Package ‘TDPanalysis’

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Type Package

Title Granier's Sap Flow Sensors (TDP) Analysis

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Description Set of functions designed to help in the analysis of TDP sensors. Features includes dates and time conversion, weather data interpolation, daily maximum of tension analysis and calculations required to convert sap flow density data to sap flow rates at the tree and plot scale (For more information see : Granier (1985) <DOI:10.1051/forest:19850204> & Granier (1987) <DOI:10.1093/treephys/3.4.309>).

Imports stats, plyr, graphics

Depends R (>= 2.10)

Encoding UTF-8

LazyData true

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RoxygenNote 7.0.2

NeedsCompilation no

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R topics documented:

date.to.DOY *Date conversion*

Description

Convert dates from the DD/MM/YYYY format to day of the year (DOY)

Usage

```
date.to.DOY(dates, format = "dd/mm/yyyy")
```

Arguments

dates	Vector with dates to convert.
format	Format of the date (support DD/MM/YYYY MM/DD/YYYY and YYYY/MM/DD).

Value

Return a vector containing the corresponding DOY.

Examples

```
dates = c("01/01/2000", "03/03/2000", "03/03/1999")
date.to.DOY(dates=dates)
```

datetime *Time & dates conversion*

Description

Convert DOY and time into a single numerical variable

Usage

```
datetime(dates, Time)
```

Arguments

dates	Vector with dates in the DOY format.
Time	Vector with time

Details

time vector should be numerical (e.g. as outputed by the time.to.cont function)

Value

Return a vector containing DOY and time as a single numerical variable

Examples

```
dates = c(102,102,102,102,103,103,103,103)
Time = c(22, 22.5, 23, 23.5, 0, 0.5, 1, 1.5)
datetime(dates=dates, Time=Time)
```

`remove.fun` *Remove unwanted dates*

Description

Remove all data for the corresponding date argument

Usage

```
remove.fun(df, dates)
```

Arguments

`df`	Data frame containing a DOY column named "DOY".
`dates`	Character vector containing the DOY to remove from the data frame.

Details

This function is primarely used to remove days for which Tmax is too extreme.

Value

Return the inputed data frame without the date corresponding the the "dates" argument.

Examples

```
DOY = c(rep(102, times=10), rep(103, times=10))
ID = c(rep("A", times=5), rep("B", times=5), rep("A", times=5), rep("B", times=5))
Tmax = c(rep(2.5, times=5), rep(2.7, times=5), rep(3.2, times=5), rep(3.4, times=5))
df <- data.frame(DOY, ID, Tmax)
dates = c("103")
remove.fun(df=df, dates=dates)
```

`SpFl` *Sap flow dataset*

Description

Exemple dataset exemple for the TDPanalysis package

Usage

```
SpFl
```

Format

An object of class `data.frame` with 432 rows and 4 columns.

Details

"DATE" is dates in dd/mm/yyyy format. "TIME" is time in hh:mm:ss format, "ID" is sub-groups and "tension" is the measured tension from the TDP probe.

`SpWd_Area_calc` *Sapwood area calculation*

Description

Calculate sapwood area based on diameter, heartwood diameter and sapwood fraction

Usage

```
SpWd_Area_calc(diam, SpWd_frac = 1, HtWd_diam = 0)
```

Arguments

`diam`	Vector with diameter.
`SpWd_frac`	Numerical (from 0 to 1). Indicate the fraction of the diameter which is sapwood
`HtWd_diam`	Vector with diameter of the heartwood.

Details

If SpWD_frac and HtWd_diam are both entered, the function will return an error. Units of "diam" and "HtWd_diam" should be the same.

Value

Return a numerical vector containing the sapwood area

Examples

```
diam = c(12,14,16,13,15)
SpWd_Area_calc(diam=diam, SpWd_frac=0.2)
```

`tens.to.sapflow` *Convert tension into sap flow density*

Description

Use the Granier formula to convert tension into sap flow density using daily or mean Tmax

Usage

```
tens.to.sapflow(tension, Tmax)
```

Arguments

`tension`	Vector with tension.
`Tmax`	Vector with corresponding maximums of tension.

Value

Return a numerical vector containing the sap flow density

References

Granier A. 1985. A new method of sap flow measurement in tree stems. Annales Des Sciences Forestieres 42(2): 193-200.

Granier A. 1987. Evaluation of transpiration in a douglas-fir stand by means of sap flow measurements. Tree Physiology 3(4): 309-319.

Examples

```
Tmax = c(rep(2.5, times=5), rep(2.7, times=5), rep(3.2, times=5), rep(3.4, times=5))
tension = c(5:25)
tens.to.sapflow(tension=tension, Tmax=Tmax)
```

timecont *Time conversion*

Description

Convert time from the HH:MM:SS format to a numerical

Usage

```
timecont(Time, sep = ":")
```

Arguments

Time	Vector with time to convert.
sep	Character element containing regular expression(s) to use to splitting.

Details

time vector should be in the HH:MM:SS format.

Value

Return a vector containing the corresponding time.

Examples

```
Time = c("14:30:00", "20:45:00", "05:00:00")
timecont(Time=Time)
```

Tmax.find *Find Tmax*

Description

Find the daily maximum of tension

Usage

```
Tmax.find(tension, dates, ID)
```

Arguments

tension	Vector with tension.
dates	Vector with dates in the DOY format.
ID	Character vector for specifying which group the tension is assigned to (e.g. trees)

Value

Return a vector containing daily Tmax for each group specified in the ID argument

Examples

```
tension = c(1:20)
dates = c(rep(102, times=10), rep(103, times=10))
ID = c(rep("A", times=5), rep("B", times=5), rep("A", times=5), rep("B", times=5))
Tmax.find(tension=tension, dates=dates, ID=ID)
```

Tmax.mean *Calculate a mean of Tmax*

Description

Calculate a mean Tmax for each sub-group

Usage

```
Tmax.mean(df)
```

Arguments

df	Data frame containing all Tmax for each sub-group.

Details

The data frame should contain a column named "Tmax" whith all Tmax and a column named "ID" to identify which Tmax belong to which sug-group.

Value

Return the inputed data frame with a new column names "Tmax_mean".

Examples

```
ID = c(rep("A", times=5), rep("B", times=5), rep("A", times=5), rep("B", times=5))
Tmax = c(rep(2.5, times=5), rep(2.7, times=5), rep(3.2, times=5), rep(3.4, times=5))
DOY = c(rep(102, times=10), rep(103, times=10))
df <- data.frame(DOY, ID, Tmax)
Tmax.mean(df)
```

`Tmaxplot` *Plot the Tmax*

Description

Plot the Tmax with indications of extreme values

Usage

```
Tmaxplot(df)
```

Arguments

`df`	Data frame containing Tmax, identification of sub-groups and DOY.

Details

The dataframe should contain at least 3 columns named "Tmax" (daily maximums of tension), "DOY" (day of the year) and "ID" (sub-groups). The red horizontal lines reprensents 3 times the inter-quartile range (3*IQR) of all the Tmax of the data. The blue horizontal line reprensent the 1.5*IQR without the Tmax outside the red lines.

Value

Return a plot of Tmax by days for each sub-group

Examples

```
DOY = c(rep(102, times=10), rep(103, times=10))
ID = c(rep("A", times=5), rep("B", times=5), rep("A", times=5), rep("B", times=5))
Tmax = c(rep(0.7512, times=5), rep(0.7359, times=5),rep(0.7644, times=5),rep(0.7666, times=5))
df <- data.frame(DOY, ID, Tmax, stringsAsFactors = FALSE)
Tmaxplot(df)
```

`Wat.transp` *Calculate daily transpiration*

Description

Calculate daily transpiration for each sub-group inputed

Usage

```
Wat.transp(Sapflow, days, ID)
```

Arguments

`Sapflow` Vector with sap flow.

`days` Vector containg the days for which to calculate transpiration

`ID` Character vector containing identification for each sub-group

Details

!!Beware of the units!! The Granier formula usually convert tension into sap flow density (in kg.dm-2.h-1). So, you should first convert sap flow density into sap flow (in kg.h-1). Moreover, if you take measurment every 30 minutes sap flow should be corrected by dividing the value by 2.

Value

Return a data frame with transpiration for each day and sub-group inputed

Examples

```
ID = c(rep("A", times=5), rep("B", times=5), rep("A", times=5), rep("B", times=5))
Sapflow = c(rep(2.5, times=5), rep(2.7, times=5), rep(3.2, times=5), rep(3.4, times=5))
days = c(rep(102, times=10), rep(103, times=10))
Wat.transp(Sapflow=Sapflow, days=days, ID=ID)
```

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