

Package ‘vostokR’

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Type Package

Title Solar Potential Calculation for Point Clouds using 'VOSTOK'

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Description Calculate solar potential for LiDAR point clouds using the 'VOSTOK' (Voxel Octree Solar Toolkit) algorithm. This R program provides an interface to the original 'VOSTOK' C++ implementation by Bechtold and Hofle (2020), enabling efficient ray casting and solar position algorithms to compute solar irradiance for each point while accounting for shadowing effects. Integrates seamlessly with the 'lidR' package for LiDAR data processing workflows. The original 'VOSTOK' toolkit is available at [doi:10.11588/data/QNA02B](https://doi.org/10.11588/data/QNA02B).

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URL <https://github.com/bi0m3trics/vostokR>

BugReports <https://github.com/bi0m3trics/vostokR/issues>

Encoding UTF-8

Imports Rcpp (>= 1.0.11), lidR (>= 4.0.0), data.table, terra, sf (>= 1.0.0), methods

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NeedsCompilation yes

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add_normals	<i>Add Normal Vectors to Point Cloud</i>
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Description

This function adds normal vectors to a LiDAR point cloud using a highly optimized C++/Eigen-based eigenvalue decomposition method with OpenMP parallelization. This implementation is 5-10x faster than pure R approaches and comparable to lasR, while providing additional geometric features useful for forestry applications.

Usage

```
add_normals(
  las,
  k = 10,
  add_features = FALSE,
  num_threads = 0,
  verbose = FALSE
)
```

Arguments

las	LAS object from lidR package
k	Number of neighbors to use for normal estimation (default: 10)
add_features	Logical, whether to add eigenvalue-based geometric features (default: FALSE)
num_threads	Number of OpenMP threads to use (default: 0 = auto-detect)
verbose	Logical. Print informational messages (default: FALSE)

Value

LAS object with added normal vectors (nx, ny, nz) and optionally geometric features

See Also

[calculate_solar_potential](#) for solar potential calculation

Examples

```
library(lidR)
library(vostokR)

# Load test data
LASfile <- system.file("extdata", "test.laz", package="vostokR")
las <- readLAS(LASfile)

# Add normals using fast C++ method
las <- add_normals(las, k = 10)
names(las@data)
```

calculate_solar_potential

Calculate Solar Potential for LiDAR Point Cloud

Description

This function takes a LiDAR point cloud from the lidR package and calculates the solar potential for each point, taking into account shadowing effects from surrounding points. Location information (lat/lon/timezone) is auto-detected from the CRS when possible.

Usage

```
calculate_solar_potential(las, ...)
```

```
## S3 method for class 'LAS'
```

```
calculate_solar_potential(  
  las,  
  year = 2025,  
  day_start = NULL,  
  day_end = NULL,  
  start_date = NULL,  
  end_date = NULL,  
  day_step = 30,  
  minute_step = 30,  
  min_sun_angle = 5,  
  voxel_size = 1,  
  lat = NULL,  
  lon = NULL,  
  timezone = NULL,  
  n_threads = NULL,  
  clear_cache = FALSE,  
  verbose = FALSE,  
  ...  
)
```

```
## S3 method for class 'LAScatalog'
calculate_solar_potential(
  las,
  year = 2025,
  day_start = 1,
  day_end = 365,
  day_step = 30,
  minute_step = 30,
  min_sun_angle = 5,
  voxel_size = 1,
  lat,
  lon,
  timezone,
  ...
)
```

Arguments

<code>las</code>	LAS or LAScatalog object from lidR package containing point cloud data
<code>...</code>	Additional arguments passed to other methods
<code>year</code>	Numeric. Year for solar calculation (default: 2025)
<code>day_start</code>	Numeric. Start day of year (1-365). Ignored if <code>start_date</code> is provided.
<code>day_end</code>	Numeric. End day of year (1-365). Ignored if <code>end_date</code> is provided.
<code>start_date</code>	Date or character. Start date (e.g., "2025-06-01"). Overrides <code>day_start</code> .
<code>end_date</code>	Date or character. End date (e.g., "2025-08-31"). Overrides <code>day_end</code> .
<code>day_step</code>	Numeric. Step size in days for calculation (default: 30)
<code>minute_step</code>	Numeric. Time step in minutes for calculation within each day (default: 30)
<code>min_sun_angle</code>	Numeric. Minimum sun angle in degrees for calculation (default: 5)
<code>voxel_size</code>	Numeric. Size of voxels for octree shadow calculation (default: 1)
<code>lat</code>	Numeric. Latitude of the study area (auto-detected from CRS if NULL)
<code>lon</code>	Numeric. Longitude of the study area (auto-detected from CRS if NULL)
<code>timezone</code>	Numeric. Time zone offset from UTC (auto-detected from CRS if NULL)
<code>n_threads</code>	Numeric. Number of OpenMP threads to use (default: auto-detect)
<code>clear_cache</code>	Logical. Clear performance caches before calculation (default: FALSE)
<code>verbose</code>	Logical. Print informational messages (default: FALSE)

Value

LAS object with added column for solar potential in Wh/m²/day

Examples

```
library(lidR)
library(vostokr)

# Load test data
LASfile <- system.file("extdata", "test.laz", package="vostokr")
las <- readLAS(LASfile)
las <- add_normals(las, k = 10)

# Quick single-day calculation
las_solar <- calculate_solar_potential(las,
                                       year = 2025,
                                       day_start = 172,
                                       day_end = 172,
                                       day_step = 1,
                                       minute_step = 60,
                                       lat = 35.0,
                                       lon = -111.0,
                                       timezone = -7)
```

clear_vostokr_caches *Clear VostokR Performance Caches*

Description

Clears internal SOLPOS and shadow caches to free memory

Usage

```
clear_vostokr_caches(verbose = FALSE)
```

Arguments

verbose Logical. Print informational messages (default: FALSE)

Value

No return value, called for side effects (clears internal caches).

get_vostokr_performance_info

Get VostokR Performance Information

Description

Returns a named list containing information about OpenMP availability and thread configuration for VostokR.

Usage

get_vostokr_performance_info()

Value

A named list with the following elements:

openmp_enabled Logical. Whether OpenMP support is available.

max_threads Integer. Maximum number of threads available.

current_threads Integer. Number of threads currently in use.

get_vostokr_threads

Get Current VostokR Thread Count

Description

Returns the number of OpenMP threads currently configured for VostokR parallel computations.

Usage

get_vostokr_threads()

Value

An integer scalar indicating the current number of OpenMP threads used by VostokR.

plot_solar_potential *Plot Solar Potential Point Cloud*

Description

Plots solar potential values directly on the point cloud using lidR's native plotting

Usage

```
plot_solar_potential(las, ...)
```

Arguments

las	LAS object with solar potential values
...	Additional arguments passed to lidR::plot()

Value

No return value, called for side effects (produces a plot).

Examples

```
library(lidR)
library(vostokR)
LASfile <- system.file("extdata", "test.laz", package = "vostokR")
las <- readLAS(LASfile)
las <- add_normals(las, k = 10)
las_solar <- calculate_solar_potential(las,
  year = 2025, day_start = 172, day_end = 172,
  day_step = 1, minute_step = 60,
  lat = 35.0, lon = -111.0, timezone = -7)
plot_solar_potential(las_solar)
```

set_vostokr_threads *Set VostokR OpenMP Thread Count*

Description

Control the number of OpenMP threads used by VostokR calculations

Usage

```
set_vostokr_threads(n_threads = NULL, verbose = FALSE)
```

Arguments

n_threads	Integer. Number of threads to use. If NULL, auto-detect based on available cores and lidR settings.
verbose	Logical. Print informational messages (default: FALSE)

Value

No return value, called for side effects (sets thread count).

solar_ground_raster *Convert Solar Potential Ground Points to Raster*

Description

Extracts ground points from solar potential results and converts to terra SpatRaster

Usage

```
solar_ground_raster(
  las,
  res = 1,
  ground_class = 2,
  use_all_points = FALSE,
  verbose = FALSE
)
```

Arguments

las	LAS object with solar potential values
res	Numeric. Resolution of output raster (default: 1)
ground_class	Numeric. Classification code for ground points (default: 2)
use_all_points	Logical. If TRUE and no ground points found, use all points (default: FALSE)
verbose	Logical. Print informational messages (default: FALSE)

Value

A SpatRaster object (from the **terra** package) containing mean solar potential values (Wh/m²/day) for ground points, gridded at the specified resolution. Returns NULL if no ground points are found and use_all_points is FALSE.

Examples

```
library(lidR)
library(vostokR)
LASfile <- system.file("extdata", "test.laz", package = "vostokR")
las <- readLAS(LASfile)
las <- add_normals(las, k = 10)
las_solar <- calculate_solar_potential(las,
  year = 2025, day_start = 172, day_end = 172,
  day_step = 1, minute_step = 60,
  lat = 35.0, lon = -111.0, timezone = -7)
solar_raster <- solar_ground_raster(las_solar, res = 0.5)
```

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