Package 'TephraMap'

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Type Package

Title Plot isopachs for from tephra samples and estimates total volume

Version 0.1.0

Author Luke Western (luke.western@bristol.ac.uk)

Maintainer Luke Western <luke.western@bristol.ac.uk>

Imports raster

Suggests INLA

Description These functions aim to use measurements of tephra thickness to create a continuous tephra field, which can be used to draw isopach thicknesses and estimate the total volume. This method is very heavily reliant on the package r-inla (Lindgren & Rue, 2015).
The main function is tephra.map(), which calls the other functions internally.
The function tephra.map() takes a csv file containing sampled tephra thickness to estimate appropriate isopachs and total volume of tephra. The input data is a csv file with X and Y coordinates in: UTM units, as distance in kilometres from some origin, or in WGS84 latitude/longitude, which will be converted to UTM coordinates internally. If you are estimating for a super eruption (super==TRUE) the coordinates must be in latitude/longitude for the calculation. The third column contains the measured thickness of the tephra deposit, with the column header as the units of the measurement in either mm, cm or m. For example the first 3 columns may appear as:
X,Y,mm
522100, 1378210, 15
521140, 1377890, 120
Estimates are done on a 2D plain except for super eruptions (super=TRUE) when it is calculated on the globe, i.e. curvature is taken into account.
Installation requires downloading INLA package by doing:
install.packages("INLA", repos=c(getOption("repos"), INLA="https://inla.r-inla-download.org/R/stable"), dep=TRUE)
Followed by installing the TephraMap package using devtools using:
devtools::install_github('lukewestern/TephraMap')
References:
Lindgren, F. and H. Rue, 2015. Bayesian spatial modelling with r-inla. Journal of Statistical Software, 63(19).

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Encoding UTF-8

LazyData true

RoxygenNote 7.0.2

R topics documented:

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  tephra.estimate   *Estimate the isopachs and total volume given tephra samples.*

Description

Estimate the isopachs and total volume given tephra samples.

Usage

```
tephra.estimate(
  fn,
  coordsys,
  UTMtz = NaN,
  super = FALSE,
  prior.range = NULL,
  prior.sigma = NULL
)
```

Arguments

fn	String of the csv file containing the sampled tephra deposits. This must have columns containing the X coordinate, Y coordinate and thickness of the tephra deposit. There must be headers for all columns, with the sampled thickness having the units as the header: <mm>, <cm> or <m> (without the < >).
coordsys	String of the coordinate system used. This must be either `"UTM"`, which is the UTM coordinates (where the UTM zone must also be given); `"dfs"`, which is distance from some origin in kilometres; or `"latlon"` for WG84 latitude and longitude, where the UTM zone must also be supplied as units are converted to UTM if super=FALSE.
UTMtz	(optional) The UTM zone if using UTM or latlon coordinates (and super==FALSE)
super	(optional, default=FALSE) Set to true if this is a super eruption. The calculation is then done on a globe rather than a flat plain. Coordinates must be in latlon. (This only works for super eruptions, i.e. those spanning several degrees longitude/latitude).
prior.range	(optional, default=NULL) Prior probability for the spatial range of the tephra field in km using a penalised complexity prior. This is a vector of length 2, c(range0,Prange), where Pr(range < range0) = Prange. Setting Prange as NA fixes range to range0. Leave as NULL for the default prior, approximated from the measurement field.
prior.sigma	(optional, default=NULL) Prior probability for the standard deviation of the log-tickness of the tephra field defined using a penalised complexity prior. This is a vector of length 2, c(sigma0,Psigma), where Pr(sigma > sigma0) = Psigma. Setting Psigma as NA fixes sigma to sigma0. Leave as NULL for default prior.

Value

A list containing (1) $out: a list as S3 object. The list contains the data.frame $data with the x and y coordinates and value of input data in mm; $field, a list containing the estimated tephra thickness field on a 500x500 grid in mm and the associated coordinates; and $volume the estimated total volume in km^3. (2) $plotparams, a list containing some parameters for plotting

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| tephra.map | *Estimate isopachs and total volume* |

Description

Estimate the isopachs and total volume given tephra samples and optionally plot the result. The estimated tephra field is returned on a 500x500 rasterised grid with the corresponding coordinates and an estimate of the total volume and the input data.

Usage

```
tephra.map(
  datafile,
  coord,
  UTMzone = NaN,
  plot = TRUE,
  super = FALSE,
  prior.range = NULL,
  prior.sigma = NULL
)
```

Arguments

datafile	String of the csv file containing the sampled tephra deposits. This must have columns containing the X coordinate, Y coordinate and thickness of the tephra deposit. There must be headers for all columns, with the sampled thickness having the units as the header: <mm>, <cm> or <m> (without the < >).
coord	String of the coordinate system used. This must be either "UTM", which is the UTM coordinates (where the UTM zone must also be given); "dfs", which is distance from some origin in kilometres; or "latlon" for WG84 latitude and longitude, where the UTM zone must also be supplied as units are converted to UTM if super=FALSE.
UTMzone	(optional) The UTM zone if using UTM or latlon coordinates (and super==FALSE)
plot	(optional, default=TRUE) whether to plot the output
super	(optional, default=FALSE) Set to TRUE if this is a super eruption. The calculation is then done on a globe rather than a flat plain. Coordinates must be in latlon. (This only works for super eruptions, i.e. those spanning several degrees longitude/latitude)
prior.range	(optional, default=NULL) Prior probability for the spatial range of the tephra field in km using a penalised complexity prior. This is a vector of length 2, c(range0,Prange), where Pr(range < range0) = Prange. Setting Prange as NA fixes range to range0. Leave as NULL for the default prior, approximated from the measurement field.

prior.sigma   (optional, default=NULL) Prior probability for the standard deviation of the log-tickness of the tephra field defined using a penalised complexity prior. This is a vector of length 2, c(sigma0,Psigma), where Pr(sigma > sigma0) = Psigma. Setting Psigma as NA fixes sigma to sigma0. Leave as NULL for default prior.

Value

List as S3 object. List contains: `$data`: a data.frame with the x and y coordinates and value of input data in mm; `$field`: a list containing the estimated tephra thickness on a 500x500 grid in mm and the associated coordinates; and `$volume`: the estimated total volume in km^3.

Examples

```
tephrafield <- tephra.map("CerroNegro.csv", "UTM", UTMzone=16)
```

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tephra.plot   *Plot an isopach map*

Description

Plot an isopach map after estimating the thickness

Usage

```
tephra.plot(outlist)
```

Arguments

outlist   The output from `tephra.estimate()`

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