

Package ‘sspline’

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Title Smoothing Splines on the Sphere

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Depends R (>= 0.99)

Description R package for Computing the Spherical Smoothing Splines

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URL <http://www.stat.wisc.edu/~xie>

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WT6367	<i>World Average Winter Temperature from 1963-1967</i>
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Description

The WT6367 data frame has 1391 rows and 4 columns. It contains the average temperature from 1963 to 1967 for those stations having non-missing observations on the winter (Dec-Feb) for ten years (1963-1967 and 1993-1997).

Format

This data frame contains the following columns:

- recid** a numeric vector containing the coded information of the stations (length 11). The first three digits represent the country code; the next five digits, the station number; the last three digits, whether a station is a WMO station or close to one.
- lon** a numeric vector containing the longitudes (in degrees) of the stations.
- lat** a numeric vector containing the latitudes (in degrees) of the stations.
- avgt** a numeric vector containing the average temperatures for the stations (rounded to the second decimal point).

Source

The Global Historical Climatology Network (GHCN)
<http://www.ncdc.noaa.gov/cgi-bin/res40.pl?page=ghcn.html>

Examples

```
data(WT6367)

## Fit a smoothing spherical spline with part of the data
subdat <- WT6367[sample(nrow(WT6367), 200), 2:4]
attach(subdat)

smooth.sspline(lon, lat, avgt)

detach(subdat)
```

WT9397

World Average Winter Temperature from 1993-1997

Description

The WT9397 data frame has 1391 rows and 4 columns. It contains the average temperature from 1993 to 1997 for those stations having non-missing observations on the winter (Dec-Feb) for ten years (1963-1967 and 1993-1997).

Format

This data frame contains the following columns:

- recid** a numeric vector containing the coded information of the stations (length 11). The first three digits represent the country code; the next five digits, the station number; the last three digits, whether a station is a WMO station or close to one.
- lon** a numeric vector containing the longitudes (in degrees) of the stations.
- lat** a numeric vector containing the latitudes (in degrees) of the stations.
- avgt** a numeric vector containing the average temperatures for the stations (rounded to the second decimal point).

Source

The Global Historical Climatology Network (GHCN)
<http://www.ncdc.noaa.gov/cgi-bin/res40.pl?page=ghcn.html>

Examples

```
data(WT9397)

## Fit a smoothing spherical spline with part of the data
subdat <- WT9397[sample(nrow(WT9397), 200), 2:4]
attach(subdat)

smooth.sspline(lon, lat, avgt)

detach(subdat)
```

WTdiff	<i>World Average Winter Temperature Change (1963-1967 Vs 1993-1997)</i>
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Description

The WTdiff data frame has 1391 rows and 4 columns. It contains the average temperature change from 1963-1967 to 1993-1997 for those stations having non-missing observations on the winter (Dec-Feb) for ten years (1963-1967 and 1993-1997).

Format

This data frame contains the following columns:

recid a numeric vector containing the coded information of the stations (length 11). The first three digits represent the country code; the next five digits, the station number; the last three digits, whether a station is a WMO station or close to one.

lon a numeric vector containing the longitudes (in degrees) of the stations.

lat a numeric vector containing the latitudes (in degrees) of the stations.

avgd a numeric vector containing the average temperature change from 1963-1967 to 1993-1997 for the stations.

Source

The Global Historical Climatology Network (GHCN)
<http://www.ncdc.noaa.gov/cgi-bin/res40.pl?page=ghcn.html>

Examples

```
data(WTdiff)

## Fit a smoothing spherical spline with part of the data
subdat <- WTdiff[sample(nrow(WTdiff), 200), 2:4]
attach(subdat)

smooth.sspline(lon, lat, avgd)

detach(subdat)
```

`map.world`*World Map*

Description

Sketch the continental boundary to give a rough idea of the position on the world.

Usage

```
map.world(add=FALSE, main="", ...)
```

Arguments

<code>add</code>	a logical scalar, if TRUE, add a map to the existing plot; otherwise, plot a new world map
<code>main</code>	a character vector, the main title of the plot
<code>...</code>	other parameters needed to pass to the lines function

Value

NULL

Author(s)

Original in S by Steve Wofsy <scw@io.harward.edu>,
ported to R by Xianhong Xie <xie@stat.wisc.edu>.

References

S Archive under <http://lib.stat.cmu.edu>

Examples

```
map.world(main = "The World Map")
```

`plot.smooth.sspline`*Plot a Smooth.sspline Object*

Description

Plot a smoothing spherical spline using color to represent the function value.

Usage

```
plot.smooth.sspline(x, lon, lat, main="", xlab="Longitude",  
  ylab="Latitude", key.title="Temp\n(deg)", ...)  
plot(x, lon, lat, main="", xlab="Longitude",  
  ylab="Latitude", key.title="Temp\n(deg)", ...)
```

Arguments

<code>x</code>	a <code>smooth.sspline</code> object
<code>lon</code>	the longitudes on which the function values will be calculated
<code>lat</code>	the latitudes on which the function values will be calculated
<code>main</code>	the main title of the plot
<code>xlab</code>	the x-axis label of the main plot
<code>ylab</code>	the y-axis label of the main plot
<code>key.title</code>	the title for the colored key
<code>...</code>	other plotting parameters, such as <i>lwd</i> , <i>asp</i> , and ...

Details

It calls `predict.smooth.sspline` and `filled.contour`.

Value

NULL

Note

The longitudes and latitudes are measured in degrees.

Author(s)

Xianhong Xie

See Also

[predict.smooth.sspline](#)

Examples

```
data(WTdiff)

subdat <- WTdiff[sample(nrow(WTdiff), 200), 2:4]
attach(subdat)

splobj <- smooth.sspline(lon, lat, avgd)

plot(splobj, lon=seq(-180, 180, len=50), lat=seq(-90, 90, len=25),
     main="World Average Temperature Change")

detach(subdat)
```

predict.smooth.sspline

Spherical Smoothing Spline Prediction

Description

Make prediction on the sphere using the information got from a `smooth.sspline` object.

Usage

```
predict.smooth.sspline(object, lon, lat, grid=FALSE)
predict(object, lon, lat, grid=FALSE)
```

Arguments

<code>object</code>	a <code>smooth.sspline</code> object
<code>lon</code>	the longitudes on which the prediction is to be made
<code>lat</code>	the latitudes on which the prediction is to be made
<code>grid</code>	whether the prediction is on a grid

Details

It calls Fortran subroutine with the `.Fortran` interface.

Value

If `grid = TRUE`, return a matrix with dimension $(\text{length}(\text{lon}), \text{length}(\text{lat}))$; otherwise, return a vector of length = $\text{length}(\text{lon})$.

Note

The longitudes and latitudes are measured in degrees.

Author(s)

Xianhong Xie

References

Grace Wahba (1981), *Spline Interpolation and Smoothing on the Sphere*, SIAM J. SCI. STAT. COMPUT.

See Also

[smooth.sspline](#)

Examples

```
data(WT9397)

subdat <- WT9397[sample(nrow(WT9397), 200), 2:4]
attach(subdat)

splobj <- smooth.sspline(lon, lat, avgt)

predict(splobj, lon=seq(-180,180,len=50), lat=seq(-90,90,len=25), grid=T)

detach(subdat)
```

`print.smooth.sspline` *Display a Smooth.sspline Object*

Description

The print and summary methods for `smooth.sspline` object.

Usage

```
print.smooth.sspline(x)
summary.smooth.sspline(object)
print(x)
summary(object)
```

Arguments

`x`, `object`: `smooth.sspline` objects

Value

For `print.smooth.sspline`, a `smooth.sspline` object; for `summary.smooth.sspline`, `NULL`.

Author(s)

Xianhong Xie

Examples

```
data(WT6367)

subdat <- WT6367[sample(nrow(WT6367), 200), 2:4]
attach(subdat)

splobj <- smooth.sspline(lon, lat, avgt)

print(splobj)
summary(splobj)

detach(subdat)
```

smooth.sspline	<i>Smoothing Spline on the Sphere</i>
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Description

It fits a smoothing splines on the sphere with the smoothing parameter chosen by the generalized cross validation (GCV) criteria.

Usage

```
smooth.sspline(lon, lat, y)
```

Arguments

lon	numeric vector, the longitudes
lat	numeric vector, the latitudes
y	numeric vector, the observations at (lon, lat)

Details

It calls Fortran subroutine with the .Fortran interface.

Value

A `smooth.sspline` object with the components

lon	the original longitude
lat	the original latitude
obs	the original observation
lambda	the lambda that minimizes the gcv score
gcv	the corresponding gcv value at lambda
varhat	the estimated variance
c	the coefficient vector c for the estimated function
d	the coefficient d for the estimated function
yhat	the estimated (smoothed) observation
call	the call to <code>smooth.sspline</code>

Note

The longitudes and latitudes are measured in degrees.

Author(s)

Xianhong Xie

References

Grace Wahba (1981), *Spline Interpolation and Smoothing on the Sphere*, SIAM J. SCI. STAT. COMPUT.

Examples

```
data(WTdiff)

subdat <- WTdiff[sample(nrow(WTdiff), 200), 2:4]
attach(subdat)

smooth.sspline(lon, lat, avgd)

detach(subdat)
```

station

Distribution of the Stations on the World

Description

It gives a simple illumination on how the given (lon, lat) pairs distributes on the world.

Usage

```
station(lon=NULL, lat=NULL, pch=24, col="blue", bg="red", ...)
```

Arguments

lon	numeric, the longitudes
lat	numeric, the latitudes
pch	the plotting symbol
col	color value or name, the color used to draw the symbol
bg	color value or name, the color used to fill the symbol
...	other plotting parameters

Details

It calls the `map.world` to draw a world map.

Value

NULL

Note

The longitudes and latitudes are measured in degrees.

Author(s)

Xianhong Xie <<xie@stat.wisc.edu>>

See Also

[map.world](#)

Examples

```
data(WTdiff)
subdat <- WTdiff[sample(nrow(WTdiff), 200), 2:3]
attach(subdat)
```

```
station(lon, lat)
```

```
detach(subdat)
```

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