B-25: A Novel approach to estimate missing data in rainfall time series

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Missing values are found in most of the rainfall time series. The available techniques to estimate missing data either involve heavy computations or require historical data. Hence, the objective of this study was to develop a relatively simple methodology to estimate missing data and verify the accuracy of such estimations in comparison with Normal Ratio (NR) method.

The methodology to estimate missing data was developed to get the advantage of spatial uniformity of rainfall within short distances and contains no account of the historical recurrence. The new method named as Areal Precipitation Ratio (APR) method requires the location of at least 4 surrounding stations. Sixty four gauging stations in Upper Mahaweli Catchment Area (UMCA) were selected to test the methodology The exact geographical locations were verified using a GPS. The estimation of area for each station within UMCA was carried out in GIS including and excluding missing station in individual calculations.

$$P_m = \frac{1}{A_m}((A_{11} - A_1) * P_1 + (A_{22} - A_2) * P_2 + \ldots (A_{nn} - A_n) * Pn)$$

where P_m – estimated daily value for missing station
A_m . area for missing station according to nearest neighbour criteria
$A_1 \ldots A_n$ areas when missing station is included
$A_{11} \ldots A_{nn}$ areas when missing station is excluded
$P_1 \ldots P_n$ daily precipitation of surrounding stations

APR and NR methods were applied to estimate missing data for a known period of 1 month in each of the 4 seasons and for 10 individual stations representing the agro-ecological zones of the UMCA. The percentage root mean square error for NR and APR estimates are 0.276 and 0.375, respectively. However, when there are no historical data, APR is a viable alternative and it involves less computations. Further, it accounts for the spatial correlations that exist in nature.

APR method can be applied to individual storm events and it indirectly locates the storm origin and accounts for the spatial reduction or decay rate of the storm distribution.