Indices

The Climdex project offers a list of 27 climate extremes indices. These indices are annual or monthly statistics of modelled or observed climate data. Here you can find descriptions and formulae for each of the indices.

Quick links to indices

Heat and cold

FD SU ID TR GSL TXx TNx TXn TNn TN10p TX10p TN90p TX90p
WSDI CSDI DTR ETR

Precipitation

Rx1day Rx5day SDII R10mm R20mm Rnnmm CDD CWD R95p R99p R95pTOT
R99pTOT PRCPTOT

FD

Number of frost days

Annual count of days when *TN* (daily minimum temperature) < 0°C. Let TN_{ij} be daily minimum temperature on day *i* in year *j*. Count the number of days where TN_{ij} < 0 °C.

Get data

SU

Number of summer days

Annual count of days when *TX* (daily maximum temperature) > 25°C. Let TX_{ij} be daily minimum temperature on day *i* in year *j*. Count the number of days where TX_{ij} > 25 °C.

Get data

ID

Number of icing days

Annual count of days when TX (daily maximum temperature) < 0 °C. Let TX_{ij}be daily maximum temperature on day *i* in year *j*. Count the number of days where TX_{ij} < 0 °C.

Get data

TR

Number of tropical nights

Annual count of days when TN (daily minimum temperature) > 20 °C. Let TN_{ij} be daily minimum temperature on day *i* in year *j*. Count the number of days where TN_{ij} > 20 °C.

Get data

GSL

Growing season length

Annual* count between the first span of at least 6 days with daily mean temperature TG >5 °C and the first span after July 1st (Jan 1st in SH) of 6 days with TG <5 °C.

Let TG_{ij} be daily mean temperature on day *i* in year *j*. Count the number of days between the first occurrence of at least 6 consecutive days with TG_{ij} > 5 °C and the first occurrence after 1st July (Jan 1st in SH) of at least 6 consecutive days with TG_{ij} < 5 °C.

* Annual means Jan 1st to Dec 31st in the Northern Hemisphere (NH); July 1st to June 30th in the Southern Hemisphere (SH).

Get data

TXx

Maximum value of daily maximum temperature

Let TX_x be the daily maximum temperatures in month *k*, period *j*. The maximum daily maximum temperature each month is then $TX_{x_{kj}}$ = max($TX_{x_{kj}}$).

Get data

TNx

Maximum value of daily minimum temperature

Let TN_x be the daily minimum temperatures in month *k*, period *j*. The maximum daily minimum temperature each month is then $TN_{x_{kj}}$ = max($TN_{x_{kj}}$).

Get data

TXn

Minimum value of daily maximum temperature

Let TX_n be the daily maximum temperatures in month *k*, period *j*. The minimum daily maximum temperature each month is then $TX_{n_{kj}}$ = min($TX_{n_{kj}}$)

Get data

TNn

Minimum value of daily minimum temperature

Let TN_n be the daily minimum temperatures in month k, period j. The minimum daily minimum temperature each month is then $TN_{n_{kj}}=\min(TN_{n_{kj}})$

Get data

TN10p

Percentage of days when TN < 10th percentile

Let TN_{ij} be the daily minimum temperature on day i in period j and let $TN_{in}10$ be the calendar day 10^{th} percentile centred on a 5-day window for the base period 1961-1990. The percentage of time for the base period is determined where: $TN_{ij} < TN_{in}10$. To avoid possible inhomogeneity across the in-base and out-base periods, the calculation for the base period (1961-1990) requires the use of a bootstrap procedure. Details are described in **Zhang *et al.* (2005)**.

Get data

TX10p

Percentage of days when TX < 10th percentile

Let TX_{ij} be the daily maximum temperature on day i in period j and let $TX_{in}10$ be the calendar day 10^{th} percentile centred on a 5-day window for the base period 1961-1990. The percentage of time for the base period is determined where $TX_{ij} < TX_{in}10$. To avoid possible inhomogeneity across the in-base and out-base periods, the calculation for the base period (1961-1990) requires the use of a bootstrap processure. Details are described in **Zhang *et al.* (2005)**.

Get data

TN90p

Percentage of days when TN > 90th percentile

Let TN_{ij} be the daily minimum temperature on day i in period j and let $TN_{in}90$ be the calendar day 90^{th} percentile centred on a 5-day window for the base period 1961-1990. The percentage of time for the base period is determined where $TN_{ij} > TN_{in}90$. To avoid possible inhomogeneity across the in-base and out-base periods, the calculation for the base period (1961-1990) requires the use of a bootstrap processure. Details are described in **Zhang *et al.* (2005)**

Get data

TX90p

Percentage of days when TX > 90th percentile

Let TX_{ij} be the daily maximum temperature on day i in period j and let $TX_{in}90$ be the calendar day 90^{th} percentile centred on a 5-day window for the base period 1961-1990. The percentage of time for the base period is determined where $TX_{ij} > TX_{in}90$. To avoid possible inhomogeneity across the in-base and out-base periods, the calculation for the base period (1961-1990) requires the use of a bootstrap processure. Details are described in **Zhang *et al.* (2005)**.

Get data

WSDI

Warm spell duration index: annual count of days with at least 6 consecutive days when TX > 90th percentile

Let TX_{ij} be the daily maximum temperature on day *i* in period *j* and let $TX_{in}90$ be the calendar day 90^{th} percentile centred on a 5-day window for the base period 1961-1990. Then the number of days per period is summed where, in intervals of at least 6 consecutive days, $TX_{ij} > TX_{in}90$.

Get data

CSDI

Cold spell duration index: annual count of days with at least 6 consecutive days when *TN* < 10th percentile

Let TN_{ij} be the daily maximum temperature on day *i* in period *j* and let $TN_{in}10$ be the calendar day 10^{th} percentile centred on a 5-day window for the base period 1961-1990. Then the number of days per period is summed where, in intervals of at least 6 consecutive days, $TN_{ij} < TN_{in}10$.

Get data

DTR

Daily temperature range

Let TX_{ij} and TN_{ij} be the daily maximum and minimum temperature respectively on day *i* in period *j*. If *I* represents the number of days in *j*, then:

$$\mathrm{DTR}_j = \frac{\sum_{i=1}^{I}(\mathrm{TX}_{ij} - \mathrm{TN}_{ij})}{I}$$

Get data

ETR

Extreme temperature range

Let TX_x be the daily maximum temperature in month *k* and TN_n the daily minimum temperature in month *k*. The extreme temperature range each month is then:

$$\mathrm{ETR}_k = \mathrm{TXx}_k - \mathrm{TNn}_k$$

Get data

Rx1day

Maximum 1-day precipitation

Let RR_{ij} be the daily precipitation amount on day *i* in period *j*. The maximum 1-day value for period *j* are $Rx1day_j$ = max (RR_{ij})

Get data

Get data

Rx5day

Maximum consecutive 5-day precipitation

Let RR_{kj} be the precipitation amount for the 5-day interval ending $_k$, period *j*. Then maximum 5-day values for period *j* are $Rx5day_j$ = max (RR_{kj})

Get data

SDII

Simple precipitation intensity index

Let RR_{wj} be the daily precipitation amount on wet days, *w (RR ≥ 1mm)* in period *j*. If *W* represents number of wet days in *j*, then:

$$\mathrm{SDII}_j = \frac{\sum_{w=1}^{W} \mathrm{RR}_{wj}}{W}$$

Get data

R10mm

Annual count of days when PRCP ≥ 10mm

Let RR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the number of days where $RR_{ij} \geq 10mm$

Get data

R20mm

Annual count of days when PRCP ≥ 20mm

Let RR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the number of days where $RR_{ij} \geq 20mm$

Get data

Rnnmm

Annual count of days when PRCP ≥ nn mm, where nn is a user-defined threshold

Let RR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the number of days where $RR_{ij} \geq nnmm$.

Get data

CDD

Maximum length of dry spell: maximum number of consecutive days with RR < 1mm

Maximum length of dry spell: maximum number of consecutive days with RR < 1mm

Let RR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the largest number of consecutive days where $RR_{ij} < 1mm$.

Get data

CWD

Maximum length of wet spell: maximum number of consecutive days with RR ≥ 1mm

Let RR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the largest number of consecutive days where $RR_{ij} \geq 1mm$.

Get data

R95p

Annual total PRCP when RR > 95th percentile

Let RR_{wj} be the daily precipitation amount on a wet day *w (RR ≥ 1.0mm)* in period *i* and let $RR_{wn}95$ be the 95th percentile of precipitation on wet days in the 1961-1990 period. If *W* represents the number of wet days in the period, then:

$$\mathrm{R95}_p = \sum_{w=1}^{W} \mathrm{RR}_{wj} \text{ where } \mathrm{RR}_{wj} > \mathrm{RR}_{wn}\ 95$$

Get data

R99p

Annual total PRCP when RR > 99th percentile

Let RR_{wj} be the daily precipitation amount on a wet day *w (RR ≥ 1.0mm)* in period *i* and let $RR_{wn}99$ be the 99th percentile of precipitation on wet days in the 1961-1990 period. If *W* represents the number of wet days in the period, then:

$$\mathrm{R99}_p = \sum_{w=1}^{W} \mathrm{RR}_{wj} \text{ where } \mathrm{RR}_{wj} > \mathrm{RR}_{wn}\ 99$$

Get data

R95pTOT

Contribution to total precipitation from very wet days

$$\mathrm{R95pTOT} = \frac{100 \text{ x } \mathrm{R95p}}{\mathrm{PRCPTOT}}$$

Get data

R99pTOT

Contribution to total precipitation from extremely wet days

$$\mathrm{R99pTOT} = \frac{100 \text{ x } \mathrm{R99p}}{\mathrm{PRCPTOT}}$$

PRCPTOT

Get data

PRCPTOT

Annual total precipitation on wet days

Let RR_{ij} be the daily pre If i represents the number of days in j, then:

$$\mathrm{PRCPTOT}_j = \sum_{i=1}^{I} \mathrm{RR}_{ij}$$

Get data

References

Karl, T.R., N. Nicholls, and A. Ghazi. 1999. ***CLIVAR/GCOS/WMO workshop on indices and indicators for climate extremes: Workshop summary***, Weather and Climate Extremes, 42, 3-7. doi: **10.1007/978-94-015-9265-9_2**

Peterson, T.C., *et al.* 2001. ***Report on the Activities of the Working Group on Climate Change Detection and Related Rapporteurs 1998-2001***, WMO, Rep. WCDMP-47, WMO-TD 1071, Geneve, Switzerland, 143pp. Download (PDF from clivar.org): **Peterson et al. 2001 (PDF)**

Zhang, X., *et al.* 2005. ***Avoiding Inhomogeneity in Percentile-Based Indices of Temperature Extremes***, J. Climate, 18, 1641-1651. doi: **10.1175/JCLI3366.1**

Climdex Sitemap

Learn
- What is Climdex?
- Datasets
- Indices
- Tools

Access
- Gridded data
- Station data

About
- About the project
- Team profiles

climate extremes
ARC centre of excellence