MNEMOS software (SNIH - Argentina)

**Description**

Reads xlsx files generated with MNEMOS software.

**Usage**

```
read_mnemos(
  path,
  by = "none",
  out_name = NULL,
  sheet = NULL,
  skip = 3,
  get_sheet = FALSE
)
```
Arguments

- **path**: path to the xlsx file.
- **by**: string with the time step of the series (e.g.: 'month', 'day', '6 hour', '3 hour', '1 hour', '15 min'). If you set it as 'none', the function will ignore automatic gap filling.
- **out_name**: optional. String vector with user defined variable(s) column(s) name(s).
- **sheet**: optional. Sheet to read. Either a string (the name of a sheet), or an integer (the position of the sheet). If neither argument specifies the sheet, defaults to the first sheet.
- **skip**: optional. Minimum number of rows to skip before reading anything, be it column names or data. Leading empty rows are automatically skipped, so this is a lower bound.
- **get_sheet**: logical indicating whether you want to print available variables (TRUE) in every file sheet or not.

Value

A data frame with the data inside the specified sheet. Gaps between dates are filled with NA_real_ and duplicated rows are eliminated automatically. In case you set `get_sheet = TRUE` the function will return a list with the variables inside each sheet.

Examples

```r
# list mnemos files
list.files( system.file('extdata', package = 'hydrotoolbox'), pattern = 'mnemos' )

# set path
path <- system.file('extdata', 'mnemos_guido.xlsx', package = 'hydrotoolbox')

# we can see which variables are inside the sheet's file
read_mnemos(path = path, get_sheet = TRUE)

# now we want to read the maximum temperature
Tmax_guido <- read_mnemos(path = path, by = 'day',
                          out_name = 'tmax(°C)', sheet = '11413-016')
```

---

**read_snih**

*Reads data from Servicio Nacional de Información Hídrica* 
[R](https://back.argentina.gob.ar/obras-publicas/hidricas/base-de-datos-hidrologica-integrada(SNIH - Argentina)*
**Description**

Reads excel files downloaded from the SNIH web page as a data frame.

**Usage**

```r
read_snih(path, by, out_name = NULL)
```

**Arguments**

- `path`: path to the xlsx file.
- `by`: string with the time step of the series (e.g.: 'month', 'day', '6 hour', '3 hour', '1 hour', '15 min'). If you set it as 'none', the function will ignore automatic gap filling.
- `out_name`: optional. String vector with user defined variable(s) column(s) name(s).

**Value**

A data frame with the data inside the xlsx file. Gaps between dates are filled with `NA_real_` and duplicated rows are eliminated automatically.

**Examples**

```r
# set path to file
path_file <- system.file('extdata', 'snih_qd_guido.xlsx', package = 'hydrotoolbox')

# read daily streamflow with default column name
head(read_snih(path = path_file, by = 'day'))

# now we use the function with column name
head(read_snih(path = path_file, by = 'day', out_name = 'qd(m3/s)'))
```

---

**report_miss**

*Report NA_real_ values inside a table.*

**Description**

Creates a data frame with reported dates and number of times-step of missing or not recorded data.

**Usage**

```r
report_miss(x, col_name = "all")
```
Arguments

x  
data frame with hydro-meteo data. First column is date and the second the numeric vector to be reported.

col_name  
string vector with the column(s) name(s) to report. By default the function will report all numeric columns.

Value

A list containing a data frame (one per col_name) with three columns: start-date, end-date and number of missing time steps.

Examples

```r
# read guido daily streamflow records
path <- system.file('extdata', 'snih_qd_guido.xlsx', package = 'hydrotoolbox')

# load raw data
qd_guido <-
  read_snih(path = path, by = 'day', out_name = 'q(m3/s)') %>%
  mov_avg(k = 5, out_name = 'q_smooth')

# get the data report
qd_guido %>%
  report_miss()
```

---

rm_spike

Remove spikes

Description

Remove spikes and set their value as NA_real_.

Usage

rm_spike(x, col_name, out_name = NULL, tolerance)

Arguments

x  
data frame with class Date in the first column and numeric on the others.

col_name  
string with column(s) name(s) where to apply the function.

out_name  
optional. String with new column(s) name(s). If you set it as NULL, the function will overwrite the original data frame.

tolerance  
numeric vector with the maximum tolerance between a number and its successor. If you provide a single value it will be recycled.
**set_threshold**

**Value**

The same data frame but with the peaks removed.

**Examples**

```r
# set path to file"path_file <- system.file("extdata", 'ianigla_cuevas.csv',
        package = 'hydrotoolbox')

# read with default names
cuevas <- read_ianigla(path = path_file,
        out_name = c('tair(°C)', 'rh(%)', 'patm(mbar)',
                     'p(mm)', 'wspd(km/hr)', 'wdir(°)',
                     'kin(kW/m2)', 'hsnow(cm)', 'tsoil(°C)')

# remove spikes in snow height series
cuevas %>%
  rm_spike(col_name = 'hsnow(cm)',
          out_name = 'hsnow',
          tolerance = 50) # 50 cm of snow is OK for this zone
```

---

**set_threshold**  
*Set a threshold*

**Description**

Set tolerable extreme values (maximum or minimum). Records greater or equal than (\'\geq\') or lesser or equal than (\'\leq\') 'threshold' argument are set to NA_real_.

**Usage**

```r
set_threshold(x, col_name, out_name = NULL, threshold, case = "\geq")
```

**Arguments**

- **x**: data frame with class Date in the first column and numeric on the others.
- **col_name**: string with column(s) name(s) where to apply the function.
- **out_name**: optional. String with new column(s) name(s). If you set it as NULL, the function will overwrite the original data frame.
- **threshold**: numeric vector with the threshold value(s). If you provide a single value it will be recycled among col_name strings.
- **case**: string with either '>=' (greater or equal than) or '<=' (lesser or equal than) symbol. Default string is '>='.

set_value

Value

The same data frame but with the threshold set.

Examples

```r
# set path to file
path_file <- system.file('extdata', 'ianigla_cuevas.csv',
                           package = 'hydrotolbox')

# read with default names
cuevas <- read_ianigla(path = path_file,
                        out_name = c('tair(°C)', 'rh(%)', 'patm(mbar)',
                                     'p(mm)', 'wspd(km/hr)', 'wdir(°)',
                                     'kin(kW/m2)', 'hsnow(cm)', 'tsoil(°C)'))

# remove values higher than 1.50 meters
cuevas %>%
  set_threshold(col_name = 'hsnow(cm)',
               out_name = 'hsnow_thres',
               threshold = 150)
```

set_value

Set user defined values

Description

Specify specific values between dates.

Usage

`set_value(x, col_name, out_name = NULL, value, from, to)`

Arguments

- `x`: data frame with class Date or POSIXct in the first column and numeric on the others.
- `col_name`: string with column(s) name(s) to set.
- `out_name`: optional. String with new column(s) name(s). If you set it as NULL, the function will overwrite the original data frame.
- `value`: numeric vector with the numeric values to set between dates (from and to). If you provide a number it will be recycled. When using a multiple dates (i.e.: 'date' vector in from and to) use a list with a numeric vector inside each element.
- `from`: string vector for 'Date' class or POSIXct class for date-time data with the starting Date.
- `to`: string vector for 'Date' class or POSIXct class for date-time data with the ending Date.
Value

The same data frame but with the set numeric values between the dates.

Examples

```r
# create a data frame
dates <- seq.Date(from = as.Date('1990-01-01'), to = as.Date('1990-12-01'), by = 'm')
met_var <- runif(n = 12, 0, 10)

met_table <- data.frame(dates, met_var)

# set single value recycling
set_value(x = met_table, col_name = 'met_var', value = 10,
          from = '1990-01-01', to = '1990-06-01')

# set different periods
set_value(x = met_table, col_name = 'met_var', value = list(NA_real_, c(1, 2)),
          from = c('1990-01-01', '1990-11-01'), to = c('1990-06-01', '1990-12-01'))

# now set as new columns
set_value(x = met_table, col_name = 'met_var', out_name = 'met_set',
          value = list(NA_real_, c(1, 2)),
          from = c('1990-01-01', '1990-11-01'),
          to = c('1990-06-01', '1990-12-01'))
```

swe_derive  
Snow Water Equivalent to melt or snowfall

Description

Derive melt or snowfall series from snow water equivalent measurements (from snow pillows).

Usage

```r
swe_derive(x, col_name, out_name = NULL, case)
```

Arguments

- `x`: data frame with class Date in the first column and numeric on the others.
- `col_name`: string with column(s) name(s) where to apply the function.
- `out_name`: optional. String with new column(s) name(s). If you set it as NULL, the function will overwrite the original data frame.
- `case`: string vector with 'sf' (meaning snowfall) or 'm' (meaning melt).

Value

The same data frame but with the derived series.
Examples

```r
# set path to file
path_file <- system.file('extdata', 'dgi_toscas.xlsx',
                          package = 'hydrotoolbox')

# swe table
swe_toscas <- read_dgi(path = path_file,
                       sheet = 'swe',
                       out_name = 'swe(mm)')

# add melt and snowfall
swe_toscas <-
  swe_toscas %>%
  swe_derive(col_name = rep('swe(mm)', 2),
             out_name = c('melt(mm)', 'snowfall(mm)'),
             case = c('m', 'sf'))
```
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