

# Variability and Trends of Summer Monsoon Rainfall over Bangladesh

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## ABSTRACT

In this paper, the updated rainfall data of 50 years (1961-2010) for 30 selected rain gauge stations of Bangladesh have been used. The data were analyzed to investigate the variability and trends of summer monsoon (June-September) rainfall over Bangladesh. The possible teleconnection of monsoon rainfall variability with ENSO has also been investigated.

Annual profile of the station mean monthly rainfall of Bangladesh shows a unimodal pattern with high rainfall between June-September (monsoon season) with highest in July and low rainfall between December – February with lowest in January. All Bangladesh mean summer monsoon rainfall is 1769.14 mm, standard deviation 209.16 mm (coefficient of variance 11.82 %) and annual country average rainfall is 2456.38 mm. Summer monsoon rainfall widely varies over the geographical areas with lowest in central-western part and highest in southeastern part with next highest in northeastern part of the country. The trend analysis shows that the trend of the country average monsoon rainfall is decreasing (-0.53 mm/year). The spatial distribution of the trend values indicates that the summer monsoon rainfall exhibits increasing trends at the rate of 5-6 mm/year in the NW region and 3-4 mm/year in the south-central and extreme SE region. The eastern region exhibits decreasing trends of about -2 to -7 mm/year with highest (-6 to -7 mm/year) in the east-central part. The time series plot of country average summer monsoon rainfall shows the inter-annual variability in the timescales of 2-3 years and 4-6 years. The time series of 5 year moving average reveals existence of low frequency variability of timescales of 9-14 years. The time series of Bangladesh monsoon rainfall shows that there were 11 strong monsoon years and 8 weak monsoon years within the periods of 1961-2010 (50 years). The analysis of the decadal mean rainfall shows that the decades 1961-1970 and 1981-1990 were wet and the decades 1971-1980, 1991-2000 and 2001-2010 were dry. Floods in Bangladesh result from the excess rainfall occurring both inside and outside the country. Summer monsoon rainfall is characterized by active and weak (break) spells, which are associated with the fluctuation of monsoon rainfall in the time scales of 20-25 and 40-50 days. Such fluctuations are caused due to north-south movement of the monsoon trough. The fluctuations in the time scales of 4-7 and 10-14 days are associated with the formation of low pressure systems over the head Bay. The possible atmospheric teleconnections of summer monsoon rainfall with ENSO have also been investigated. It is found that there is strong impact of ENSO on the monsoon system of subcontinent scale, though the relationship is weak in case of Bangladesh. The variability of Bangladesh rainfall has been investigated with respect to that for Nepal, Bhutan and the neighbouring sub-divisional regions of India. The results show that Bangladesh rainfall has positive correlation with that of the Indian regions of Naga-Monipur-Mizo-Tripura, Sub Himalayan West Bengal and Sikkim, and Bhutan. The above analysis shows the homogeneity of rainfall activities over these areas. Orissa shows negative correlation with Bangladesh.

*Keywords: Rainfall, Variability, Summer Monsoon, ENSO, Trend*