Package 'lwbgt'

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Type Package

Title Reference-Compatible Outdoor Wet Bulb Globe Temperature

Version 1.2.1

Description Computes outdoor wet bulb globe temperature using the reference-compatible Liljegren numerical model described by Liljegren et al. (2008) <doi:10.1080/15459620802310770>. Provides dependency-free, vectorized access to the native calculation with explicit input units, per-row validation, and deterministic failure reporting.

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URL https://github.com/zyf0717/lwbgt,
https://zyf0717.r-universe.dev/lwbgt,
https://pypi.org/project/lwbgt/,
https://github.com/zyf0717/LWBGT.jl

BugReports https://github.com/zyf0717/lwbgt/issues

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`lwbgt-package` *Reference-Compatible Outdoor Wet Bulb Globe Temperature*

Description

Dependency-free, vectorized access to the Liljegren outdoor wet bulb globe temperature numerical model.

Details

The R, Python, Julia, Swift, and native C interfaces share the same Liljegren numerical C kernel.

Inputs use the same explicit field names and units as the native and Python interfaces. The R interface performs row-level validation and reports failures without aborting calculations for other rows.

References

Liljegren, J. C., Carhart, R. A., Lawday, P., Tschopp, S., and Sharp, R. (2008). Modeling the Wet Bulb Globe Temperature Using Standard Meteorological Measurements. *Journal of Occupational and Environmental Hygiene*, 5(10), 645–655. doi:10.1080/15459620802310770.

See Also

Other interfaces to the shared kernel: Python on PyPI, Julia (LWBGT.jl), Swift, and native C. See the documentation index for the shared kernel and its interfaces.

`calculate` *Calculate Outdoor Wet Bulb Globe Temperature*

Description

Calculates one result per input row while preserving row order. Invalid rows do not prevent valid rows from being calculated.

Usage

```
calculate(input, psychrometric = TRUE)
```

Arguments

input	A data frame containing the columns produced by lwbgt_input(). Additional columns are ignored.
psychrometric	Calculate psychrometric wet-bulb temperature, default TRUE. With FALSE, that column is NA; the other calculations are unchanged. Skipping a failed psychrometric solve can allow a row to succeed.

Value

A plain data frame with the following columns:

- status: integer status; zero means all requested solves succeeded, -1 means a requested solver did not converge, 1 means missing input, 2 means invalid input, and 3 means an invalid native result.
- status_message: character description of the row status.
- estimated_wind_speed_m_s: estimated wind at 2 m, in metres per second.
- globe_temperature_c: globe temperature, in degrees Celsius.
- natural_wet_bulb_c: natural wet-bulb temperature, in degrees Celsius.
- psychrometric_wet_bulb_c: psychrometric wet-bulb temperature, in degrees Celsius; NA when skipped.
- wbgt_c: outdoor wet bulb globe temperature, in degrees Celsius.

All numerical outputs are NA for nonzero statuses.

Examples

```
input <- lwbgt_input(
  year = 2024, month = 4, day = 15, hour = 14, minute = 30,
  gmt_offset_hours = 8, averaging_minutes = 60, urban = 1,
  latitude_deg_north = 1.3521, longitude_deg_east = 103.8198,
  solar_w_m2 = 742, pressure_hpa = 1008.4,
  air_temperature_c = 32.1, relative_humidity_percent = 68,
  wind_speed_m_s = 2.8, wind_height_m = 10,
  vertical_temperature_difference_c = 1
)
calculate(input)
```

---

esat *Calculate Saturation Vapour Pressure*

Description

Calls the native Liljegren saturation-pressure calculation. Missing inputs propagate to NA; invalid non-missing inputs produce NA and one warning per call. Non-finite native results are also replaced with NA and included in that warning.

Usage

```
esat(temperature_k, phase = 0L)
```

Arguments

temperature_k	Finite, positive numeric temperatures in kelvin.
phase	Zero for liquid water or one for ice.

Value

A numeric vector of saturation vapour pressures in hectopascals.

Examples

```
esat(c(263.15, 273.15, 303.15))
esat(263.15, phase = 1L)
```

---

lwbgt_input *Construct WBGT Input Records*

Description

Constructs one or more input rows. All arguments are required; scalar values are recycled to the common non-scalar length. Row values are validated by calculate, rather than by this constructor. Valid input ranges do not guarantee solver convergence.

Usage

```
lwbgt_input(
  year, month, day, hour, minute, gmt_offset_hours, averaging_minutes,
  urban, latitude_deg_north, longitude_deg_east, solar_w_m2,
  pressure_hpa, air_temperature_c, relative_humidity_percent,
  wind_speed_m_s, wind_height_m, vertical_temperature_difference_c
)
```

Arguments

year	Integer-valued Gregorian year from 1950 through 2049.
month, day, hour, minute	Integer-valued local standard date and time. Months are 1–12 and days must be valid for the selected year and month. A month of zero makes day a day-of-year value (1–365 or 366). Hours are 0–23 and minutes are 0–59.
gmt_offset_hours	Local standard time minus GMT, in whole hours from -12 through 14. Convert daylight-saving or fractional-offset timestamps to standard time or UTC before constructing inputs.

`averaging_minutes`
: Integer averaging interval from 0 through 1440 minutes. The kernel subtracts half this interval from the supplied timestamp to center the calculation. Use zero for instantaneous or already centered observations.

`urban`
: Zero for rural wind scaling or one for urban wind scaling.

`latitude_deg_north`, `longitude_deg_east`
: Finite coordinates in degrees north (-90 through 90) and degrees east (-180 through 180).

`solar_w_m2`
: Finite, nonnegative solar irradiance in watts per square metre.

`pressure_hpa`
: Finite, positive barometric pressure in hectopascals.

`air_temperature_c`
: Finite dry-bulb temperature in degrees Celsius, strictly above -273.15.

`relative_humidity_percent`
: Finite relative humidity from 0 through 100 percent.

`wind_speed_m_s`
: Finite, nonnegative wind speed in metres per second.

`wind_height_m`
: Finite, positive wind measurement height in metres.

`vertical_temperature_difference_c`
: Finite upper-minus-lower temperature difference in degrees Celsius. Only whether it is `< 0` or `>= 0` is used. It can affect results only for rural nighttime records when `wind_height_m` differs from 2 m and `wind_speed_m_s` is below 2.5.

Value

A plain data frame with the 17 native input columns.

Examples

```
input <- lwbgt_input(
  year = 2024, month = 4, day = 15, hour = 14, minute = 30,
  gmt_offset_hours = 8, averaging_minutes = 60, urban = 1,
  latitude_deg_north = 1.3521, longitude_deg_east = 103.8198,
  solar_w_m2 = 742, pressure_hpa = 1008.4,
  air_temperature_c = 32.1, relative_humidity_percent = 68,
  wind_speed_m_s = 2.8, wind_height_m = 10,
  vertical_temperature_difference_c = 1
)
```

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