# Package ‘StreamMetabolism’

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**Type** Package  
**Title** Calculate Single Station Metabolism from Diurnal Oxygen Curves  
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**Depends** zoo, chron, maptools  
**Description** I provide functions to calculate Gross Primary Productivity, Net Ecosystem Production, and Ecosystem Respiration from single station diurnal Oxygen curves.  
**License** GPL (>= 3)  
**LazyLoad** yes  
**Repository** CRAN  
**NeedsCompilation** no  
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contiguous.zoo

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Description

Convert from cubic feet per second to liters per second

Usage

cfs.lps(x)

Arguments

x Discharge in cfs

Author(s)

Stephen A Sefick Jr.

contiguous.zoo

Description

find continuous non NA portions of zoo time series data

Usage

contiguous.zoo(x)

Arguments

x zoo time series object whatever indexes you want

Details

if you want to just find the contiguous portions of just one signal and not the interaction between two just duplicate the signal contiguous.zoo(data.frame(x, coredata(x))) should give you what you want
Value
data frame consisting of

start start index
end end index
lengths length of record
value logical stating whether a continuous string of non-NA values

Author(s)
Gabor Grothendieck and Stephen A Sefick Jr.

Cs

Saturation Concentration at temp

Description
Calculates the concentration(mg/L) @ 100

Usage
Cs(x)

Arguments
x Temperature in Degrees Celcius

Details
enter one temperature or a zoo time series of temperature

Value
single value or time series of mg/L@saturation for that temperature

Author(s)
Stephen A Sefick Jr.

References
Examples

#single temperature
temp <- sample(20:30, 1)
Cs(temp)

#USGS Data (DOTemp)
library(chron)
library(zoo)
data(DOTemp)
Cs(DOTemp[,1])

dC.dt Change in Oxygen per time step

Description
Calculate the rate of change of Dissolved Oxygen

Usage
dC.dt(x)

Arguments
x Dissolved Oxygen time series

Details
input zoo series takes the difference of DOt+1 - DOt

Value
zoo series of Dissolved Oxygen Differences with an NA for the first value as there is no value before that to subtract

Author(s)
Stephen A Sefick Jr.

References

Examples
data(DOTemp)
Diffconc <- dC.dt(DOTemp[,2])
plot(Diffconc)
Description

Test data set from Stephens and Jennings SWProd calculator (USGS). The data has been interpolated to make it have readings every fifteen minutes.

Usage

data(DOTemp)

Format

DateTime  DateTime
Temp  Temperature in Celcius
DO  Dissolved Oxygen

Details

This is only for example and should be used judiciously for any kind of ecosystem interpretation (requires zoo and chron packages).

Source


fmt.chron

Description

Used in the FUN argument of read.zoo for dates in the format mm/dd/yyyy hh:mm:ss

Usage

fmt.chron(x)

Arguments

x  Data Time Column
Details
used internally in read.production

Author(s)
Stephen A Sefick Jr

See Also
read.production

\[ K_t \]

Temperature Correction For Reaeration Value

Description
Temperature Correction For Reaeration Value. Corrects reaeration value to temperature of the stream.

Usage
\[ K_t(K, \text{temp}) \]

Arguments
\[ K \quad \text{Rearaeration Coefficient single value or in a zoo object} \]
\[ \text{temp} \quad \text{temperature value at time t in Degrees Celcius} \]

Value
Single Values or zoo series

Author(s)
Stephen A Sefick Jr

References
**lps.cfs**

**Liters Per Second to Cubic Feet per Second**

**Examples**

```r
#data USGS
data(DOTemp)
#velocity 0.6, depth 0.4572
d <- DObbins(0.6, 0.4572)
Kcorr <- Kt(d, DOTemp[,1])
```

**Description**

Convience Function for converting from liters per second to cubic feet per second

**Usage**

```r
lps.cfs(x)
```

**Arguments**

- `x` Discharge in Liters per Second

**Value**

Discharge in Cubic feet per second

**Author(s)**

Stephen A Sefick Jr

**Examples**

```r
lps.cfs(134000)
```

---

**lps.cms**

**Liters per second to cubic meters per second**

**Description**

Conversion Function

**Usage**

```r
lps.cms(x)
```
Arguments
x discharge in Liters per second

Details
single value or if zoo series - zoo object

Value
single value or if zoo series - zoo object

Author(s)
Stephen A Sefick Jr.

Examples
lps.cms(134000)

ODobbins  O’Conner Dobbins Surface Renewal Method for calculating Rearreration Coefficient

Description
calculate reaeration coefficient with the O’Conner Dobbins method

Usage
ODobbins(vel, dep)

Arguments
vel velocity in m/s
dep depth in meters

Details
Surface Renewal

Value
Reaeration Coefficient (1/d)

Author(s)
Stephen A Sefick Jr.
**References**


**Examples**

```r
#velocity 0.6
#depth 0.4572
#Dobbins(0.6, 0.4572)
```

---

**read.production**  
*Read in Time Series Data as zoo Object*

**Description**

Wrapper Function to read.zoo

**Usage**

```r
read.production(data)
```

**Arguments**

- `data`: a csv file with headers and the date as mm/dd/yyyy hh:mm:ss format (think excel spreadsheet date format and the file is saved as a csv file)

**Details**

This is a wrapper function to read.zoo with a specific format required see above

**Value**

zoo object

**Author(s)**

Stephen A Sefick Jr

**See Also**

`read.table`
Numeric Integration Using Simpson’s method

Description

Numeric Integration using the Simpson Method

Usage

simp(y, a = NULL, b = NULL, x = NULL, n = 200)

Arguments

y  y values to integrate
x  x values to integrate over
a  NULL
b  NULL
n  number of divisions defaults to 200

Value

Numeric Value of the integration

Author(s)

Rolf Turner

Examples

# 4-x^2-y^2
fun <- function(x, y){
a <- 4
b <- x^2
d <- y^2
z <- a-b-d
return(z)
}

a <- fun(seq(-1000,1000,1), seq(-1000,1000,1))
simp(a, x=-1000:1000, n=1000)
Calculate Ecosystem Production with the Single Station Method

Description

Calculate ER, NEP, and GPP from diurnal oxygen curves.

Usage

`SM(depth, min_interval, DO, temp, K, day, sr="00:00:00", ss="23:45:00", start="00:00:00", end="23:45:00")`

Arguments

- `depth`: depth m K
- `min_interval`: time resolution (e.g., 15 min)
- `temp`: Time Series temperature in degrees Celcius
- `DO`: Time Series Dissolved Oxygen in mg/L
- `day`: date of the day of interest must be in quotes
- `start`: time of the start of the "day" usually 00:00:00 must be in quotes
- `end`: time of the end of the "day" usually 23:45:00 must be in quotes
- `sr`: time of sunrise in the form 04:22:00 must be in quotes
- `ss`: time of sunset in the form 19:23:00 must be in quotes
- `K`: K at 20 deg. C (1/dt; e.g., 1/15min)

Details

ER is calculated as sum Et (i.e, mean nighttime NEP corrected for the difference in daytime temp and average nighttime temp)

GPP is calculated by summing NEP-ERt from sunrise to sunset

`NEP=ER+GPP`

Tested Against Rivermet spreadsheet (Izagirre 2007). The data from station 1 (7/10 - 7/15/2003) were used with K=0.07 from "Introduced K". ER, NEP, and GPP are in mg/L*d. The results were not identical. When Estimation from rivermet was regressed on estimation from this software, GPP, ER, and NEP intercepts did not differ significantly from 0 and slopes were nearly 1: 0.94, 0.91, and 0.95, respectively. Further testing is greatly appreciated.

Value

- `ER`: Ecosystem Respiration
- `NEP`: Net Ecosystem Production
- `GPP`: Gross Primary Productivity
sunrise.set

Author(s)
Stephen A Sefick Jr.

References

Examples
# zoo real data
# velocity 0.6
# depth 0.4572
# sunrise 6:00AM
# sunset 8:15PM
# K/96 to get K per dt (i.e., 96 15 min interval in 1 day)
# data(DOTemp)

K <- O Dobbins(0.6, 0.4572)
prod <- $M(min_interval=15, K=K/96,
depth=0.4572, temp=DOTemp[,1], DO=DOTemp[,2],
day="5/18/70", start="00:00:00",
end="23:45:00", sr="06:00:00", ss="20:15:00")
prod

table

sunrise.set

Calculate Sunrise Sunset Times

Description
This function calculates sunrise sunset times in POSIXct and returns it in a handy dandy format to either export as a csv file or use directly in the calculation of Stream Metabolism. This function is based on maptools which is based on the NOAA sunrise sunset calculator.

Usage
sunrise.set(lat, long, date, timezone = "UTC", num.days = 1)
sunrise.set

Arguments

lat    Latitude in decimal degrees
long   Longitude in decimal degrees
date   starting date (needs to be in quotes and in the format yyyy/mm/dd)
timezone Time zone set to UTC default (needs to be in quotes)
num. days 1 if you just want only the calculation preformed on "date" (default)

Details

Remember that the Prime Meridian is 0 through Greenwich, England. So anything W is - and anything E is +. Also anything in the Northern hemisphere is + latitude and Southern Hemisphere is - latitude. Generally UTC+5 is Eastern Standard Time, UTC+6 is CST, UTC+7 MST, UTC+8 PST. Another way of specifying time zones is Country City see examples. Be aware of timezones and daylight and standard time when using this function!!!!!! This will help you avoid headaches caused because minor oversites = large error in your calculations

Value

output data frame with all dates sunrise and sunset times specified

Author(s)

Stephen A Sefick Jr.

References

old site: http://www.esrl.noaa.gov/gmd/grad/solcalc/sunrise.html
new site: http://www.esrl.noaa.gov/gmd/grad/solcalc/

Examples

#This is for Atlanta Georgia
#(Only so that you can compare it to the NOAA
#website that is given above)
sunrise.set(33.43, -84.22, "2008/01/01", timezone="UTC+5")

#Same As above but look at Time Zone Specification
sunrise.set(33.43, -84.22, "2008/01/01", timezone="America/New_York")
window_chron

Time Windows of Diurnal Curves

Description

Takes a time window of a larger series

Usage

window_chron(x, day1, hour1, day2, hour2, ...)

Arguments

x data to be subsected
day1 start day
hour1 start time
day2 end date
hour2 end time
...
other arguments

Value

subset by time

Author(s)

Stephen A Sefick Jr.

References

chron, window, window.zoo

See Also

window

Examples

# with real data
data(DOTemp)
d <- window_chron(DOTemp, "8/18/70", "06:00:00", "8/18/70", "20:15:00")
plot(d)
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