ABSTRACT

Extreme Precipitation in Jamaica: Past, Present and Future Trends

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Accurate information on extreme precipitation intensities, trends and possible variability with climate change remains an important climate science challenge. The existing information for Jamaica that covers the period 1957 to 1991 is outdated, while both new and recovered information remains unused. Recent devastating flood events have resulted in a large numbers of deaths and economic losses to the country. All of this is against a background of increasing trends in extreme precipitation globally but with limited information for Jamaica.

Here, existing data is re-analysed with new statistical methods and compared to existing intensity-duration-frequency curves. Next, extension and infilling of the data is achieved by retrieving unused data from 1895 to 1957 and 2004 to 2011, empirical models and downscaling techniques. The resulting time series covers the period 1895 to 2010. The benefits of extending and infilling on frequency analysis are explored by comparing the previously defined curves to new curves generated in this study.

Trends and climate connections in the extended time series of extreme precipitation are also examined using statistical methods. The analysis shows a reduction in short duration extremes (i.e., compared to prior analyses) with break points in 1960 to 1970, and an increase in long duration extremes with break points in 1998 to 2000 that are correlated to other stations. A new Atlantic Warm Pool (AWP) climate index is shown to be positively correlated to the break points. The warm (cool) phase of the Atlantic Multidecadal Oscillation (AMO) is also determined to be positively correlated with increased (decreased) extreme precipitation.

Effects of perturbed climate states on intensities are investigated. Extreme La Niña conditions in both the control and possible future climate change scenario are shown to have a significant effect on increasing intensities. Possible increased occurrences of extreme La Niña could increase intensities by 100% and reduce return periods by 80%. Further investigations are required to understand temporal and spatial trends; the applicability of precipitation mass curve distribution; and the AMO to precipitation climate connections.

Keywords: Christopher Patrick Burgess, intensity duration frequency curve; future climate; climate simulations; extreme precipitation; climate trends; flood risk; climate downscaling; Atlantic Multidecadal Oscillation; Atlantic Warm Pool; Jamaica