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Assessing the effect of climate change on rainfall intensity-duration-frequency (IDF) relation of Dhaka city

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Adverse impact of climate change may jeopardize the ongoing development of Bangladesh. The impacts of higher temperatures, more variable precipitation, more extreme weather events, and sea level rise are already in reality and will continue to intensify. The impacts results are not only from the gradual changes in temperature and sea level but also, in particular, from the increased climate variability and extreme events, including more intense storm runoff, floods, droughts etc. These changes effects the economic performance of Bangladesh and the lives and livelihoods of millions of poor people. Thus the rural peoples are compelled to migrate towards urban localities making crowded and unpleasant environmental condition. As such magnitude and frequency of climatic parameters like rainfall runoff in urban catchments may be influenced considerably when compared to those occurred in the past. The IPCC Special Report on the Regional Impacts of Climate Change indicates that there would be drastic changes in the rainfall patterns in the warmer climate and Bangladesh may experience 5-6% increase of rainfall by 2030, which may create frequent massive and prolonged floods. Estimation of design storm runoff requires the analysis of historical extreme events resulting Rainfall-Intensity-Duration-Frequency (IDF) relation. This relation is used to obtain rainfall information for planning and designing of small hydraulic structures in ungaged drainage catchment. Also a popular use of IDF curve is inevitable for the analysis of urban storm drainage management. Presently available IDF curves of major urban cities in Bangladesh were developed based on relatively older sets of annual series. However it is anticipated that due to global change of climatic situation, the IDF parameters may alter and needs updating based on more recent annual rainfall series. This paper deals with an attempt to identify the effect of climatic change on the extreme storm and thus updating the IDF curve for Dhaka city of Bangladesh. Daily rainfall data of Dhaka, have been collected from Bangladesh Meteorological Department (BMD) for last 61 years. This historical rainfall data have been separated into two annual extreme series, one is from year 1953 to 1983 and other is year 1984 to 2014. The objective is to analyze and compare the changes of rainfall IDF curve with those obtained from old series, in order to realize the effect of climate change as per IPCC recommendation. Two common frequency analysis techniques such as Gumbel EV-I and Log Pearson Type III (LPT-III) distribution were used to develop the IDF relationship from rainfall data of selected stations. Available empirical formula has been used to generate the short duration rainfall intensity as synthesized from daily rainfall data. The results obtained using Gumbel method is slightly higher than LPT-III distribution method. The parameters of the IDF equations and coefficient of correlation for different return periods are evaluated. It was found that the co-efficient and exponents of existing IDF relationship have been altered when compared with those obtained based on newer series. It is anticipated that such alteration of IDF parameters is due to the change of climatic variability. Thus it re-emphasizes the importance of updating the existing IDF curves of the major cities of Bangladesh.

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Progress in mechanics of composites – A personal view

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Historical developments in two dimensional models of composite and sandwich laminates are described. Classical, first-order and higher-order theories are detailed. A new partial discretization methodology through combination of finite elements and numerical integration techniques for evaluation of transverse stresses is highlighted.

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