

# Package ‘precintcon’

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**Type** Package

**Title** Precipitation Intensity, Concentration and Anomaly Analysis

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**Description** It contains functions to analyze the precipitation intensity, concentration and anomaly.

**URL** <https://github.com/lucasvenez/precintcon>

**BugReports** <https://github.com/lucasvenez/precintcon/issues>

**Depends** R (>= 2.14), ggplot2 (>= 2.0.0), scales

**License** GPL (>= 2)

**Collate** 'app.r' 'as.precintcon.annual.r' 'as.annual.r'  
'as.precintcon.daily.r' 'as.daily.r' 'as.precintcon.decade.r'  
'as.decade.r' 'deciles.r' 'as.precintcon.deciles.r'  
'precintcon.deciles.analysis.r' 'as.deciles.r'  
'as.precintcon.fd.r' 'precintcon.fd.r' 'as.fd.r'  
'as.precintcon.monthly.r' 'as.monthly.r'  
'as.precintcon.seasonal.r' 'as.seasonal.r'  
'precintcon.ci.per.year.analysis.r' 'ci.per.year.r'  
'precintcon.ci.analysis.r' 'ci.r' 'cv.r' 'ff.index.r'  
'precintcon.limits.analysis.r' 'limits.r' 'pcd.r'  
'precintcon.pci.analysis.r' 'pci.r' 'pci.seasonal.r'  
'pci.supraseasonal.r' 'pcp.r' 'precintcon.pn.analysis.r' 'pn.r'  
'precintcon.plot.lorenz.r' 'pplot.ci.r'  
'precintcon.plot.deciles.r' 'pplot.deciles.r'  
'precintcon.plot.histogram.r' 'pplot.histogram.r'  
'pplot.lorenz.r' 'pplot.pcd.r' 'precintcon.plot.pci.r'  
'pplot.pci.r' 'pplot.pcp.r' 'precintcon.plot.pn.r' 'pplot.pn.r'  
'precintcon.plot.rai.r' 'pplot.rai.r' 'precintcon.plot.spi.r'

'pplot.spi.r' 'precintcon.H.r' 'precintcon.Z.r'  
 'precintcon.b.r' 'precintcon.classification.r'  
 'precintcon.gamma.r' 'precintcon.ln.a.r' 'precintcon.max.r'  
 'precintcon.min.r' 'precintcon.monthly.aggregation.r'  
 'precintcon.plot.lorenz.ungrouped.r' 'precintcon.pn.r'  
 'precintcon.r' 'precintcon.r.squared.r'  
 'precintcon.rai.analysis.r' 'precintcon.read.data.r'  
 'precintcon.spi.analysis.r'  
 'precintcon.spi.per.year.analysis.r'  
 'precintcon.stat.analysis.r' 'rai.r' 'read.data.r'  
 'spi.per.year.r' 'spi.r' 'stat.r' 'tii.r' 'trend.test.r'

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---

<i>app</i>	<i>Amount and Percentage of Precipitation</i>
------------	---

---

**Description**

It calculates the amount and percentage of precipitation contributed by a such percent of rainiest days.

**Usage**

`app(..., percent = 25)`

**Arguments**

`percent` is the percentage of the rainiest days to be considered (default = 25).  
`...` a set of daily precipitation series.

**Value**

data.frame containing the following variables:

- `dataset` is the dataset name of the precipitation serie;
- `percentage` is the percentage of the rainiest days;
- `absolute` is the absolute amount of precipitation generated by percentage
- `relative` is the percentage of precipitation benenerated by percentage

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[read.data as.daily ci](#)

## Examples

```
##  
# Loading the daily precipitation serie  
data(daily)  
  
##  
# Calculating amount and percentage of precipitation using different parameters  
  
app(daily)  
  
app(daily, percent = 20)  
  
app(daily, percent = c(10, 15, 20, 25))
```

---

as.annual	<i>Converting to seasonal precipitation serie.</i>
-----------	--

---

## Description

Converts a daily, monthly, or seasonal precipitation serie to an annual serie.

## Usage

```
as.annual(object)
```

## Arguments

object            a `precintcon.daily`, `precintcon.monthly`, or `precintcon.seasonal` object or a `data.frame` containing 33 or 3 columns.

## Value

A `data.frame` (`precintcon.annual`) containing the following variables:

- `year` is the year.
- `precipitation` is the precipitation amount in millimeters.

## Author(s)

Lucas Venezian Povoá <lucasvenez@gmail.com>

## See Also

[as.daily](#) [as.monthly](#) [as.seasonal](#) [pplot.lorenz](#) [read.data](#)

**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Converting precipitation  
as.annual(daily)
```

---

as.daily	<i>Converting a data.frame to a daily precipitation serie</i>
----------	---

---

**Description**

Converts a `data.frame` to a `precintcon.daily`.

**Usage**

```
as.daily(object, na.value = NA)
```

**Arguments**

<code>object</code>	a <code>precintcon.daily</code> or a <code>data.frame</code> containing 33 columns.
<code>na.value</code>	the value used for representing non-existent values (Default value: NA).

**Value**

A `data.frame` (`precintcon.daily`) containing the following variables:

- `year` is the year.
- `month` is the month.
- `d1` is the precipitation value in millimeters of the 1st day of the month.
- `d2` is the precipitation value in millimeters of the 2nd day of the month.
- `d3` is the precipitation value in millimeters of the 3rd day of the month.
- `d4` is the precipitation value in millimeters of the 4th day of the month.
- `d5` is the precipitation value in millimeters of the 5th day of the month.
- `d6` is the precipitation value in millimeters of the 6th day of the month.
- `d7` is the precipitation value in millimeters of the 7th day of the month.
- `d8` is the precipitation value in millimeters of the 8th day of the month.
- `d9` is the precipitation value in millimeters of the 9th day of the month.
- `d10` is the precipitation value in millimeters of the 10th day of the month.
- `d11` is the precipitation value in millimeters of the 11th day of the month.
- `d12` is the precipitation value in millimeters of the 12th day of the month.

- d13 is the precipitation value in millimeters of the 13th day of the month.
- d14 is the precipitation value in millimeters of the 14th day of the month.
- d15 is the precipitation value in millimeters of the 15th day of the month.
- d16 is the precipitation value in millimeters of the 16th day of the month.
- d17 is the precipitation value in millimeters of the 17th day of the month.
- d18 is the precipitation value in millimeters of the 18th day of the month.
- d19 is the precipitation value in millimeters of the 19th day of the month.
- d20 is the precipitation value in millimeters of the 20th day of the month.
- d21 is the precipitation value in millimeters of the 21th day of the month.
- d22 is the precipitation value in millimeters of the 22th day of the month.
- d23 is the precipitation value in millimeters of the 23th day of the month.
- d24 is the precipitation value in millimeters of the 24th day of the month.
- d25 is the precipitation value in millimeters of the 25th day of the month.
- d26 is the precipitation value in millimeters of the 26th day of the month.
- d27 is the precipitation value in millimeters of the 27th day of the month.
- d28 is the precipitation value in millimeters of the 28th day of the month.
- d29 is the precipitation value in millimeters of the 29th day of the month.
- d30 is the precipitation value in millimeters of the 30th day of the month.
- d31 is the precipitation value in millimeters of the 31th day of the month.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[as.decade](#) [as.annual](#) [as.seasonal](#) [as.monthly](#)

**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Converting precipitation  
as.daily(daily)
```

---

`as.decade`*Converting a precipitation serie to a decade serie*

---

**Description**

It converts a daily, monthly or annual precipitation serie to a decade serie.

**Usage**

```
as.decade(object)
```

**Arguments**

`object` a `precintcon.daily`, `precintcon.monthly`, `precintcon.seasonal`, `precintcon.annual` object or a `data.frame` containing 33 or 3 columns.

**Details**

It excludes no complete decades for converting the serie, e.g., a serie starting in 1977 and finishing in 2008 will have the year 1977 to 1979 and 2000 to 2008 excluded, resulting into a serie of the years 1980 and 1990.

**Value**

A `data.frame` (`precintcon.decade`) containing the following variables:

- `year` is the year.
- `precipitation` is the decade's precipitation in millimeters.

**Author(s)**

Lucas Venezian Pova <lucasvenez@gmail.com>

**See Also**

[as.precintcon.annual](#) [as.precintcon.seasonal](#) [as.precintcon.monthly](#) [as.precintcon.daily](#)

**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Converting precipitation  
as.decade(daily)
```

---

`as.deciles`*Deciles of a precipitation serie*

---

**Description**

Groups the monthly precipitation into deciles, i.e., it splits a precipitation serie into ten equal parts in crescent order, from the lower to the highest precipitation.

**Usage**

```
as.precintcon.deciles(object)
```

**Arguments**

`object` a daily or monthly precipitation serie.

**Value**

A data.frame (precintcon.deciles) containing the following variables:

- D1 corresponds to the precipitation values not exceeding 10% of the lowest values.
- D2 corresponds to the precipitation values not exceeding 20 of the lowest values.
- D3 corresponds to the precipitation values not exceeding 30 of the lowest values.
- D4 corresponds to the precipitation values not exceeding 40% of the lowest values.
- D5 is equals to the median that corresponds to the precipitation values not exceeding 50% of the lowest values.
- D6 corresponds to the precipitation values not exceeding 60% of the lowest values.
- D7 corresponds to the precipitation values not exceeding 70 of the lowest values.
- D8 corresponds to the precipitation values not exceeding 80 of the lowest values.
- D9 corresponds to the precipitation values not exceeding 90 of the lowest values.
- D10 corresponds to the precipitation values not exceeding 100 of the lowest values.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[read.data](#)



---

`as.fd`*Frequency distribution of a precipitation serie*

---

**Description**

Calculates the frequency distribution of a daily precipitation serie based on `interval`.

**Usage**

```
as.precintcon.fd(object, interval = 1)
```

**Arguments**

<code>object</code>	a daily precipitation serie.
<code>interval</code>	the interval in millimeters for calculating the frequency distribution.

**Value**

A `data.frame` (`precintcon.fd`) containing the following variables:

- `initial.class` is the initial value of the class.
- `final.class` is the final value of the class.
- `midpoint` is the middle point of the class.
- `n` is the absolute frequency, i.e., the number of days in each class.
- `sum.n` is the cumulative frequency, obtained by adding the absolute frequencies of all the classes up to the one under consideration.
- `P` is the pluviometric total of each class, obtained by multiplying `midpoint` by `n`.
- `sum.P` is the cumulative class's pluviometric total, obtained by adding the pluviometric total of all the classes up to the one under consideration.
- `p.sum.n` is the cumulative percentage of rainy days.
- `p.sum.P` is the cumulative percentage of rainfall amounts.

**Author(s)**

Lucas Venezian Povoia <lucasvenez@gmail.com>

**See Also**

[read.data.as.daily.ci](#)

**Examples**

```
##  
# Loading the daily precipitation serie  
data(daily)  
  
##  
# Performing the frequency distribution  
as.precintcon.fd(daily)
```

---

as.monthly

*Convert a daily precipitation serie to a monthly serie*

---

**Description**

Converts a daily precipitation serie to a monthly serie.

**Usage**

```
as.monthly(object)
```

**Arguments**

object            a precintcon.daily object or a data.frame containing 33 or 3 columns

**Value**

A data.frame (precintcon.monthly) containing the following variables:

- year is the year.
- month is the month.
- precipitation is the precipitation amount in millimeters.

**Author(s)**

Lucas Venezian Pova <lucasvenez@gmail.com>

**See Also**

[pplot.lorenz read.data](#)

**Examples**

```
## Loading the daily precipitation serie.  
#  
data(daily)  
  
## Converting precipitation  
#  
as.monthly(daily)
```

---

as.seasonal	<i>Converting to seasonal precipitation serie</i>
-------------	---

---

**Description**

It converts a daily or monthly precipitation serie to a seasonal serie according to meteorological seasons.

**Usage**

```
as.seasonal(object)
```

**Arguments**

object            a `precintcon.daily`, or `precintcon.monthly` object or a `data.frame` containing 33 or 3 columns.

**Details**

If the serie has no a month of a season, it is waived in conversion, e.g., if a serie has January and February of 1975, but no December of 1974, the first two months are removed of the resulting serie because the season that depends all of them is not complete.

**Value**

A `data.frame` (`precintcon.seasonal`) containing the following variables:

- `year` is the year.
- `season` is the season.
- `precipitation` is the precipitation amount in millimeters.

**Author(s)**

Lucas Venezian Pova <[lucasvenez@gmail.com](mailto:lucasvenez@gmail.com)>

**See Also**

[pplot.lorenz.read.data](#)

**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Converting precipitation  
as.seasonal(daily)
```

---

ci	<i>Concentration Index</i>
----	----------------------------

---

**Description**

Calculates the Concentration Index (CI) on a daily precipitation serie.

**Usage**

```
ci(..., interval = 1)
```

**Arguments**

interval	the interval in millimeters applied for calculating the concentration index. (Default value: 1)
...	a set of daily precipitation series.

**Value**

A data.frame containing the following variables:

- dataset is the precipitation serie name.
- a is the constant of the exponential curve defined via the least-squares method.
- b is the constant of the exponential curve defined via the least-squares method.
- r2 is the determination of coefficient of determination (R2) of the exponential model.
- A is the area over the exponential curve.
- S is the are compressed for the exponential curve.
- ci is the concentration index.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[pplot.lorenz read.data as.daily](#)

**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Performing the Concentration Index Analysis  
ci(daily, interval = 1)
```

---

`ci.per.year`*Concentration Index per Year*

---

**Description**

Calculates the Concentration Index (CI) per year on a daily precipitation serie.

**Usage**

```
ci.per.year(object, interval = 1)
```

**Arguments**

<code>object</code>	a daily precipitation serie.
<code>interval</code>	the interval in millimeters applied for calculating the concentration index. (Default value: 1)

**Value**

A data.frame (precintcon.ci) containing the following variables:

- year is the year.
- ci is the concentration index.

**Author(s)**

Lucas Venezian Povoia <lucasvenez@gmail.com>

**See Also**

[pplot.lorenz](#) [read.data.as.daily](#)

**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Performing the Concentration Index Analysis  
ci.per.year(daily, interval = 1)
```

---

cv	<i>Coefficient of Variance</i>
----	--------------------------------

---

**Description**

It calculates the coefficient of variance of a monthly precipitation.

**Usage**

```
cv(object)
```

**Arguments**

`object` is a daily or monthly precipitation serie.

**Details**

A daily precipitation serie is transformed to a monthly serie.

**Value**

the coefficient of variance

**Author(s)**

Lucas Venezian Pova <lucasvenez@gmail.com>

**Examples**

```
##  
# Loading the montly precipitation serie.  
data(monthly)  
  
##  
# Calculating the Coefficient of Variance  
cv(monthly)
```

---

daily

*Daily precipitation between 1976 and 2010*

---

**Description**

This data set gives the daily precipitation (in millimeters) between 1976 and 2010, as compiled by the National Water Agency (ANA), Brazil.

**Usage**

`data(daily)`

**Format**

A data frame with 420 observations on the following 33 variables:

`year` the year.

`month` the month.

`d1` the precipitation value in millimeters of the day #1 of the month.

`d2` the precipitation value in millimeters of the day #2 of the month.

`d3` the precipitation value in millimeters of the day #3 of the month.

`d4` the precipitation value in millimeters of the day #4 of the month.

`d5` the precipitation value in millimeters of the day #5 of the month.

`d6` the precipitation value in millimeters of the day #6 of the month.

`d7` the precipitation value in millimeters of the day #7 of the month.

`d8` the precipitation value in millimeters of the day #8 of the month.

`d9` the precipitation value in millimeters of the day #9 of the month.

`d10` the precipitation value in millimeters of the day #10 of the month.

`d11` the precipitation value in millimeters of the day #11 of the month.

`d12` the precipitation value in millimeters of the day #12 of the month.

`d13` the precipitation value in millimeters of the day #13 of the month.

`d14` the precipitation value in millimeters of the day #14 of the month.

`d15` the precipitation value in millimeters of the day #15 of the month.

`d16` the precipitation value in millimeters of the day #16 of the month.

`d17` the precipitation value in millimeters of the day #17 of the month.

`d18` the precipitation value in millimeters of the day #18 of the month.

`d19` the precipitation value in millimeters of the day #19 of the month.

`d20` the precipitation value in millimeters of the day #20 of the month.

`d21` the precipitation value in millimeters of the day #21 of the month.

`d22` the precipitation value in millimeters of the day #22 of the month.

d23 the precipitation value in millimeters of the day #23 of the month.  
d24 the precipitation value in millimeters of the day #24 of the month.  
d25 the precipitation value in millimeters of the day #25 of the month.  
d26 the precipitation value in millimeters of the day #26 of the month.  
d27 the precipitation value in millimeters of the day #27 of the month.  
d28 the precipitation value in millimeters of the day #28 of the month.  
d29 the precipitation value in millimeters of the day #29 of the month.  
d30 the precipitation value in millimeters of the day #30 of the month.  
d31 the precipitation value in millimeters of the day #31 of the month.

**Source**

National Water Agency (ANA) <http://www2.ana.gov.br/Paginas/default.aspx>

**Examples**

```
data(daily)
## maybe pci(daily) ; rai(daily) ...
```

---

ff.index

*F factor*

---

**Description**

It calculates the Approximated Rainfall Erosivity Factor according to the ff index.

**Usage**

```
ff.index(object)
```

**Arguments**

object is a daily or monthly precipitation serie

**Value**

the ff index in millimeters

**Author(s)**

Lucas Venezian Povoá

**References**

Ferro, V., Giordano, G., Iovino, M. (1991). Isoerosivity and Erosion Risk Map for Sicily. Hydrolog. Sci. J. 36, 549-564



**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Calculating ff index  
ff.index(daily)
```

---

limits

*Limits*

---

**Description**

Calculates the upper and lower limit on a set of daily or monthly precipitation series.

**Usage**

```
limits(...)
```

**Arguments**

... a set of daily or monthly precipitation series.

**Value**

A data.frame containing the following variables:

- dataset is the precipitation serie name.
- max is the maximum value in the precipitation serie.
- max.date is the first date of the maximum precipitation serie.
- min is the minimum value in the precipitation serie.
- min.date is the first date of the minimum precipitation serie.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[read.data.as.daily](#)

**Examples**

```
##  
# Loading the monthly precipitation serie.  
data(monthly)  
  
##  
# Performing the Concentration Index Analysis  
limits(monthly)
```

---

monthly	<i>Monthly precipitation between 1950 and 1992.</i>
---------	---

---

**Description**

This dataset gives the monthly precipitation (in millimeters) between 1950 and 1992, as compiled by the National Water Agency (ANA), Brazil.

**Usage**

```
data(monthly)
```

**Format**

A data frame with 516 observations on the following 3 variables:

year the year.

month the month.

precipitation the precipitation amount in millimeters.

**Source**

National Water Agency (ANA) <http://www2.ana.gov.br/Paginas/default.aspx>

**Examples**

```
data(monthly)  
## maybe pci(monthly) ; rai(monthly) ...
```

---

pcd

*Precipitation Concentration Degree*

---

### Description

Calculates the Precipitation Concentration Degree (PCD) on a daily or monthly precipitation serie.

### Usage

```
pcd(object)
```

### Arguments

object            a daily or monthly precipitation serie.

### Value

A data.frame containing the following variables:

- year is the year.
- pcd is the percentage of precipitation concentration corresponding to a year. Values closer to 0 mean precipitation dispersion among all months and 1 concentration into only a month.

### Author(s)

Lucas Venezian Povoá <lucasvenez@gmail.com>

### References

Zhang LJ, Qian YF (2003) Annual distribution features of precipitation in China and their interannual variations. *J Acta Meteorological Sinica* 17:146-163

### See Also

[pplot.pcd read.data as.daily as.monthly](#)

### Examples

```
##  
# Loading the monthly precipitation serie.  
data(monthly)  
  
##  
# Performing the Precipitation Concentration Index analysis  
pcd(monthly)
```

---

pci	<i>Precipitation Concentration Index</i>
-----	--

---

**Description**

It calculates the Precipitation Concentration Index (PCI) on a daily or monthly precipitation serie.

**Usage**

```
pci(object)
```

**Arguments**

object            a daily or monthly precipitation serie.

**Value**

A data.frame containing the following variables:

- year is the year.
- pci is the precipitation concentration index.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[pplot.pci](#) [read.data.as.daily](#) [as.monthly](#)

**Examples**

```
##  
# Loading the monthly precipitation serie.  
data(monthly)  
  
##  
# Performing the Precipitation Concentration Index analysis  
pci(monthly)
```

---

pci.seasonal	<i>Seasonal Precipitation Concentration Index</i>
--------------	---

---

**Description**

It calculates the Precipitation Concentration Index (PCI) in a seasonal granularity on a daily or monthly precipitation serie.

**Usage**

```
pci.seasonal(object, hemisthere)
```

**Arguments**

object	is a daily or monthly precipitation serie
hemisthere	is the hemisthere, "n" for northern and "s" for south, of the precipitation serie

**Value**

A data.frame containing the following variables:

- year is the year;
- season is the meteorological season; and
- pci.seasonal is the seasonal perceptation concentration index.

**Author(s)**

Lucas Venezian Pova <lucasvenez@gmail.com>

**Examples**

```
##  
# Loading the daily precipitation serie  
data(daily)  
  
##  
# Calculating the seasonal perceptation concentration index  
pci.seasonal(daily, hemisthere = "s")
```

---

pci.supraseasonal      *Supraseasonal Precipitation Concentration Index*

---

### Description

It calculates the supraseasonal precipitation concentration index.

### Usage

```
pci.supraseasonal(object, hemisthere = c("n", "s"))
```

### Arguments

object            is a daily or monthly precipitation serie.  
hemisthere        is the hemisthere, "n" for northern and "s" for south, of the precipitation serie.

### Value

A data.frame containing the following variables:

- year is the year;
- season is the meteorological supraseason, wet or dry; and
- pci.season is the seasonal perceptation concentration index.

### Author(s)

Lucas Venezian Pova <lucasvenez@gmail.com>

### References

M. de Luis, J. C. Gonz'alez-Hidalgo, M. Brunetti, L. A. Longares (2011). Precipitation concentration changes in Spain 1946-2005. *Natural Hazards and Earth System Science*, 5:11, pp. 1259–1265

### Examples

```
##  
# Loading the daily precipitation serie  
data(daily)  
  
##  
# Calculating the supraseasonal precipitation concentration index  
pci.supraseasonal(daily, hemisthere = "s")
```

---

pcp

*Precipitation Concentration Period*

---

### Description

Calculates the Precipitation Concentration Period (PCP) on a daily or monthly precipitation serie.

### Usage

```
pcp(object)
```

### Arguments

object            a daily or monthly precipitation serie.

### Value

A data.frame containing the following variables:

- year is the year.
- pcp is the precipitation concentration period, in degree, corresponding to a year. Results correspond to a month like below when using the 'azimuth' default values: 0 = January, 30 = February, 60 = March, ..., 300 = November, and 330 = December.

### Author(s)

Lucas Venezian Pova <lucasvenez@gmail.com>

### References

Zhang L.J., Qian Y.F. (2003) Annual distribution features of precipitation in China and their inter-annual variations. J Acta Meteorological Sinica 17:146-163

### See Also

[pplot.pcp read.data as.daily as.monthly](#)

### Examples

```
##  
# Loading the monthly precipitation serie.  
data(monthly)  
  
##  
# Performing the Precipitation Concentration Degree analysis  
pcd(monthly)
```

---

pn *Percentage of Normal*

---

### Description

Calculates the Percentage of Normal (PN) on a daily or monthly precipitation serie.

### Usage

```
pn(object, interval = 30, scale = "a")
```

### Arguments

object	a daily or monthly precipitation serie.
interval	the number of months applied for calculating the percentage of normal.
scale	the scale used for calculating the percentage of normal, which should be either "w" for weak (not supported yet), "m" for month, "s" for season, or "d" for decades.

### Value

A data.frame (precintcon.pn) containing the following variables:

- year is the year.
- month is the month. It exists only whether scale = "m".
- pn is the percentage of normal.

### Author(s)

Lucas Venezian Povoia <lucasvenez@gmail.com>

### See Also

[pplot.pn read.data as.daily as.monthly](#)

### Examples

```
##  
# Loading the monthly precipitation serie.  
data(monthly)  
  
##  
# Performing the Percentage of Normal analysis  
pn(monthly)
```



---

pplot.deciles	<i>Plot deciles</i>
---------------	---------------------

---

### Description

Plots the deciles of a precipitation serie.

### Usage

```
pplot.deciles(..., ylab = "Precipitation",  
legend.title = "Legend", legend = NULL,  
fontsize = 10, axis.text.color = "black",  
export = FALSE, export.name = "deciles_plot.png",  
width = 8.6, height = 7.5, units = "cm", grouped = FALSE)
```

### Arguments

ylab	the text for the y axis. (Default value: "Precipitation")
legend.title	the text for the legend title. (Default value: "Legend")
legend	the text vector for the legend items. If NULL the legends will be equals to the variable names. (Default value: NULL)
fontsize	the font size value in pt. (Default value: 10)
axis.text.color	the legend colors. (Default value: "black")
export	the logical value for defining whether the graph should be export to a file or not. (Default value: FALSE)
export.name	the text for defining the exported file name. It is only used if export = TRUE. (Default value: "deciles_plot.png")
width	the number for defining the exported graph width. It is only used if export = TRUE. (Default value: 8.6)
height	the number for defining the exported graph height. It is only used if export = TRUE. (Default value: 7.5)
units	the text for defining the units of the height and width parameters. It is only used if export = TRUE. (Default value: "cm")
grouped	the logical value for defining whether the graphs should be plotted in group.
...	a set of daily or monthly precipitation serie.

### Author(s)

Lucas Venezian Povoia <lucasvenez@gmail.com>

### See Also

[deciles read.data](#)

**Examples**

```
## Loading the monthly precipitation serie.
#
data(monthly)

## Performing the a set of statistical analysis
#
pplot.deciles(monthly)
```

---

pplot.histogram      *Plot histogram*

---

**Description**

Plots the histogram of a precipitation serie.

**Usage**

```
pplot.histogram(..., density = FALSE, xlab = "Precipitation (mm)",
  ylab = "Frequency", legend.title = "Legend",
  legend = NULL, fontsize = 10, axis.text.color = "black",
  export = FALSE, export.name = "histogram_plot.png",
  width = 10, height = 10, units = "cm")
```

**Arguments**

density	the logical value for defining whether the graph should be plotted with bars or lines. (Default value: FALSE)
xlab	the text for the x axis. (Default value: "Precipitation (mm)")
ylab	the text for the y axis. (Default value: "Frequency")
legend.title	the text for the legend title. (Default value: "Legend")
legend	the text vector for the legend items. If NULL the legends will be equals to the variable names. (Default value: NULL)
fontsize	the font size value in pt. (Default value: 10)
axis.text.color	the legend colors. (Default value: "black")
export	the logical value for defining whether the graph should be export to a file or not. (Default value: FALSE)
export.name	the text for defining the exported file name. It is only used if export = TRUE. (Default value: "histogram_plot.png")
width	the number for defining the exported graph width. It is only used if export = TRUE. (Default value: 10)
height	the number for defining the exported graph height. It is only used if export = TRUE. (Default value: 10)
units	the text for defining the units of the height and width parameters. It is only used if export = TRUE. (Default value: "cm")
...	a set of daily or monthly precipitation series.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[read.data](#)

**Examples**

```
##
# Loading the daily precipitation serie.
data(daily)

##
# Performing the a set of statistical analysis
pplot.histogram(daily)
```

---

pplot.lorenz

*Plot Lorenz's curve*

---

**Description**

Plots the Lorenz's curve of a precipitation serie.

**Usage**

```
pplot.lorenz(..., interval = 1, grouped = FALSE,
xlab = expression(sum(n[i]), i==1), ylab = expression(sum(P[i]), i==1),
legend.title = "Legend", legend = NULL, fontsize = 10,
axis.text.color = "black", export = FALSE, export.name = "lorenz_plot.png",
width = 8.6, height = 7.5, units = "cm")
```

**Arguments**

interval	the interval in millimeters applied for calculating the Lorenz's curve. (Default value: 1)
grouped	the logical value for defining whether all series should be plotted in the same graph or not. (Default value: FALSE)
xlab	the text for the x axis. (Default value: <code>expression(sum(n[i]), i==1)</code> )
ylab	the text for the y axis. (Default value: <code>expression(sum(P[i]), i==1)</code> )
legend.title	the text for the legend title. (Default value: "Legend")
legend	the text vector for the legend items. If NULL the legends will be equals to the variable names. (Default value: NULL)
fontsize	the font size value in pt. (Default value: 10)
axis.text.color	the legend colors. (Default value: "black")

export	the logical value for defining whether the graph should be export to a file or not. (Default value: FALSE)
export.name	the text for defining the exported file name. It is only used if export = TRUE. (Default value: "histogram_plot.png")
width	the number for defining the exported graph width. It is only used if export = TRUE. (Default value: 10)
height	the number for defining the exported graph height. It is only used if export = TRUE. (Default value: 10)
units	the text for defining the units of the height and width parameters. It is only used if export = TRUE. (Default value: "cm")
...	a set of daily precipitation series.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[ci read.data as.daily](#)

**Examples**

```
##
# Loading the daily precipitation serie.
data(daily)

##
# Performing the a set of statistical analysis
pplot.ci(daily, interval = 1)
```

---

pplot.pcd

*Plot Precipitation Concentration Degree*

---

**Description**

Plots the Precipitation Concentration Degree per year of a precipitation serie.

**Usage**

```
pplot.pcd(..., xlab = "Year", ylab = "PCD",
           ylim = c(0,360), legend = NULL, fontsize = 10, axis.text.color = "black",
           export = FALSE, export.name = "pcd_plot.png", width = 8.6,
           height = 7.5, units = "cm")
```

**Arguments**

xlab	the text for the x axis. (Default value: "Year")
ylab	the text for the y axis. (Default value: "PCD")
ylim	the limits of the y axis. (Default value: c(0, 360))
legend	the text vector for the legend items. If NULL the legends will be equals to the variable names. (Default value: NULL)
fontsize	the font size value in pt. (Default value: 10)
axis.text.color	the legend colors. (Default value: "black")
export	the logical value for defining whether the graph should be export to a file or not. (Default value: FALSE)
export.name	the text for defining the exported file name. It is only used if export = TRUE. (Default value: "pcd_plot.png")
width	the number for defining the exported graph width. It is only used if export = TRUE. (Default value: 8.6)
height	the number for defining the exported graph height. It is only used if export = TRUE. (Default value: 7.5)
units	the text for defining the units of the height and width parameters. It is only used if export = TRUE. (Default value: "cm")
...	a set of daily or monthly precipitation series.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**References**

Zhang LJ, Qian YF (2003) Annual distribution features of precipitation in China and their interannual variations. *J Acta Meteorological Sinica* 17:146-163

**See Also**

[pcd read.data](#)

**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Plotting PCD index per year  
pplot.pcd(daily)
```

---

`pplot.pci`*Plot Precipitation Concentration Index*

---

**Description**

Plots the Precipitation Concentration Index of a precipitation serie.

**Usage**

```
pplot.pci(..., xlab = "Years", ylab = "PCI", legend = NULL,  
fontsize = 10, axis.text.color = "black", export = FALSE,  
export.name = "pci_plot.png", width = 10, height = 10, units = "cm")
```

**Arguments**

<code>xlab</code>	the text for the x axis. (Default value: "Years")
<code>ylab</code>	the text for the y axis. (Default value: "PCI")
<code>legend</code>	the text vector for the legend items. If NULL the legends will be equals to the variable names. (Default value: NULL)
<code>fontsize</code>	the font size value in pt. (Default value: 10)
<code>axis.text.color</code>	the legend colors. (Default value: "black")
<code>export</code>	the logical value for defining whether the graph should be export to a file or not. (Default value: FALSE)
<code>export.name</code>	the text for defining the exported file name. It is only used if <code>export = TRUE</code> . (Default value: "pci_plot.png")
<code>width</code>	the number for defining the exported graph width. It is only used if <code>export = TRUE</code> . (Default value: 10)
<code>height</code>	the number for defining the exported graph height. It is only used if <code>export = TRUE</code> . (Default value: 10)
<code>units</code>	the text for defining the units of the height and width parameters. It is only used if <code>export = TRUE</code> . (Default value: "cm")
<code>...</code>	a set of daily precipitation series.

**Author(s)**

Lucas Venezian Povoia <lucasvenez@gmail.com>

**See Also**

[read.data](#)

**Examples**

```
##
# Loading the daily precipitation serie.
data(daily)

##
# Performing the a set of statistical analysis
pplot.pci(daily)
```

pplot.pcp

*Plot Precipitation Concentration Period per Year***Description**

Plots the Precipitation Concentration Period per year of a precipitation serie.

**Usage**

```
pplot.pcp(..., xlab = "Year",
           ylab = "PCP", ylim = c(0,360), legend = NULL, fontsize = 10,
           axis.text.color = "black", export = FALSE, export.name = "pcd_plot.png",
           width = 8.6, height = 7.5, units = "cm")
```

**Arguments**

xlab	the text for the x axis. (Default value: "Year")
ylab	the text for the y axis. (Default value: "PCD")
ylim	the limits of the y axis. (Default value: c(0, 360))
legend	the text vector for the legend items. If NULL the legends will be equals to the variable names. (Default value: NULL)
fontsize	the font size value in pt. (Default value: 10)
axis.text.color	the legend colors. (Default value: "black")
export	the logical value for defining whether the graph should be export to a file or not. (Default value: FALSE)
export.name	the text for defining the exported file name. It is only used if export = TRUE. (Default value: "pcd_plot.png")
width	the number for defining the exported graph width. It is only used if export = TRUE. (Default value: 8.6)
height	the number for defining the exported graph height. It is only used if export = TRUE. (Default value: 7.5)
units	the text for defining the units of the height and width parameters. It is only used if export = TRUE. (Default value: "cm")
...	a set of daily or monthly precipitation series.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**References**

Zhang LJ, Qian YF (2003) Annual distribution features of precipitation in China and their interannual variations. *J Acta Meteorological Sinica* 17:146-163

**See Also**

[pcp read.data](#)

**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Plotting PCP per year  
pplot.pcp(daily)
```

---

pplot.pn

*Plot Percent of Normal*

---

**Description**

Plots the Percent of Normal of a precipitation serie.

**Usage**

```
pplot.pn(..., interval = 30, scale = "a", xlab = NA, ylab = "PN",  
          fontsize = 10, axis.text.color = "black", legend = NULL,  
          export = FALSE, export.name = "pn_plot.png", width = 10,  
          height = 10, units = "cm")
```

**Arguments**

interval	the number of months applied for calculating the percentage of normal.
scale	the scale used for calculating the percentage of normal, which should be either "w" for weak (not supported yet), "m" for month, "s" for season, or "d" for decades.
xlab	the text for the x axis. (Default value: NA)
ylab	the text for the y axis. (Default value: "PN")
fontsize	the font size value in pt. (Default value: 10)
axis.text.color	the legend colors. (Default value: "black")



legend	the text vector for the legend items. If NULL the legends will be equals to the variable names. (Default value: NULL)
export	the logical value for defining whether the graph should be export to a file or not. (Default value: FALSE)
export.name	the text for defining the exported file name. It is only used if export = TRUE. (Default value: "pci_plot.png")
width	the number for defining the exported graph width. It is only used if export = TRUE. (Default value: 10)
height	the number for defining the exported graph height. It is only used if export = TRUE. (Default value: 10)
units	the text for defining the units of the height and width parameters. It is only used if export = TRUE. (Default value: "cm")
...	a set of daily or monthly precipitation serie.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[read.data](#)

**Examples**

```
##
# Loading the daily precipitation serie.
data(daily)

##
# Performing the a set of statistical analysis
pplot.pn(daily)
```

---

pplot.ra

*Plot Rainfall Anomaly Index*

---

**Description**

Plots the Rainfall Anomaly Index of a precipitation serie.

**Usage**

```
pplot.ra(..., granularity = "m", xlab = "Month", ylab = "RAI",
  ylim = c(-3,3), legend = NULL, fontsize = 10,
  axis.text.color = "black", export = FALSE,
  export.name = "rai_plot.png", width = 8.6,
  height = 7.5, units = "cm")
```

**Arguments**

granularity	the granularity applied for calculating the rainfall anomaly index, which should be either "a" for annual granularity or "m" for monthly granularity ". (Default value: "m")
xlab	the text for the x axis. (Default value: "Month")
ylab	the text for the y axis. (Default value: "RAI")
ylim	the limits of the y axis. (Default value: c(-3, 3))
legend	the text vector for the legend items. If NULL the legends will be equals to the variable names. (Default value: NULL)
fontsize	the font size value in pt. (Default value: 10)
axis.text.color	the legend colors. (Default value: "black")
export	the logical value for defining whether the graph should be export to a file or not. (Default value: FALSE)
export.name	the text for defining the exported file name. It is only used if export = TRUE. (Default value: "rai_plot.png")
width	the number for defining the exported graph width. It is only used if export = TRUE. (Default value: 8.6)
height	the number for defining the exported graph height. It is only used if export = TRUE. (Default value: 7.5)
units	the text for defining the units of the height and width parameters. It is only used if export = TRUE. (Default value: "cm")
...	a set of daily or monthly precipitation series.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**References**

Rooy, M. P. van. A Rainfall anomaly index independent of time and space, Notos. v.14, p.43-48, 1965.

**See Also**

[read.data](#)

**Examples**

```
##
# Loading the daily precipitation serie.
data(daily)

##
# Performing the a set of statistical analysis
pplot.rai(daily, granularity = "m")
```

pplot.spi

*Plot Standardized Precipitation Index***Description**

Plots the Standardized Precipitation Index of a precipitation serie.

**Usage**

```
pplot.spi(..., period = 3, distribution = "Gamma", xlab = "Months",
ylab = "SPI", ylim = c(-3,3), legend = NULL, fontsize = 10,
axis.text.color = "black", export = FALSE, export.name = "spi_plot.png",
width = 8.6, height = 7.5, units = "cm")
```

**Arguments**

period	the number of months to be aggregated for calculating the standardized precipitation index. (Default value: 3)
distribution	it has no effect yet. (Default value: "Gamma")
xlab	the text for the x axis. (Default value: "Months")
ylab	the text for the y axis. (Default value: "SPI")
ylim	the limits of the y axis. (Default value: c(-3, 3))
legend	the text vector for the legend items. If NULL the legends will be equals to the variable names. (Default value: NULL)
fontsize	the font size value in pt. (Default value: 10)
axis.text.color	the legend colors. (Default value: "black")
export	the logical value for defining whether the graph should be export to a file or not. (Default value: FALSE)
export.name	the text for defining the exported file name. It is only used if export = TRUE. (Default value: "spi_plot.png")
width	the number for defining the exported graph width. It is only used if export = TRUE. (Default value: 8.6)
height	the number for defining the exported graph height. It is only used if export = TRUE. (Default value: 7.5)
units	the text for defining the units of the height and width parameters. It is only used if export = TRUE. (Default value: "cm")
...	a set of daily or monthly precipitation series.

**Author(s)**

Lucas Venezian Povoia <lucasvenez@gmail.com>

**See Also**

[read.data](#)

**Examples**

```
##  
# Loading the daily precipitation serie.  
data(daily)  
  
##  
# Performing the a set of statistical analysis  
pplot.spi(daily)
```

---

precintcon

*Precipitation Intensity, Concentration and Anomaly Analysis*

---

**Description**

It contains functions to analyze the precipitation intensity, concentration and anomaly.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

Jonas Teixeira Nery <jonas@ourinhos.unesp.br>

**References**

Michael J. Hayes (2015). *Comparison of Major Drought Indices*. National Drought Mitigation Center. <http://goo.gl/skHfs9>.

Gibbs, W. J. (1967). *Rainfall deciles as drought indicators*. Bureau of Meteorology Bulletin, n. 48. Commonwealth of Australia.

Luis, M. D., Gonzolez-Hidalgo, J. C., Brunetti, M., Longares, L. A. (2011). *Precipitation concentration changes in Spain 1946-2005*. Natural Hazards and Earth System Science, v. 11, n. 5, p. 1259–1265.

Martin-Vide, J. (2004). *Spatial distribution of a daily precipitation concentration index in peninsular Spain*. International Journal of Climatology, v. 24, n. 8, p. 959–971.

Guttman, N. B. (1999). *Accepting the standardized precipitation index: a calculation algorithm*. Journal of the American Water Resources Association, v. 35, n. 2, p. 311–322. Blackwell Publishing Ltd.

Barring, L., Hulme, M. (1991). *Filters and approximate confidence intervals for interpreting rainfall anomaly indices*. Journal of climate, v. 4, n. 8, p. 837–847.

---

rai	<i>Rainfall Anomaly Index</i>
-----	-------------------------------

---

**Description**

Calculates the Rainfall Anomaly Index (RAI) on a daily or monthly precipitation serie.

**Usage**

```
rai(object, granularity = "m")
```

**Arguments**

object	a daily or monthly precipitation serie.
granularity	the granularity applied for calculating the rainfall anomaly index, which should be either "m" for monthly granularity or "a" for annual granularity. (Default value: "m")

**Value**

A data.frame (precintcon.ra) containing the following variables:

- year is the year.
- month is the month. This attribute exists only when granularity = "m".
- rai is the rainfall anomaly index.

**Author(s)**

Lucas Venezian Povoia <lucasvenez@gmail.com>

**References**

Van Rooy, M. P. "A rainfall anomaly index independent of time and space." Notos 14.43 (1965): 6.

**See Also**

[pplot.ra](#) [read.data](#)

**Examples**

```
##  
# Loading the monthly precipitation serie.  
data(monthly)  
  
##  
# Performing the Rainfall Anomaly Index analysis  
rai(monthly, granularity = "m")
```

---

read.data	<i>Load a precipitation series</i>
-----------	------------------------------------

---

### Description

Load a file with a daily or monthly precipitation series.

### Usage

```
read.data(file, sep = ";", dec = ".", header = TRUE, na.value = NA)
```

### Arguments

file	a string containing the file path.
sep	the character applied for delimited columns. (Default value: ";")
dec	the character applied for defined decimal point. (Default value: ".")
header	a logical value defining whether the first line of the file refers to column names. (Default value: TRUE)
na.value	the value used for representing missing values. (Default value: NA)

### Value

A data frame containing a representation of the data in the file. The file is addressed as `precintcon.daily` or `precintcon.monthly` depending of its structure.

The file should contains three columns when loading monthly series and thirty three columns when loading daily series.

The first columns refers to years and the second one refers to months. When dealing with daily datasets, the thirty one remaining columns refers to the amount of precipitation in the days of the months. Otherwise, the remaining column refers to the amount of precipitation in each month.

### Author(s)

Lucas Venezian Pova <lucasvenez@gmail.com>

### See Also

[daily](#) [monthly](#) [read.table](#) [read.csv](#) [read.csv2](#)

### Examples

```
##
# Loading a serie on Windows
## Not run: d1 <- read.data("C:\PRECINTCON\203040.csv", sep = ";", dec = ".", header = TRUE)

##
# Loading a serie on Unix-like
## Not run: d1 <- read.data("/home/precintcon/203040.csv", sep = ";", dec = ".", header = TRUE)
```

---

spi	<i>Standardized Precipitation Index</i>
-----	---

---

**Description**

Calculates the Standardized Precipitation Index (SPI) on a daily or monthly precipitation serie.

**Usage**

```
spi(object, period = 3, distribution = "Gamma")
```

**Arguments**

object	a daily or monthly precipitation serie.
period	the number of months to be aggregated in the calculation of the standardized precipitation index. (Default value: 3)
distribution	it has no effect yet. (Default value: "Gamma")

**Value**

A data.frame (precintcon.spi) containing the following variables:

- year is the year.
- month is the month.
- spi is the standardized precipitation index.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**See Also**

[precintcon.plot.spi read.data](#)

**Examples**

```
##  
# Loading the monthly precipitation serie.  
data(monthly)  
  
##  
# Performing the Standardized Precipitation Index  
spi(monthly, period = 3)
```

---

spi.per.year	<i>Standardized Precipitation Index</i>
--------------	---

---

**Description**

Calculates the Standardized Precipitation Index (SPI) per year on a daily or monthly precipitation serie.

**Usage**

```
spi.per.year(object, period = 3, distribution = "Gamma", FUN = mean)
```

**Arguments**

object	a daily or monthly precipitation serie.
period	the number of months to be aggregate in the calculation of the standardized precipitation index. (Default value: 3)
distribution	(it has no effect yet).
FUN	the function used to summarize the standardized precipitation index per year. (Default function: mean).

**Value**

A data.frame (precintcon.spi.per.year) containing the following variables:

- year is the year.
- spi is the standardized precipitation index.

**Author(s)**

Lucas Venezian Pova <lucasvenez@gmail.com>

**See Also**

[spi read.data](#)

**Examples**

```
##  
# Loading the monthly precipitation serie.  
data(monthly)  
  
##  
# Performing the Standardized Precipitation Index  
spi.per.year(monthly, period = 3)
```



---

`stat`*Basic statistics for precipitation datasets.*

---

**Description**

Perform the calculation of basic statistics of precipitation datasets.

**Usage**

```
stat(...)
```

**Arguments**

... a set of daily or monthly precipitation serie.

**Value**

A data.frame (precintcon.stat) containing the following variables:

- `dataset` is the precipitation serie name.
- `mean.daily` is the daily average precipitation. It exists only for daily datasets.
- `sd.daily` is the standard deviation of a daily precipitation serie. It exists only for daily datasets.
- `var.daily` is the variance of a daily precipitation serie. It exists only for daily datasets.
- `mean.monthly` is the monthly average precipitation.
- `sd.monthly` is the standard deviation of a monthly precipitation serie.
- `var.monthly` is the variance of a monthly precipitation serie.
- `total` is the total precipitation.

**Author(s)**

Lucas Venezian Povoá <lucasvenez@gmail.com>

**Examples**

```
##  
# Loading the monthly precipitation serie.  
data(monthly)  
  
##  
# Plotting the deciles.  
stat(monthly)
```

---

tii	<i>Temporaly Irregularity Index</i>
-----	-------------------------------------

---

**Description**

It calculates the temporaly irregularity index according to the function  $\sum(\log(P_{i+1}/P_i))/(n-1)$ , where  $P_i$  is the precipitation amount of year  $i$ , and  $n$  is the number of years.

**Usage**

```
tii(object)
```

**Arguments**

object            is a daily or monthly precipitation serie

**Details**

Daily or monthly precipitation series are transformed to annual series.

**Value**

the temporaly irregularity index according to the function  $\sum(\log(P_{i+1}/P_i))/(n-1)$

**Author(s)**

Lucas Venezian Povoá

**Examples**

```
##  
# Loading the monthly precipitation serie  
data(monthly)  
  
##  
# Calculationg the Temporaly Irregularity Index  
tii(monthly)
```

---

trend.test	<i>Mann-Kendall Trend Test</i>
------------	--------------------------------

---

**Description**

It calculates a trend test using the rank-based nonparametric Mann-Kendall method.

**Usage**

```
trend.test(object, significance.level = 0.05)
```

**Arguments**

`object` is a daily or monthly precipitation serie.  
`significance.level` is the significance level to be considered in the analysis. It is usually equals to 5% (default: 0.05).

**Value**

A trend test index.

**Author(s)**

Lucas Venezian Povoia <lucasvenez@gmail.com>

**References**

H. B. Mann (1945). Nonparametric tests against trend. *Econometrica*, vol. 13, pp. 245-259. M. G. Kendall (1975). *Rank Correlation Methods*. Griffin, London, UK.

**See Also**

[ci.ci.per.yearpci.read.data](#)

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