Package 'geoprofiler'

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Title Perpendicular Line Transects for Geosciences

Version 0.0.2

Description Toolset to create perpendicular profile graphs and swath profiles. Method are based on coordinate rotation algorithm by Schaeben et al. (2024) <doi:10.1002/mma.9823>.

License GPL (>= 3)

URL https://tobiste.github.io/geoprofiler/

BugReports https://github.com/tobiste/geoprofiler/issues

Depends R (>= 4.1.0)

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Contents

`draw` *Draw a profile line or a point to retrieve coordinates*

Description

Opens a plot window showing the the map with the data, where the user can click profile coordinates.

Usage

```
get_coordinates(x, n = 1, type = "o", col = "#B63679FF", ...)

draw_profile(x, n = 10, ...)
```

Arguments

`x`	`sf` object
`n`	the maximum number of points to locate. Valid values start at 1.
`type`	One of `"n"`, `"p"`, `"l"` or `"o"`. If `"p"` or `"o"` the points are plotted; if `"l"` or `"o"` they are joined by lines.
`col`	color of line or point
`...`	additional graphics parameters used if `type != "n"` for plotting the locations.

Value

`sf` object of the profile.

line_ends *Extract End Points of a Line*

Description

Extract End Points of a Line

Usage

```
line_ends(x)
```

Arguments

x	sf line object

Value

sf point object

Examples

```
p1 <- data.frame(lon = -90.8, lat = 48.6) |>
  sf::st_as_sf(coords = c("lon", "lat"), crs = "WGS84")
profile_points(p1,
  profile.azimuth = 135, profile.length = 10000,
  crs = sf::st_crs("EPSG:26915")
) |>
  profile_line() |>
  line_ends()
```

locations_example *Example* sf *data set*

Description

example dataset

Usage

```
data('locations_example')
```

Format

An object of class sf

Examples

```
data("locations_example")
head(locations_example)
```

point_distance *Distance Between Points*

Description

This uses the **haversine** formula (by default) to calculate the great-circle distance between two points, i.e., the shortest distance over the earth's surface.

Usage

```
point_distance(a, b, ...)
```

Arguments

a	lon, lat coordinate of point 1
b	lon, lat coordinate of point 2
...	parameters passed to tectonicr::dist_greatcircle()

Value

units object giving the distance

Examples

```
berlin <- c(13.4, 52.517) # lon, lat
tokyo <- c(139.767, 35.7) # lon, lat
point_distance(berlin, tokyo)
```

profile_azimuth *Azimuth Between Profile Points*

Description

Azimuth Between Profile Points

Usage

```
profile_azimuth(x)
```

Arguments

x	sf point object. First point marks the start point.

Details

If only two points are given, the azimuth is calculated using triangulation from the `tectonicr` package. If more than two points are given, the azimuth is calculated using linear interpolation in the coordinate reference frame given by `profile`.

Value

Azimuth as `units` object

See Also

`profile_length()`

Examples

```
p1 <- data.frame(lon = -90.8, lat = 48.6) |>
  sf::st_as_sf(coords = c("lon", "lat"), crs = "WGS84")

profile_points(p1,
  profile.azimuth = 135, profile.length = 10000,
  crs = sf::st_crs("EPSG:26915")
) |>
  profile_azimuth()
```

`profile_coords` *Profile Coordinates*

Description

Project points on a cross section given by a starting point and the direction

Usage

```
profile_coords(x, profile, azimuth = NULL, drop.units = TRUE)
```

Arguments

`x`	`'sf'` object
`profile`	`'sf'` object of the profile or the profile's starting point.
`azimuth`	numeric. Direction (in degrees) emanating from starting point. Is ignored when `profile` contains two points or is a `LINESTRING`.
`drop.units`	logical. Whether the return should show the units or not.

Value

`tibble` where `X` is the distance along the profile line. `Y` is the distance across the profile line. (units of `X` and `Y` depend on coordinate reference system).

Author(s)

Tobias Stephan

Examples

```
data(locations_example)
p1 <- data.frame(lon = -90.8, lat = 48.6) |>
  sf::st_as_sf(coords = c("lon", "lat"), crs = "WGS84")
profile_crds <- profile_coords(locations_example, profile = p1, azimuth = 135)
head(profile_crds)

# Plot the transformed coordinates
plot(profile_crds)
```

`profile_length` *Length of Profile*

Description

Length of Profile

Usage

```
profile_length(x, ...)
```

Arguments

`x`	`sf` line object
`...`	(optional) passed on to `s2::s2_distance()`

Value

`units` object when coordinate system is set.

See Also

`profile_azimuth()`

Examples

```
p1 <- data.frame(lon = -90.8, lat = 48.6) |>
  sf::st_as_sf(coords = c("lon", "lat"), crs = "WGS84")
profile_points(p1,
  profile.azimuth = 135, profile.length = 10000,
  crs = sf::st_crs("EPSG:26915")
) |>
  profile_line() |>
  profile_length()
```

profile_line *Combine Points to a Line*

Description

Combine Points to a Line

Usage

```
profile_line(x)
```

Arguments

x	sf point object

Value

sf line object

See Also

profile_points()

Examples

```
p1 <- data.frame(lon = -90.8, lat = 48.6) |>
  sf::st_as_sf(coords = c("lon", "lat"), crs = "WGS84")
profile_points(p1,
  profile.azimuth = 135, profile.length = 10000,
  crs = sf::st_crs("EPSG:26915")
) |>
  profile_line()
```

profile_points *Profile End Point*

Description

Create a end point along a profile line starting at a point with a defined direction and length.

Usage

```
profile_points(
  start,
  profile.azimuth,
  profile.length,
  crs = st_crs(start),
  return.sf = TRUE
)
```

Arguments

start	sf point object.
profile.azimuth	numeric or units object. Direction of profile in degrees if numeric.
profile.length	numeric or units object.
crs	Coordinate reference system. Should be parsed by sf::st_crs().
return.sf	logical. Should the profile points be returned as a sf object (TRUE, the default) object or as a data.frame.

Value

class depends on return.sf.

Note

Use metric values (meters, kilometers, etc) in case of a projected coordinate reference frame, and degree when geographical coordinate reference frame.

Examples

```
p1 <- data.frame(lon = -90.8, lat = 48.6) |>
  sf::st_as_sf(coords = c("lon", "lat"), crs = "WGS84")
profile_points(p1,
  profile.azimuth = 135, profile.length = units::set_units(10, "km"),
  crs = sf::st_crs("EPSG:26915")
)
```

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raster_example *Example raster data set*

Description

example dataset

Usage

```
data('raster_example')
```

Format

An object of class matrix

Examples

```
data("raster_example")
head(raster_example)
```

swath_profile *Swath Elevation Profile Statistics*

Description

Calculate swath-profile values perpendicular to a straight baseline. The distance between samples and the number of samples can be specified, see arguments k and dist. Values of the swath-profile are extracted from a given raster file, see argument raster. CRS of raster and points have to be the same.

Usage

```
swath_profile(
  profile,
  raster,
  k = 1,
  dist,
  crs = terra::crs(raster),
  method = c("bilinear", "simple")
)
```

Arguments

profile	either a sf object or a matrix(ncol=2, nrow=2) with x and y coordinates of beginning and end point of the baseline; each point in one row **column 1** x coordinates (or longitudes) **column 2** y coordinates (latitudes)
raster	Raster file ("SpatRaster" object as loaded by terra::rast())
k	integer. number of lines on each side of the baseline
dist	numeric. distance between lines
crs	character. coordinate reference system. Both the raster and the profile are transformed into this CRS. Uses the CRS of raster by default.
method	character. method for extraction of raw data, see terra::extract(): default value: "bilinear"

Details

The final width of the swath is: $2k \times$ dist.

Value

list.

swath matrix. Statistics of the raster measured along the lines

data list of numeric vector containing the data extracted from the raster along each line

lines swath lines as "sf" objects

Source

The algorithm is a modified version of "swathR" by Vincent Haburaj (https://github.com/jjvhab/swathR).

See Also

swath_stats()

Examples

```
# Create a random raster
r <- terra::rast(ncol = 10, nrow = 10, xmin = -150, xmax = -80, ymin = 20, ymax = 60, crs = "WGS84")
terra::values(r) <- runif(terra::ncell(r))

# Create a random profile
profile <- data.frame(lon = c(-140, -90), lat = c(55, 25)) |>
  sf::st_as_sf(coords = c("lon", "lat"), crs = "WGS84")
swath_profile(profile, r, k = 2, dist = 1)
```

---

swath_stats *Summary Statistics on Swath Elevation Profile*

Description

Statistics of the elevation data across a swath profile.

Usage

```
swath_stats(x, profile.length = NULL)
```

Arguments

x	list. The return object of swath_profile()
profile.length	numeric or units object. If NULL the fractional distance is returned, i.e. 0 at start and 1 at the end of the profile.

Value

tibble

See Also

swath_profile()

Examples

```
# Create a random raster
r <- terra::rast(ncol = 10, nrow = 10, xmin = -150, xmax = -80, ymin = 20, ymax = 60)
terra::values(r) <- runif(terra::ncell(r))

# Create a random profile
profile <- data.frame(lon = c(-140, -90), lat = c(55, 25)) |>
  sf::st_as_sf(coords = c("lon", "lat"), crs = "WGS84")
swath <- swath_profile(profile, r, k = 5, dist = 10)

swath_stats(swath, profile.length = profile_length(profile_line(profile)))
```

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