1. Equation used in the RclimDex

CDD

It is the consuctive number of days with precipitation amount i for j period of time,where $RR_{ij} <$ 1mm

CWD

It is the consuctive number of days with precipitation amount i for j period of time,where $RR_{ij} >$ 1mm

PRCPOT

Let RR_{ij} is the daily precipitation amount i in j time period and I is the number of wet days during this time span, then

$PRCPOT_J$=

27. PRCPTOT

Let *RRij* be the daily precipitation amount on day *i* in period *j* . If *I* represents the number of days in *j* , then

$$\text{PRCPOT}=\sum_{i=1}^{I} RR_{ij}$$

R10mm

Suppose the RR_{ij} is the precipitation amount on day I in a specific period j. Then it is the total number of days in specific period of time with precipitation amount $RR_{ij} >$ 10mm

R20mm

Suppose the RR_{ij} is the precipitation amount on day I in a specific period j . Then it is the total number of days in specific period of time with precipitation amount $RR_{ij} >$ 20mm

R25mm

Suppose the RR_{ij} is the precipitation amount on day I in a specific period j . Then it is the total number of days in specific period of time with precipitation amount $RR_{ij} >$ 25mm

R95p

Suppose the RR_{ij} is the precipitation amount on wet day i (RR >1mm) in a specific period j and R95p is the 95th percentile of wet days during 1961-2014.

$$\text{R95p}= \sum_{i=1}^{j} RR_{ij}$$ where RR_{ij}>RR 95th percentile

R99p

Suppose the RR_{ij} is the precipitation amount on wet day i (RR >1mm) in a specific period j and R95p is the 99^{th} percentile of wet days during 1961-2014.

R95p= $\sum_{i=1}^{j} RR_{ij}$ where RR_{ij} > RR 99th percentile

<u>RX1day</u>

Suppose the RR_{ij} is the precipitation amount on day i in a specific period j . Then it is the maximum precipitation amount in specific period of time Rx1day = max(RR_{ij}).

<u>RX5day</u>

Suppose the RR_{ij} is the precipitation amount for five day interval ending with i in a specific period j . Then it is the maximum value for precipitation amount in specific period of time Rx5day = max(RR_{ij}).

<u>SDII</u>

Suppose the RR_{ij} is the wet days precipitation amount (*RR* ◎1*mm)* in a specific period j . And if I represents the count of wet days in j, then

$$SDII_J = \frac{\sum_{i=1}^{j} RR_{ij}}{i}$$

2. Autocorrelation test

The autocorrelation test has been employed to remove the correlation effects in the data. For the sample data (x_1,x_2 … ….. x_n) used in this study, the following steps were followed;

i. Salas et al (1980) applied lag-1 serial coefficient on data to eliminate the effect of correlation from the data as presented in Equation (S1)

$$r_1 = \frac{\frac{1}{n-1}\sum_{i=1}^{n-1}\left(x_i - E(x_i)\right)\left(x_{i+1} - E(x_i)\right)}{\frac{1}{n}\sum_{i=1}^{n}\left(x_i - E(x_i)\right)^2} \quad \text{(S1)}$$

$$E\left(x_i\right) = \frac{1}{n}\sum_{i=1}^{n} x_i \quad \text{(S2)}$$

Where the number of observation and mean of the data are represented by n and $\boldsymbol{E(x_i)}$, respectively.

ii. For testing the time series Equation (S3) was applied at the time series

$$\frac{-1-1.645\sqrt{(n-2)}}{n-1} \le r_1 \le \frac{-1+1.645\sqrt{(n-2)}}{n-1} \quad \text{(S3)}$$

For independent data sets the $\mathbf{r_1}$ value must be between the above mentioned intervals otherwise it is correlated if the value is not within the said intervals. The pre-whitening test must be applied to eliminate the effects of correlation as described below

$$\left(x_2 - r_1 x_1, x_3 - r_1 x_2, \cdots, x_n - r_1 x_{n-1}\right)$$

3. Mann-Kendall Trend Test

The most used non parametric approach for trend analysis named as Mann-Kendall trend test is used to analyse the time-series data in this study.

The 'S' statistic of the Mann-Kendall test can be obtained by applying the Equation (S4),

$$S = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \operatorname{sgn}(x_j - x_i) \tag{S4}$$

where x_i and x_j are yearly values for i and j years, respectively, with j>i, n represents the number of data points and $\operatorname{sgn}(x_j - x_i)$ is the sign function.

The variance of Mann Kendall can be computed as

$$V(S) = \frac{n(n-1)(2n+5) - \sum_{k=1}^{m} t_k (t_k - 1)(2k_t + 5)}{18} \tag{S5}$$

where n represents the number of data points; whilst number of tied groups can be represented by m with the ties of extent k. A data group with the same values represents the tied group. The test statistics is computed using the below Equation (S6) for a sample size with n > 10.

$$Z_s = \begin{cases} \dfrac{s-1}{\sqrt{V(S)}} & if \quad S > 0 \\ 0 & if \quad S = 0 \\ \dfrac{s+1}{\sqrt{V(S)}} & if \quad S < 0 \end{cases} \tag{S6}$$

Positive/negative values of Z_s represents the increasing/decreasing trend. The null hypothesis ($H_\circ$) is rejected if $Z_s > Z_{1}\text{-}\alpha/2$, where the values of $Z_{1}\text{-}\alpha/2$ is achieved from a standard normal cumulative distribution table. The presented MK test is generally used to identify the significance of the data at 99.99% and/or 99% confidence interval of time series data for $|Z_s| > 2.57$and $|Z_s|$>1.96, respectively, with the $H_\circ$ of no trend is rejected.

4. Theil-Sen approach (TSA)

Sen (1968) presented the non-parametric approach to estimate the trends slope for N pairs of the data samples. Equally distributed time series should be arranged in ascending order and the below given formula applied to compute the trend slope.

$$Q_k = \frac{\left(x_j - x_i\right)}{j - i}, \text{ for k=1…. N} \tag{S7}$$

where x_i and x_j are data points of time series i and j, respectively, with (j>i). The N=$\frac{n(n-1)}{2}$ values of Q slopes are computed if there are n values of x_i are presents in the time series. All N values are arranged in ascending order to obtain the Sen's slope estimator, that is the median of these N values, with the help of Equation (S8)

$$Q_{med} = \begin{cases} Q_{(N+1)/2} \; if \; Nis \; odd \\ \dfrac{Q_{N/2} + Q_{N+2/2}}{\sqrt{V(S)}} \quad if \; N \; is \; even \end{cases} \tag{S8}$$

The steepness of the slope is obtained from the magnitude of Q_{med}while its positive/negative sign represents the direction of increasing / decreasing trend.