Package 'mpspline2'

October 13, 2022

Type Package

Title Mass-Preserving Spline Functions for Soil Data

Version 0.1.6

Date 2022-04-03

Description
A low-dependency implementation of GSIF::mpspline() <https://r-forge.r-project.org/scm/viewvc.php/pkg/R/mpspline.R?view=markup&revision=240&root=gsif>, which applies a mass-preserving spline to soil attributes. Splining soil data is a safe way to make continuous down-profile estimates of attributes measured over discrete, often discontinuous depth intervals.

License GPL

Encoding UTF-8

Imports stats

Suggests testthat, covr

RoxygenNote 7.1.2

NeedsCompilation no

Author Lauren O'Brien [aut, cre] (<https://orcid.org/0000-0002-7336-2171>),
Brendan Malone [ctb] (<https://orcid.org/0000-0002-0473-8518>),
Tomislav Hengl [ctb] (<https://orcid.org/0000-0002-9921-5129>),
Tom Bishop [ctb],
David Rossiter [ctb],
Dylan Beaudette [ctb],
Andrew Brown [ctb]

Maintainer Lauren O'Brien <obrlsoilau@gmail.com>

Repository CRAN

Date/Publication 2022-04-03 19:20:04 UTC

R topics documented:

`mpspline` *Spline discrete soils data - multiple sites*

Description

This function implements the mass-preserving spline method of Bishop *et al* (1999) (doi: 10.1016/S00167061(99)000038) for interpolating between measured soil attributes down a soil profile, across multiple sites' worth of data.

Usage

```
mpspline(
  obj = NULL,
  var_name = NULL,
  lam = 0.1,
  d = c(0, 5, 15, 30, 60, 100, 200),
  vlow = 0,
  vhigh = 1000
)
```

Arguments

`obj`	data.frame or matrix. Column 1 must contain site identifiers. Columns 2 and 3 must contain upper and lower sample depths, respectively. Subsequent columns will contain measured values for those depths.
`var_name`	length-1 character or length-1 integer denoting the column in `obj` in which target data is stored. If not supplied, the fourth column of the input object is assumed to contain the target data.
`lam`	number; smoothing parameter for spline. Defaults to 0.1.
`d`	sequential integer vector; denotes the output depth ranges in cm. Defaults to `c(0, 5, 15, 30, 60, 100, 200)` after the GlobalSoilMap specification, giving output predictions over intervals 0-5cm, 5-15cm, etc.
`vlow`	numeric; constrains the minimum predicted value to a realistic number. Defaults to 0.
`vhigh`	numeric; constrains the maximum predicted value to a realistic number. Defaults to 1000.

Value

A nested list of data for each input site. List elements are: Site ID, vector of predicted values over input intervals, vector of predicted values for each cm down the profile to `max(d)`, vector of predicted values over `d` (output) intervals, and root mean squared error.

Examples

```
dat <- data.frame("SID" = c( 1,  1,  1,  1,   2,   2,   2,   2),
                  "UD" = c( 0, 20, 40, 60,   0,  15,  45,  80),
                  "LD" = c(10, 30, 50, 70,   5,  30,  60, 100),
                 "VAL" = c( 6,  4,  3, 10, 0.1, 0.9, 2.5,   6),
                  stringsAsFactors = FALSE)
m1 <- mpspline(obj = dat, var_name = 'VAL')
```

`mpspline_compact` *Spline discrete soils data - multiple sites, compact output*

Description

This function implements the mass-preserving spline method of Bishop *et al* (1999) (doi: 10.1016/S00167061(99)000038) for interpolating between measured soil attributes down a soil profile, across multiple sites' worth of data. It returns a more compact output object than `mpspline()`.

Usage

```
mpspline_compact(
  obj = NULL,
  var_name = NULL,
  lam = 0.1,
  d = c(0, 5, 15, 30, 60, 100, 200),
  vlow = 0,
  vhigh = 1000
)
```

Arguments

`obj`	data.frame or matrix. Column 1 must contain site identifiers. Columns 2 and 3 must contain upper and lower sample depths, respectively. Subsequent columns will contain measured values for those depths.
`var_name`	length-1 character or length-1 integer denoting the column in `obj` in which target data is stored. If not supplied, the fourth column of the input object is assumed to contain the target data.
`lam`	number; smoothing parameter for spline. Defaults to 0.1.
`d`	sequential integer vector; denotes the output depth ranges in cm. Defaults to `c(0, 5, 15, 30, 60, 100, 200)` after the GlobalSoilMap specification, giving output predictions over intervals 0-5cm, 5-15cm, etc.
`vlow`	numeric; constrains the minimum predicted value to a realistic number. Defaults to 0.
`vhigh`	numeric; constrains the maximum predicted value to a realistic number. Defaults to 1000.

Value

A four-item list containing a matrix of predicted values over the input depth ranges, a matrix of predicted values over the output depth ranges, a matrix of 1cm predictions, and a matrix of RMSE and IQR-scaled RMSE values. Site identifiers are in rownames attributes.

Examples

```
dat <- data.frame("SID" = c( 1,  1,  1,  1,   2,   2,   2,   2),
                  "UD" = c( 0, 20, 40, 60,   0,  15,  45,  80),
                  "LD" = c(10, 30, 50, 70,   5,  30,  60, 100),
                 "VAL" = c( 6,  4,  3, 10, 0.1, 0.9, 2.5,   6),
                  stringsAsFactors = FALSE)
mpspline_compact(obj = dat, var_name = 'VAL')
```

`mpspline_one` *Spline discrete soils data - single site*

Description

This function implements the mass-preserving spline method of Bishop *et al* (1999) (doi: 10.1016/S00167061(99)000038) for interpolating between measured soil attributes down a single soil profile.

Usage

```
mpspline_one(
  site = NULL,
  var_name = NULL,
  lam = 0.1,
  d = c(0, 5, 15, 30, 60, 100, 200),
  vlow = 0,
  vhigh = 1000
)
```

Arguments

`site`	data frame containing data for a single soil profile. Column 1 must contain site identifiers. Columns 2 and 3 must contain upper and lower sample depths, respectively, measured in centimeters. Subsequent columns will contain measured values for those depths.
`var_name`	length-1 character or length-1 integer denoting the column in `site` in which target data is stored. If not supplied, the fourth column of the input object is assumed to contain the target data.
`lam`	number; smoothing parameter for spline. Defaults to 0.1.
`d`	sequential integer vector; denotes the output depth ranges in cm. Defaults to `c(0, 5, 15, 30, 60, 100, 200)` after the GlobalSoilMap specification, giving output predictions over intervals 0-5cm, 5-15cm, etc.

vlow	numeric; constrains the minimum predicted value to a realistic number. Defaults to 0.
vhigh	numeric; constrains the maximum predicted value to a realistic number. Defaults to 1000.

Value

A list with the following elements: Site ID, vector of predicted values over input intervals, vector of predicted values for each cm down the profile to `max(d)`, vector of predicted values over `d` (output) intervals, and root mean squared error.

Examples

```
dat <- data.frame("SID" = c( 1,  1,  1,  1),
                  "UD" = c( 0, 20, 40, 60),
                  "LD" = c(10, 30, 50, 70),
                 "VAL" = c( 6,  4,  3, 10),
                  stringsAsFactors = FALSE)
mpspline_one(site = dat, var_name = 'VAL')
```

---

mpspline_tidy *Spline discrete soils data - multiple sites, tidy output*

Description

This function implements the mass-preserving spline method of Bishop *et al* (1999) (doi: 10.1016/S00167061(99)000038) for interpolating between measured soil attributes down a soil profile, across multiple sites' worth of data. It returns an output object with tidy data formatting.

Usage

```
mpspline_tidy(
  obj = NULL,
  var_name = NULL,
  lam = 0.1,
  d = c(0, 5, 15, 30, 60, 100, 200),
  vlow = 0,
  vhigh = 1000
)
```

Arguments

obj	data.frame or matrix. Column 1 must contain site identifiers. Columns 2 and 3 must contain upper and lower sample depths, respectively, and be measured in centimeters. Subsequent columns will contain measured values for those depths.
var_name	length-1 character or length-1 integer denoting the column in `obj` in which target data is stored. If not supplied, the fourth column of the input object is assumed to contain the target data.

`lam`	number; smoothing parameter for spline. Defaults to 0.1.
`d`	sequential integer vector; denotes the output depth ranges in cm. Defaults to `c(0, 5, 15, 30, 60, 100, 200)` after the GlobalSoilMap specification, giving output predictions over intervals 0-5cm, 5-15cm, etc.
`vlow`	numeric; constrains the minimum predicted value to a realistic number. Defaults to 0.
`vhigh`	numeric; constrains the maximum predicted value to a realistic number. Defaults to 1000.

Value

A four-item list containing data frames of predicted values over the input depth ranges, the output depth ranges, 1cm-increment predictions, and RMSE and IQR-scaled RMSE values.

Examples

```
dat <- data.frame("SID" = c( 1,  1,  1,  1,   2,   2,   2,   2),
                  "UD" = c( 0, 20, 40, 60,   0,  15,  45,  80),
                  "LD" = c(10, 30, 50, 70,   5,  30,  60, 100),
                 "VAL" = c( 6,  4,  3, 10, 0.1, 0.9, 2.5,   6),
                  stringsAsFactors = FALSE)
mpspline_tidy(obj = dat, var_name = 'VAL')
```

Index