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RECENT TRENDS OF EXTREME POSITIVE RAINFALL ANOMALIES IN THE DRY ZONE OF SRI LANKA *

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INTRODUCTION

The Dry zone covers about 70% of the total land extent in Sri Lanka. It is the major agricultural region of the country since the earliest historical times of the island; the dry zone of Sri Lanka consist of thousands of man-made small and large tanks without which human existence in the Dry zone would be difficult as described by many authors. Village tank settlements have always been the back-bone of our Hydraulic Civilization since ancient times. It is also perceived as one of the most appropriate adaptation strategy for climate variability and change in the Dry zone.

Among the various issues and the threats faced by these tanks, high siltation is of special significance. Continually shrinking catchment area of respective tanks due to encroachment of forests and irrational land use practices on upstream lands, result in more soil erosion leading to rapid siltation of tanks in the Dry zone. Moreover, high-intense rains receiving during convectional rainy periods (March-April and September-October) also increase the soil erosion rate of the Dry zone landscape. Siltation of tanks not only causes reduction of storage capacity but also leads to alter the tank geometry and ecology with subsequent web of negative impacts on society, livelihood of the peasants and environment. Global warming is expected to lead to a more vigorous hydrological cycle, including more total rainfall and more frequent high intensity rainfall events (IPCC, 2013), which in turn increases the soil erosion and subsequent siltation of tanks. High intense rains were used to be a common feature of the rainfall climatology of the Dry zone only during convectional rainy periods. However, it has been observed in recent times that such rains have become a regular event at any rainy season irrespective

* *See "Tropical Agriculturist" Volume 163 for details.*

of the nature of origin, which may further aggravate the problem of siltation of tank cascade systems in the Dry zone. Therefore, a study was undertaken to identify whether there is a change in occurrence of extreme rainfall events in the Dry zone enabling policy makers to formulate appropriate risk reduction strategies to conserve the village tank eco-systems in the Dry zone.

DATA COLLECTION AND ANALYSIS

To study the recent trends of positive extreme rainfall events, a 25 year daily time series was taken from 1990 to 2014 from 13 rain gauge stations scattered throughout the Dry zone, representing different Agro Ecological Regions (AER). Among the various statistical measures available to flag extreme positive rainfall anomalies in a daily rainfall time series, the approach using 95th and 99th percentiles of the daily rainfall values was used to define High Rainfall (HRF) and Very Heavy Rainfall (VHRF) events, respectively in this study. Punyawardena and Premalal (2013) and Shahid (2011) have successfully employed the same approach to identify the trends in extreme rainfall events in the Central Highlands of Sri Lanka and Bangladesh, respectively.

The base period for the analysis was taken as the 1960-1989 to capture a period of 30 years to determine the 95th and 99th percentiles in annual and seasonal time series of each station. The 25-year period from 1990 to 2014 was taken to determine the trends of HRF and VHRF events by annually as well as rainfall season wise, *viz*, First Inter Monsoon (FIM), South West Monsoon (SWM), Second Inter Monsoon (SIM) and North East Monsoon (NEM). A trend analysis was carried out on extreme positive rainfall events, namely, HRF and VHRF events for annual daily rainfall and each rainfall season.

Furthermore, the number of days that received positive extreme rainfall events - HRF and VHRF events - were categorized independently in to 5 year time periods (pentad) from 1990 to 2014, namely, 1990-1994, 1995-1999, 2000-2004, 2005-2009 and 2010-2014 to determine whether there is any recent occurrence of such rainfall events. The observed apparent increasing trends of HRF and VHRF during last pentad of 2010-2014 in most locations were tested for significance using "CATMOD" procedure in SAS statistical software as these data were not normally distributed.

RESULTS AND DISCUSSION

Even though there is an apparent increasing trends of both HRF and VHRF events in annual daily time series at almost all study locations none of them were statistically significant. There was a mixed trend of relationship in HRF and VHRF events during different rainfall seasons with both decreasing and increasing trends. However, most of them were not significant except a few instances. Pentad analysis reveals that even though trends in occurrence of HRF and VHRF events during most recent 25-year period of 1990-2014 is not significant, an apparent increasing trend of these extreme events during last 25 year period, last five years in particular signals a change in usual rhythm of rainfall climatology in the Dry zone of Sri Lanka that could be probably attributed to the climate change. With continuing global warming, these extreme events are expected to increase in the future (IPCC, 2013) and thus, current apparent trends could become obvious events in the future.

The impacts of these frequent positive extreme rainfall events are already manifested in the Dry zone agriculture during recent times. Meanwhile, increasing trends of extreme positive rainfall anomalies during SWM and NEM seasons during most recent pentad (2010-2014) is quite important aspect to pay attention in the context of crop production in the Dry zone. These SWM and NEM seasons mark the latter half of the two major cultivation seasons in the region namely, *Yala* and *Maha*, respectively. Thus, increasing positive rainfall anomalies in SWM and NEM seasons result in frequent excess moisture conditions in rainfed upland crops and flooding in lowland paddy fields during reproductive phase of both aforesaid cropping systems with subsequent loss of yield both quantitatively and qualitatively.

CONCLUSIONS

An apparent trend of extreme positive rainfall anomalies in the Dry zone is discernible, especially during SWM and NEM rainfall seasons. As these two rainy periods coincide with the reproductive phase of the crops grown in both *Yala* and *Maha* cultivation seasons in the Dry zone, it may likely to inflict significant implications on the agricultural production in the region in terms of both quantity and quality.

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