

Package: lwbgt (via r-universe)

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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](https://doi.org/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/LWBG.T.jl>

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

Depends R (>= 4.3.0)

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Repository <https://zyf0717.r-universe.dev>

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lwbgt-package	<i>Reference-Compatible Outdoor Wet Bulb Globe Temperature</i>
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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 \(LWBGJ.jl\)](#), [Swift](#), and [native C](#). See the [documentation index](#) for the shared kernel and its interfaces.

calculate	<i>Calculate Outdoor Wet Bulb Globe Temperature</i>
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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 <code>lwbgt_input()</code> . 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)
```

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	<i>Construct WBGT Input Records</i>
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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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