Package: kwb.hydrus1d (via r-universe)

September 9, 2024

Title R Interface for the Last Official Release of Hydrus1D (V4.17.0140) for Windows

Version 0.0.0.9000

Description R Interface for the Last Official Release of Hydrus1D (v4.17.0140) for Windows.

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URL https://github.com/KWB-R/kwb.hydrus1d

BugReports https://github.com/KWB-R/kwb.hydrus1d/issues

Imports archive, dplyr, fs, janitor, kwb.utils, magrittr, readr, rlang, stringr, tibble, tidyselect

Suggests covr, knitr, rmarkdown

Remotes kwb-r/kwb.utils

Encoding UTF-8

LazyData true

Roxygen list(markdown = TRUE)

RoxygenNote 7.2.2

VignetteBuilder knitr

Repository https://kwb-r.r-universe.dev

RemoteUrl https://github.com/KWB-R/kwb.hydrus1d

RemoteRef HEAD

RemoteSha 8ba0c5fd8a3939ae0e0c605e239f5f311d9c0159

Contents

`check_hydrus_exe` *Check HYDRUS Executable and download if needed*

Description

Check HYDRUS Executable and download if needed

Usage

```
check_hydrus_exe(
  dir = file.path(system.file(package = "kwb.hydrus1d"), "extdata/hydrus1d"),
  skip_preinstalled = FALSE
)
```

Arguments

`dir`	target directory (default: file.path(system.file(package = "kwb.hydrus1d"), "extdata/hydrus1d"), in case compliant HYDRUS1D version is not available, executable will be downloaded from https://github.com/mrustl/hydrus1d/archive/refs/tags/v4.17.0140.zip
`skip_preinstalled`	if TRUE checking of preinstalled HYDRUS-1D will be skipped and executable will be downloaded, otherwise not (the default)

Value

path to preinstalled HYDRUS-1D executable (if compliant and parameter skip_preinstalled == FALSE), otherwise path to downloaded HYDRUS-1D

Examples

```
check_hydrus_exe(skip_preinstalled = FALSE)
check_hydrus_exe(skip_preinstalled = TRUE)
```

`defaults_atmosphere` *Defaults for Atmosphere*

Description

Defaults for Atmosphere

Usage

```
defaults_atmosphere(
  Prec = 0L,
  rSoil = 0L,
  rRoot = 0L,
  hCritA = 100000L,
  rB = 0L,
  hB = 0L,
  ht = 0L,
  tTop = 0L,
  tBot = 0L,
  Ampl = 0L,
  cTop = 0L,
  cBot = 0L,
  RootDepth = 0L
)
```

Arguments

`Prec`	Precipitation (default: 0)
`rSoil`	Evaporation (default: 0)
`rRoot`	Transpiration (default: 0)
`hCritA`	(default: 100000)
`rB`	rB (default: 0)
`hB`	hB (default: 0)
`ht`	ht (default: 0)
`tTop`	tTop (default: 0)
`tBot`	tBot (default: 0)
`Ampl`	Ampl (default: 0)
`cTop`	concentration of solute 1 at top (default: 0)
`cBot`	concentration of solute 1 at bottom (default: 0)
`RootDepth`	root depth (default: 0)

Value

tibble with defaults for atmospheric parameters

Examples

```
defaults_atmosphere()
```

`get_atmosphere_headers` *Get Atmosphere Headers*

Description

Get Atmosphere Headers

Usage

```
get_atmosphere_headers()
```

Value

vector with atmosphere headers for "ATMOSPH.in"

Examples

```
get_atmosphere_headers()
```

`get_output_meta` *Helper Function: Get Metadata of Outputs ('A_LEVEL.out', 'T_LEVEL.out')*

Description

Helper Function: Get Metadata of Outputs ('A_LEVEL.out', 'T_LEVEL.out')

Usage

```
get_output_meta(output)
```

Arguments

`output`	imported output as retrieved by `read_alevel` or `read_tlevel`

Value

returns metainformation list with sublists "general" and "units" of imported 'A_LEVEL.out' or 'T_LEVEL.out' file

Examples

```
test_file <- function(x) system.file("extdata/model/test", x, package = "kwb.hydrus1d")
alevel <- read_alevel(path = test_file("A_LEVEL.out"))
get_output_meta(alevel)
tlevel <- read_tlevel(path = test_file("T_LEVEL.out"))
get_output_meta(tlevel)
```

---

get_units_list *Helper function: get units list from meta general*

Description

Helper function: get units list from meta general

Usage

```
get_units_list(meta_general)
```

Arguments

meta_general	as retrieved by read_meta_general

Value

list with elements unit_L, unit_T and unit_M

Examples

```
path_tlevel <- system.file("extdata/model/test/T_LEVEL.out", package = "kwb.hydrus1d")
content <- readLines(path_tlevel)
content_general <- content[3:5]
cat(content_general)
meta_general <- read_meta_general(content_general)
get_units_list(meta_general)
```

---

prepare_atmosphere_input *Prepare Atmosphere Input*

Description

Prepare Atmosphere Input

Usage

```
prepare_atmosphere_input(inputs, defaults = defaults_atmosphere())
```

Arguments

inputs	tibble or data.frame with user defined inputs for parameters defined in get_atmosphere_headers
defaults	defaults for undefined parameters. Default: defaults_atmosphere

Value

tibble with atmosphere values

Examples

```
inputs <- tibble::tibble(tAtm = 1:10, Prec = 10, rSoil = 0.4)
prepare_atmosphere_input(inputs)
```

---

read_alevel *Read A_LEVEL.out*

Description

A-level information is printed each time a time-dependent boundary condition is specified. The information is directed to output file A_LEVEL.OUT.

Usage

```
read_alevel(path, dbg = FALSE)
```

Arguments

path	full path to A_LEVEL.out file
dbg	show debug messages (default: FALSE)

Value

imports A_LEVEL out with tidy column names and saves metainformation in attributes 'meta_general' and 'meta_units'

time Time, t, at current time-level [T]

sum_r_top Cumulative potential surface flux [L] (infiltration/evaporation: -/+)

sum_r_root Cumulative potential transpiration [L]

sum_v_top Cumulative value of the actual surface flux [L] (infiltration/evaporation: -/+) [-]

sum_v_root Cumulative value of the actual transpiration [L]

sum_v_bot Cumulative value of the bottom boundary flux [L] (inflow/outflow: +/-)

h_top Pressure head at the soil surface [L]

h_root Mean value of the pressure head in the soil root zone for which Beta(n)>0 [L]

h_bot Pressure head at the bottom of the soil profile [L]

a_level A-level number (current variable boundary condition number) [-]

References

https://www.pc-progress.com/Downloads/Pgm_Hydrus1D/HYDRUS1D-4.17.pdf#page=277

Examples

```
path_alevel <- system.file("extdata/model/test/A_LEVEL.out", package = "kwb.hydrus1d")
alevel <- read_alevel(path = path_alevel)
alevel
```

---

read_meta_general *Helper Function: Read Meta General*

Description

Helper Function: Read Meta General

Usage

```
read_meta_general(content_general)
```

Arguments

content_general	lines with content general (see example)

Value

tibble with columns description, modelstart_datetime and unit L,T,M

Examples

```
path_tlevel <- system.file("extdata/model/test/T_LEVEL.out", package = "kwb.hydrus1d")
content <- readLines(path_tlevel)
content_general <- content[3:5]
cat(content_general)
read_meta_general(content_general)
```

`read_runinf` *Read Run_Inf.out*

Description

Contains time and iteration information

Usage

```
read_runinf(path, dbg = FALSE)
```

Arguments

`path`	full path to Run_Inf.out file
`dbg`	show debug messages (default: FALSE)

Value

imports Run_Inf.out with tidy column names and saves metainformation in attributes 'meta_general' and 'meta_units'

tlevel Time-level (current time-step number) [-]

time Time, t, at current time-level [T]

dt Time step, delta t [T]

itr_w Number of iterations necessary for solution of the water flow equation [-]

itr_c Number of iterations necessary for solution of the solute transport equation [-]

it_cum Cumulative number of iterations [-]

kod_t Code for the boundary condition at the soil surface

kod_b Code for the boundary condition at the bottom of the soil profile

converg Information whether or not the numerical convergence was achieved at the current time-level

peclet Maximum local Peclet number [-]

courant Maximum local Courant number [-]

References

https://www.pc-progress.com/Downloads/Pgm_Hydrus1D/HYDRUS1D-4.17.pdf#page=272

Examples

```
path_runinf <- system.file("extdata/model/test/Run_Inf.out", package = "kwb.hydrus1d")
runinf <- read_runinf(path = path_runinf)
runinf
```

`read_solute` *Read solute1.out*

Description

Reads Solute output

Usage

```
read_solute(
  path = system.file("extdata/model/test/solute1.out", package = "kwb.hydrus1d"),
   dbg = FALSE
)
```

Arguments

`path`	full path to solute_id.out file (default: system.file("extdata/model/test/solute1.out", package = "kwb.hydrus1d"))
`dbg`	show debug messages (default: FALSE)

Value

imports solute_id.out with tidy column names and saves metainformation in attributes 'meta_general' and 'meta_units'

time Time, t, at current time-level [T]

cv_top Actual solute flux across the soil surface [ML-2 T -1] (inflow/outflow: +/-)

cv_bot Actual solute flux across the bottom of the soil profile [ML-2 T -1] (inflow/outflow: +/-)

sum_cv_top Cumulative solute flux across the soil surface [ML-2] (inflow/outflow: +/-)

sum_cv_bot Cumulative solute flux across the bottom of the soil profile [ML-2] (inflow/outflow: +/-)

sum_cv_ch0 Cumulative amount of solute added to the flow region by zero-order reactions [ML-2] (negative when removed from the system)

sum_cv_ch1 Cumulative amount of solute removed from the flow region by first-order reactions [ML-2] (negative removed from the system).

c_top Solute concentration at the soil surface [ML-3]

c_root Mean solute concentration of the root zone [ML-3]

c_bot Solute concentration at the bottom of the soil profile [ML-3]

cv_root Actual root solute uptake in the root zone [ML-2 T -1] (positive when removed from the system)

sum_cv_root Cumulative amount of solute removed from the flow region by root water uptake S [ML-2] (positive when removed from the system)

sum_cv_n_eql Cumulative mass transfer to either kinetic adsorption sites (type-2 adsorption sites), or to the immobile liquid region [ML-2] (inflow/outflow: +/-).

t_level Time-level (current time-step number) [-]

c_gwl Average concentration in the saturated zone [ML-3] (in the groundwater)

c_run_off Solute flux in the runoff ([ML-3] * [LT-1]) [ML-2T-1]

sum_c_run_off Cumulative solute flux in the runoff ([ML-3] * [LT-1]* [T]) [ML-2]

cv_i Solute flux at the first through third observation node ([ML-3] * [LT-1]) [ML-2T-1]

sum_cv_i cumulative solute flux at the first through third observation node ([ML-3] * [LT-1] * [T]) [ML-2]. Total solute fluxes are reported when only one solute is simulated. Only convective fluxes (for the first solute) are reported when 2 or more solutes are simulated

References

https://www.pc-progress.com/Downloads/Pgm_Hydrus1D/HYDRUS1D-4.17.pdf#page=273

Examples

```
path_solute <- system.file("extdata/model/test/solute1.out", package = "kwb.hydrus1d")
solute <- read_solute(path = path_solute)
solute
```

`read_tlevel` *Read T_LEVEL.out*

Description

Stores pressure heads and fluxes on the boundaries and in the root zone.

Usage

```
read_tlevel(path, dbg = FALSE)
```

Arguments

`path`	full path to T_LEVEL.out file
`dbg`	show debug messages (default: FALSE)

Value

imports T_LEVEL out with tidy column names and saves metainformation in attributes 'meta_general' and 'meta_units'

time Time, t, at current time-level [T]

r_top Potential surface flux [LT-1] (infiltration/evaporation: -/+)

r_root Potential transpiration rate [LT-1]

v_top Actual surface flux [LT-1] (infiltration/evaporation: -/+)

v_root Actual transpiration rate [LT-1]

v_bot Actual flux across the bottom of the soil profile [LT-1] (inflow/outflow +/-)

sum_r_top Cumulative value of the potential surface flux [L] (infiltration/evaporation: -/+)

sum_r_root Cumulative value of the potential transpiration rate [L]

sum_v_top Cumulative value of the actual surface flux [L]

sum_v_root Cumulative value of the actual transpiration rate [L] (infiltration/evaporation: -/+)

sum_v_bot Cumulative value of the actual flux across the bottom of the soil profile [LT-1] (inflow/outflow +/-)

h_top Pressure head at the soil surface [L]

h_root Mean value of the pressure head over the region for which Beta(n) > 0 (i.e. within the root zone) [L]

h_bot Pressure head at the bottom of the soil profile [L]

run_off Surface runoff [LT-1]

sum_run_off Cumulative surface runoff [L]

volume Volume of water in the entire flow domain [L]

sum_infil Cumulative infiltration [L]

sum_evap Cumulative actual evaporation [L]

t_level Time-level (current time-step number) [-]

cum_w_trans Cumulative mass transfer between the mobile and immobile regions for dual porosity model [L]

snow_layer Thickness of snow layer, expressed as the "snow water equivalent" (the amount of water contained within the snowpack) [L]

References

https://www.pc-progress.com/Downloads/Pgm_Hydrus1D/HYDRUS1D-4.17.pdf#page=271

Examples

```
path_tlevel <- system.file("extdata/model/test/T_LEVEL.out", package = "kwb.hydrus1d")
tlevel <- read_tlevel(path = path_tlevel)
tlevel
```

`run_model` *Run Model*

Description

Run Model

Usage

```
run_model(
  exe_path = check_hydrus_exe(),
  model_path = system.file("extdata/model/test", package = "kwb.hydrus1d"),
  ...
)
```

Arguments

exe_path	path to Hydrus1D executable v4.17.040 (default: as retrieved by check_hydrus_exe)
model_path	path to model directory (default: system.file("extdata/model/test", package = "kwb.hydrus1d"))
...	additional arguments passed to shell

Value

runs HYDRUS 1D model

Examples

```
run_model()
```

---

write_atmosphere *Write "ATMOSPH.IN" input file*

Description

Write "ATMOSPH.IN" input file

Usage

```
write_atmosphere(
  atm,
  MaxAL = 365,
  DailyVar = FALSE,
  SinusVar = FALSE,
  lLai = FALSE,
  lBCCycles = FALSE,
  lInterc = FALSE,
  hCritS = 0,
  round_digits = 2,
  remove_scientific = TRUE
)
```

Arguments

atm	tibble of input data as defined in prepare_atmospherice_input
MaxAL	Number of meteorological records
DailyVar	TRUE if HYDRUS-1D is to generate daily variations in evaporation and transpiration (see section 2.7.2.)., otherwise: FALSE (default: FALSE)
SinusVar	TRUE if HYDRUS-1D is to generate sinusoidal variations in precipitation (see section 2.7.2.), otherwise: FALSE(default: FALSE)
lLai	Logical variable indicating that potential evapotranspiration is to be divided into potential evaporation and potential transpiration using eq. (2.75). (default: FALSE)
lBCCycles	TRUE if a set of boundary conditions is to be repeated multiple times, otherwise FALSE(default: FALSE)
lInterc	TRUE if interception is considered using eq. (2.78), otherwise FALSE (default: FALSE)
hCritS	Maximum allowed pressure head at the soil surface (L). (default: 0)
round_digits	digits used for rounding values (default: 2) of all columns besides "tAtm"
remove_scientific	if TRUE scientific notation of numbers is removed, otherwise not (default: TRUE)

Value

Creates ATMOSPH.IN input textfile

Examples

```
inputs <- tibble::tibble(tAtm = 1:10, Prec = 10, rSoil = 0.4)
atm <- prepare_atmosphere_input(inputs)
atm
atm_string <- write_atmosphere(atm = atm, MaxAL = nrow(atm))
cat(atm_string)
```

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