

# Package ‘Tides’

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**Version** 1.0

**Title** Tides

**Author** Tom Cox <tom.cox@ua.ac.be>

**Maintainer** Tom Cox <tom.cox@ua.ac.be>

**Description** Functions to calculate characteristics of quasi periodic time series, e.g. observed estuarine water levels

**License** GPL

**LazyData** yes

**NeedsCompilation** no

**Repository** CRAN

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Tides-package

*Characteristics of water level time series in intertidal systems.*

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### Description

The tides package contains routines to calculate ecologically relevant characteristics of observed tides in intertidal systems.

### Details

Package: Tides  
Type: Package  
Version: 0.2  
License: GNU Public License 2 or above

### Author(s)

Tom Cox (maintainer)

### See Also

[TidalCharacteristics](#): the aggregate function returning several characteristics of the tides

### Examples

```
## Not run:  
##  
  
## End(Not run)
```

---

extrema

*Extrema*

---

### Description

Calculate maxima and minima of quasi periodic time series. The function works good when the time series is 'smooth enough'. The function will fail when multiple local extrema exist, with a magnitude similar to the extremum extremorum and in an interval larger than  $[t-T2, t+T2]$  around the extremum extremorum at time  $t$ . When this is the case, this might be solved by adding extra wrappers around the function.

**Usage**

```
extrema(h, h0, T2 = 5*60*60, hoffset = 0, filtconst = 1)
```

**Arguments**

h	Water level time series. Data frame with time and h column
h0	Reference level, either single valued vector with dimension corresponding to h
T2	'Lower' bound on half the quasi period, but higher than expected stagnant phase; default = 5h
hoffset	Offset level, to prevent spurious maxima generation due to small fluctuations
filtconst	Filtering constant for smoothing the time series with <code>filter(x, rep(1/filtconst, filtconst))</code>

**Value**

a list containing:

HL	Data frame with time, water level and reference level of the extrema. Column HL denotes H(igh) (=maximum) or L(ow) (=minimum) water levels
h	Original water level data frame with additional columns HL, denoting H(igh) or L(ow) water phase and N(umber) of tidal cycle.

**Author(s)**

Tom Cox <tom.cox@ua.ac.be>

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gapsts

*Gaps in time series*

---

**Description**

Determine gaps (time intervals bigger than a certain maximum dtMax) in a time series

**Usage**

```
gapsts(ts, dtMax, unit = "mins")
```

**Arguments**

ts	Array of times, not necessarily of class POSIXt. Time sequences with differences of subsequent values < dtMax are considered a continuous series. Time differences > dtMax are considered gaps between two consecutive series.
dtMax	Maximum time interval that is not considered as a gap.
unit	Unit of dtMax. only used when ts is of class POSIXt

**Value**

Data frame with the initial time, end time and time difference (unit = unit) of each interval > dtMax

**Author(s)**

Tom Cox <tom.cox@ua.ac.be>

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IF *Inundation frequency*

---

**Description**

Calculate inundation frequency at height h0 from series of high water levels H

**Usage**

```
IF(H, h0, N = length(H[,1]))
```

**Arguments**

H	High water levels. Data Frame with column h
h0	Reference level for which IF has to be calculated
N	number of cycles in time series, equals the number of high water levels when these are complete (= default value)

**Value**

Inundation frequency [%] at reference level h0

**Author(s)**

Tom Cox <tom.cox@ua.ac.be>

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IT *Inundation time*

---

**Description**

Calculate inundation times, i.e. time intervals for which water level  $h > h_0$ . Care must be taken when there are gaps (long time periods for which there is no data) in the time series. Either the erroneous values have to be removed manually, or a wrapper making use of the function `gapsts` can be used.

**Usage**

```
IT(h, h0, h0marg = 0.3, dtMax, unit = "mins")
```

**Arguments**

h	Water level time series. data frame with time and h column
h0	Reference level, either single valued or vector with same length as h
h0marg	Margin on reference level, to cope with small fluctuations in the Water level time series
dtMax	Maximum time interval in continuous water level series
unit	Unit of dtMax

**Value**

a list containing:

IT	Data frame with start time (t1), end time (t2) and duration (dt, unit = unit) of inundation
DT	Data frame with start time (t1), end time (t2) and duration (dt, unit = unit) of dry time

**Author(s)**

Tom Cox <tom.cox@ua.ac.be>

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plot.Tides

*Simple plot of Tides*

---

**Description**

Plot water levels, calculated high and low water, and reference level of a Tides-object

**Usage**

```
## S3 method for class 'Tides'
plot(x, ...)
```

**Arguments**

x	Tides object (e.g. the result of TidalCharacteristics())
...	Other arguments to be passed to plot()

**Details**

Produces a very simple plot of a Tides object, containing water levels, calculated high and low water, and reference level of a Tides-object. Useful for diagnostic purposes.

**Author(s)**

Tom Cox <tom.cox@ua.ac.be>

---

```
print.Tides          Print summary information of Tides-object
```

---

### Description

Print summary information of Tides-object

### Usage

```
## S3 method for class 'Tides'
print(x, ...)
```

### Arguments

```
x          Tides object (e.g. the result of TidalCharacteristics())
...       Other arguments to be passed to print()
```

### Details

Print inundation frequency, average inundation height, average inundation time, average dry time and number of tidal cycles in time series.

### Author(s)

Tom Cox <tom.cox@ua.ac.be>

---

```
TidalCharacteristics  Calculate tidal characteristics
```

---

### Description

Calculates the characteristics of observed tidal water levels. Wrapper of the functions [extrema](#), [IT](#) and [IF](#). Also works on time series with gaps.

### Usage

```
TidalCharacteristics(h,
  h0 = h$h0,
  T2 = 5*60*60,
  hoffset = 0,
  filtconst = 1,
  dtMax = 15,
  unit = "mins",
  Tavg = 12.4*60 )
```

**Arguments**

h	Water level time series. data frame with time and h column
h0	Reference level, either single valued or vector with dimension corresponding to h
T2	'Lower' bound on half the quasi period, but higher than expected stagnant phase; default = 5h
hoffset	Offset level, to prevent spurious maxima generation due to small fluctuations
filtconst	Filtering constant for smoothing the time series
dtMax	Maximum accepted time interval in a continuous series. Bigger time intervals are considered to be gaps
unit	Unit of dtMax, Tavg
Tavg	Average period of time series

**Value**

An object of class Tides, i.e. a list containing:

HL	Data frame with extrema
h	original water level data frame with additional attributes
gaps	a data frame containing start and end times of gaps in the series
IF	inundation frequency of the reference level
ITs	inundation times at the reference level
DTs	dry times at the reference level
h0	reference level
N	Total number of cycles in time span

**Author(s)**

Tom Cox <tom.cox@ua.ac.be>

**See Also**

[extrema](#), [IT](#), [plot.Tides](#)

**Examples**

```
TC <- TidalCharacteristics(waterlevels)
TC
plot(TC)
```

---

waterlevels

*Observed water levels of the tides in the Lippenbroek Flood Control Area with controlled reduced tide (FCA-CRT)*

---

**Description**

This data set gives the observed water levels (in mTAW, the Belgian reference for water levels) the Lippenbroek Flood Control Area with controlled reduced tide (FCA-CRT) between 2007-03-01 and 2007-04-01

**Usage**

waterlevels

**Format**

A data frame containing observation time, the observed water level  $h$  (mTAW) and the elevation  $h_0$  of the observation site

**References**

- Cox et al (2006) *Flood control areas as an opportunity to restore estuarine habitat*. Ecological engineering 28:55-36
- Maris et al (2007) *Tuning the tide: creating ecological conditions for tidal marsh development in a controlled inundation area*. Hydrobiologia 588: 31-43



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