

Package ‘iid.test’

January 2, 2012

Version 1.13

Date March 1 2011

Title iid-test

Author Rasmus E. Benestad <rasmus.benestad@met.no>

Maintainer Rasmus E. Benestad <rasmus.benestad@met.no>

Depends clim.pact, R (>= 2.10.1)

Description Testing whether data is independent and identically distributed

License GPL (>= 2)

URL <http://www.r-project.org> <http://cran.r-project.org>

ZipData no

Repository CRAN

Date/Publication 2011-03-01 11:42:58

R topics documented:

daily.station.records	2
iid.test	3
n.records	4
obs	5
test.iid.test	6

Index	8
--------------	----------

daily.station.records *daily.station.records*

Description

Test for whether daily station data are independent and identically distributed (iid).

Reference:

Benestad, R.E., 2003: How often can we expect a record-event? *Climate Research*. 23, 3-13 (pdf)

Benestad, R.E., 2004: Record values, nonstationarity tests and extreme value distributions, *Global and Planetary Change*, vol 44, p. 11-26

The papers are available in the pdf format from http://regclim.met.no/results_iii_artref.html.

Note: Gaps of missing values will bias the results towards low number of record-events. Likewise, large number of dry days (zero precipitation) will also bias the series since if it only rains 1 out of 100 days, then no new record can be set for days without rain. One solution is to apply the test to the maximum monthly/seasonal rainfall or to exclude the record with many dry days.

Usage

```
daily.station.records(obs, element="precip", subsample=5, tolerance=2, remove.zeroes=FALSE, reverse.plot
```

Arguments

obs	A daily.station.record (The clim.pact-package).
element	Decides which element is analysed ("t2m" or "precip").
subsample	Subsampling to reduce the effects of dependencies.
tolerance	How many days with missing value is tolerable before the results are significantly biased.
remove.zeroes	Remove records with many dry days (rare and occasional precipitation events tend to lead to undercount).
reverse.plot.reverse	see iid.test

Value

list: 'record.density' and 'record.density.rev' for the reverse analysis.

Author(s)

R.E. Benestad

Examples

```
data(obs)
daily.station.records(obs, subsample=30)
```

`iid.test`*iid test*

Description

Test for whether a variable is independent and identically distributed (iid). Used in [daily.station.records](#).

Reference:

Benestad, R.E., 2003: How often can we expect a record-event? *Climate Research*. 23, 3-13 (pdf)

Benestad, R.E., 2004: Record values, nonstationarity tests and extreme value distributions, *Global and Planetary Change*, vol 44, p. 11-26

The papers are available in the pdf format from http://regclim.met.no/results_iii_artref.html.

Note, gaps of missing data (NA) can bias the results and produce an under-count. The sign of non-iid behaviour is when the 'forward' analysis indicated higher number of record-events than the confidence region and the backward analysis gives lower than the confidence region.

Version 0.7: Added a test checking for dependencies based on an expected number from a binomial distribution and given the probability $p1(n) = 1/n$. This test is applied to the parallel series for one respective time (realisation), and is then repeated for all observation times. The check uses [qbinom](#) to compute a theoretical 95% confidence interval, and a number outside this range is marked with red in the 'ball diagram' (first plot). [pbinom](#) is used to estimate the p-value for the

Usage

```
iid.test(Y,plot=TRUE,Monre.Carlo=TRUE,N.test=200,reverse.plot.reverse=TRUE)
```

Arguments

<code>Y</code>	A data matrix or a vector.
<code>plot</code>	Flag: plot the diagnostics.
<code>Monre.Carlo</code>	Flag: for estimating confidence limits.
<code>N.test</code>	Number of Monre-Carlo runs.
<code>reverse.plot.reverse</code>	TRUE: plots reverse from right to left, else left to right..

Value

list: 'record.density' and 'record.density.rev' for the reverse analysis. The variables CI.95, p.val, and i.cluster (and their reverse equivalents '.rev') return the estimated 95% conf. int, p-value, and the location of the clusters (binomial).

Author(s)

R.E. Benestad

Examples

```
dat <- rnorm(100*30)
dim(dat) <- c(100,30)
iid.test(dat)
```

n.records

n.records

Description

Number of record-events.

Reference:

Benestad, R.E., 2003: How often can we expect a record-event? Climate Research. 23, 3-13 (pdf)

Benestad, R.E., 2004: Record values, nonstationarity tests and extreme value distributions, Global and Planetary Change, vol 44, p. 11-26

The papers are available in the pdf format from http://regclim.met.no/results_iii_artref.html.

Usage

```
n.records(y)
```

Arguments

y A vector.

Value

list: N= number of records, t=vector of time index corresponding to when a new record is set, events= a vector with TRUE where there is a record-event. The same fields with a suffix '.rev' represent the same analysis but for a reversed chronological order.

Author(s)

R.E. Benestad

Examples

```
y <- rnorm(100)
n.records(y)
```

obs *Data sets.*

Description

obs contains daily temperature and precipitation from Oslo. Stored as a 'daily.station.record' (clim.pact).

The other data sets are used for producing the plots in Benestad (2004) Record-values, non-stationarity tests and extreme value distributions Global and Planetary Change vol 44, issue 1-4, p.11-26 and Benestad, R.E. (2008) 'A Simple Test for Changes in Statistical Distributions', Eos, 89 (41), 7 October 2008, p. 389-390: demo(GPC2004a), demo(GPC2004b), \& demo(Eos2008): giss contains meta-data of monthly mean temperatures from NASA/GISS (<http://data.giss.nasa.gov/gistemp/>) aberdeen.t2m... turuhansk.t2m.

cet contains the central england temperature.

GPC2004 is a list containing results from Monte-Carlo simulations carried out by demo(GPC2004a) is do.monte.carlo is set to TRUE. These data are used in demo(GPC2004b) for plotting. The data are from 7 different Monte-Carlo simulations (MC1...MC7), where MC1-3 are for random gamma-distributed data (rgamma) with scale of 1, 10, and 0.1 respectively. MC4-6 are for GEV-distributed data (rgev) with shape of 1, 10, and -1 respectively, while MC7 is for random binomially distributed data (rbinom). The GPC2004 contains:

[,1]	b.fit	numeric	coefficients from LS-fit of exp(actual number of records) against the length of series.
[,2-8]	b.fitX	numeric	coefficients from LS-fit of exp(number of records from MC1-7, where X signifies 1-7) against the length of series.
[,9-10]	b.l.fit/b.u.fit	numeric	coefficients from LS-fit of exp(5/95-percentile of MC-simulated number of records) against the length of series.
[,11-17]	E.mc.X	numeric	MC-simulated number of record densities for the MC-simulations 1-7.
[,18]	NS	numeric	Number of parallel series

CR2003 is a list of monthly maximum temperatures from the NORDKLIM data set - see [getnordklim](http://www.getnordklim.com/) - used to do the analysis in Benestad, R.E. (2003) How often can we expect a record-event? Climate Research Vol 23, 3-13 <http://www.int-res.com/abstracts/cr/v25/n1/p3-13.html>.

JC2006 contains the data used in Benestad, R.E (2006) Can we expect more extreme precipitation on the monthly time scale? J.Clim Vol. 19, No. 4, pages 630-637 <http://ams.allenpress.com/perlserv/?request=get-abstract&doi=10%2E1175%2FJCLI3656%2E1>

Usage

```
obs
giss
aberdeen.t2m
bismarck.t2m
buenos.aires.t2m
concord.t2m
funchal.t2m
honolulu.t2m
```

ishigakijima.t2m
lisboa.t2m
moskva.t2m
nassau.t2m
portland.t2m
saentis.t2m
saopaulo.t2m
seychelles.t2m
thessaloniki.t2m
thiruvanantha.t2m
turuhansk.t2m
cet
GPC2004
CR2003
JC2006

Format

The data is a 'daily.station.record' object (see [station.obj](#)).

Source

<http://data.giss.nasa.gov/gistemp/> <http://hadobs.metoffice.com/hadcet/>

References

Benestad (2004) Record-values, non-stationarity tests and extreme value distributions Global and Planetary Change vol 44, issue 1-4, p.11-26

Benestad,R.E. (2008) 'A Simple Test for Changes in Statistical Distributions', Eos, 89 (41), 7 October 2008, p. 389-390

Examples

```
data(obs)
```

test.iid.test	<i>test.iid.test</i>
---------------	----------------------

Description

Testing routine for the iid-test..

Reference:

Benestad, R.E., 2003: How often can we expect a record-event? Climate Research. 23, 3-13 (pdf)

Benestad, R.E., 2004: Record values, nonstationarity tests and extreme value distributions, Global and Planetary Change, vol 44, p. 11-26

The papers are available in the pdf format from http://regclim.met.no/results_iii_artref.html.

Usage

```
test.iid.test(distr="rnorm",d=c(70, 50),plot=TRUE,Monte.Carlo=TRUE)
```

Arguments

distr	What type of random numbers to be used, .eg normally distributed..
d	Dimension of the test matrix.
plot	For plotting the diagnostics.
Monte.Carlo	Flag for running Monte-Carlo simulations to estimate 95% C.I.

Value

list: 'record.density' and 'record.density.rev' for the reverse analysis.

Author(s)

R.E. Benestad

Examples

```
test.iid.test()
```

Index

*Topic **datasets**

obs, [5](#)

*Topic **manip**

daily.station.records, [2](#)

iid.test, [3](#)

n.records, [4](#)

test.iid.test, [6](#)

aberdeen.t2m(obs), [5](#)

bismarck.t2m(obs), [5](#)

buenos.aires.t2m(obs), [5](#)

cet(obs), [5](#)

concord.t2m(obs), [5](#)

CR2003(obs), [5](#)

daily.station.records, [2](#), [3](#)

funchal.t2m(obs), [5](#)

getnordklim, [5](#)

giss(obs), [5](#)

GPC2004(obs), [5](#)

honolulu.t2m(obs), [5](#)

iid.test, [3](#)

ishigakijima.t2m(obs), [5](#)

JC2006(obs), [5](#)

lisboa.t2m(obs), [5](#)

moskva.t2m(obs), [5](#)

n.records, [4](#)

nassau.t2m(obs), [5](#)

obs, [5](#)

pbinom, [3](#)

portland.t2m(obs), [5](#)

qbinom, [3](#)

saentis.t2m(obs), [5](#)

sao.paulo.t2m(obs), [5](#)

seychelles.t2m(obs), [5](#)

station.obj, [6](#)

test.iid.test, [6](#)

thessaloniki.t2m(obs), [5](#)

thiruvanantha.t2m(obs), [5](#)

turuhansk.t2m(obs), [5](#)