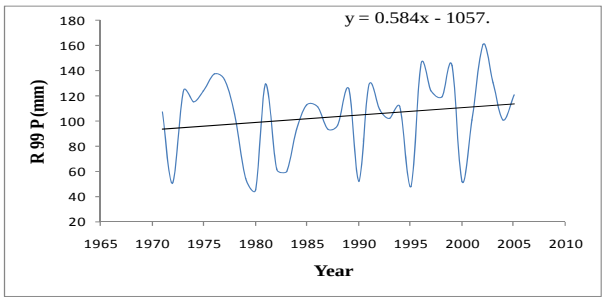

Figure 10: annual total rainfall from days greater than 99th percentile (R99P) over Jos

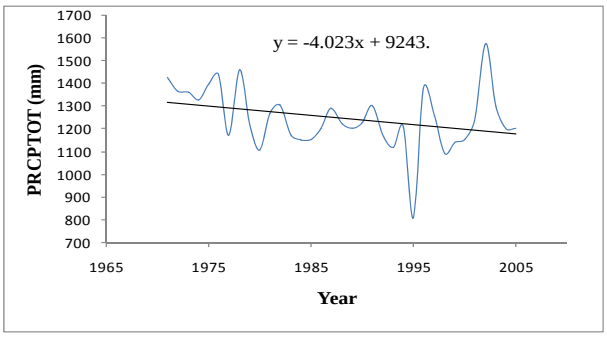

Figure 11: annual total rainfall from days greater than or equal to 1mm (PRCPTOT) over Jos

3.1.2 Patterns and Variations over Lokoja

For Lokoja, the patterns and variations in some indices of extreme rainfall events over Lokoja, which represents Kogi state, are presented in Figures 12 to 21. Figure 12 presents patterns and variations in Maximum 1-day rainfall (Rx 1 day) over Lokoja. The figure shows that Rx 1 day ranges between 54 and 154.4 mm, while it stood at an average of 80.38 mm of rainfall at Lokoja. Figure 13 showed that maximum 5-day consecutive rainfall amount (Rx 5-day) stood at an average of 70.55 mm, while it ranges from 0 to 256.2 mm. Simple daily intensity index (SDI I) in Figure 14 stood at an average of 15.8 mm/day, while it ranges from 11.7 to 20.2 mm/day. Furthermore, Figure15 showed that number heavy rainfall days when rainfall is greater or equal 10 mm (R10) over Lokoja stood at an average of 37.13 days, while it ranges between 25 and 51 days. Figure 16 showed that number heavy rainfall days when rainfall is greater than or equal to 20 mm (R20) over Lokoja stood at an average of 20.83 days, while it ranges between 11 and 36 days. Figure 17 showed that maximum number of consecutive dry days when rainfall is less or equal to 1 mm (CDD) over Lokoja ranges between 44 and 107 days, and stood at an average of 73.43 days. With the same trend, Figure 18 depicted that maximum number of consecutive wet days when rainfall is greater or equal to 1mm (CWD) over Lokoja ranges between 3 and 10 days, and stood at an average of 6.43 days. In addition, Figure 19 showed that annual total rainfall from days greater than 95th percentile (R95P) ranges between 163.5 and 436.7 mm, with an average of 283.17 mm over Lokoja. Likewise, Figure 20 revealed that annual total rainfall from days greater than 95th percentile (R99P) ranges between 454 and 242.5 mm, with an average of 85.53 mm over Lokoja. Finally, Figure 21 depicted that annual total rainfall from days greater than or equal to 1mm (PRCPTOT) over Lokoja stood at an average of 1163.57mm, and ranges between 767.4 and 1761 mm.

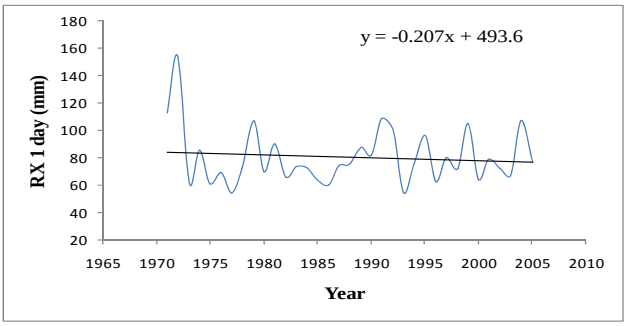

Figure 12: patterns and variations in Maximum 1-day rainfall (Rx 1 day) over Lokoja

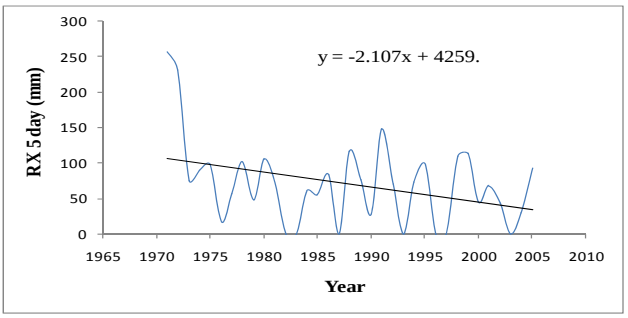

Figure 13: maximum 5-days consecutive rainfall amount (Rx 5-day) over Lokoja

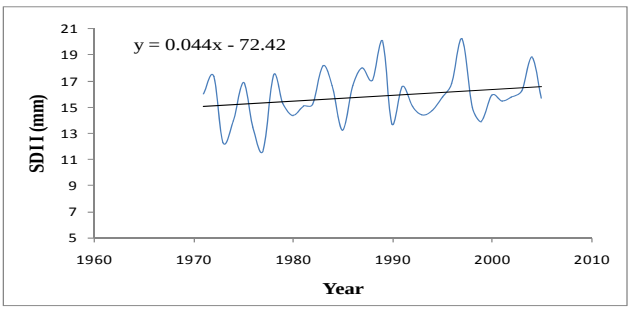

Figure 14: daily intensity index (SDI I) over Lokoja

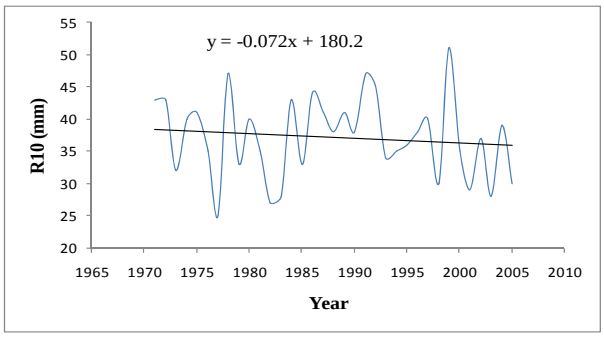

Figure 15: number heavy rainfall days when rainfall is greater or equal 10mm (R10) over Lokoja

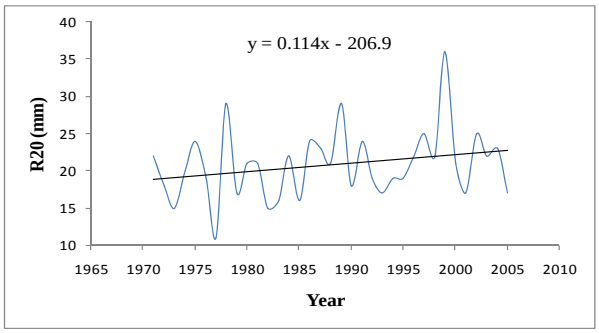

Figure 16: number heavy rainfall days when rainfall is greater or equal to 20mm (R20) over Lokoja

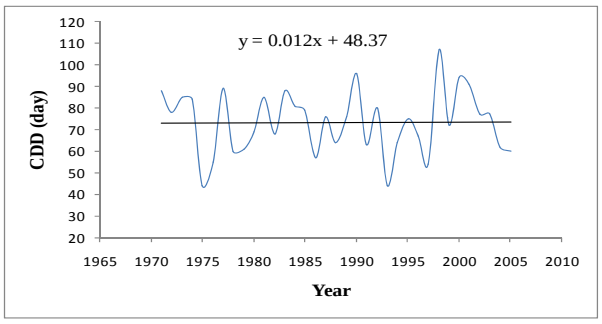

Figure 17: maximum number of consecutive dry days when rainfall is less or equal to 1mm (CDD) over Lokoja

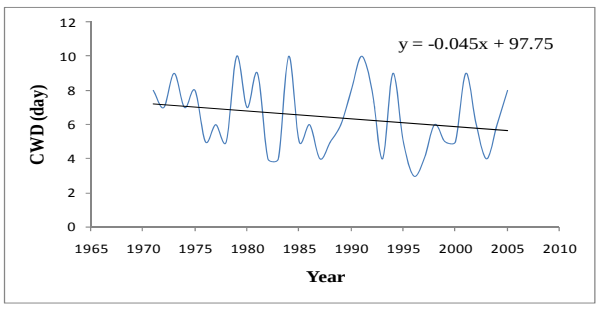

Figure 18: maximum number of consecutive wet days when rainfall is greater or equal to 1mm (CWD) over Lokoja

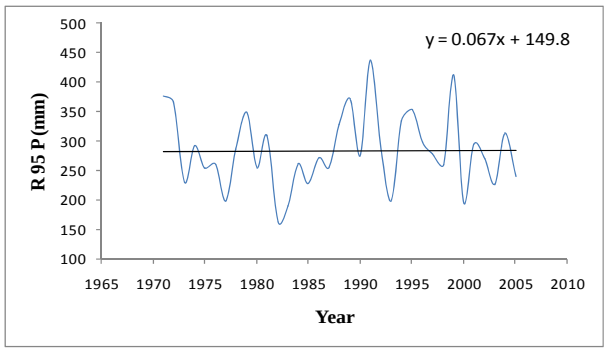

Figure 19: annual total rainfall from days greater than 95th percentile (R95P) over Lokoja

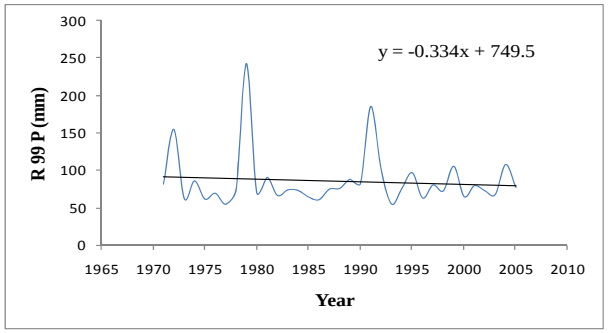

Figure 20: annual total rainfall from days greater than 99th percentile (R99P) over Lokoja

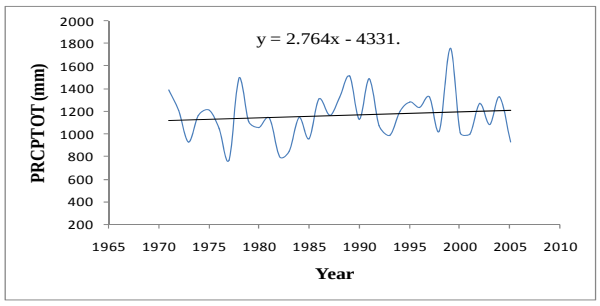

Figure 21: annual total rainfall from days greater than or equal to 1mm (PRCPTOT) over Lokoja

3.1.3 Patterns and Variations over Makurdi

The patterns and variations in some indices of extreme rainfall events over Makurdi, which represents Benue state, is as presented in Figures 22-31. Figure 22 presented patterns and variations in Maximum 1-day rainfall (Rx 1 day) over Makurdi. The Figure 23 showed that Rx 1 day ranges between 45.2 and 125.3 mm, while it stood at an average of 82.8 mm of rainfall at Makurdi. Figure 24 showed that maximum 5-days consecutive rainfall amount (Rx 5-day) stood at an average of 67.4 mm, while it ranges from 0 to 144.6 mm. Simple daily intensity

index (SDI I) in Figure 25 stood at an average of 16.35 mm/day, while it ranges from 12.47 to 21.96 mm/day. Furthermore, Figure 26 displayed the number of heavy rainfall days with rainfall greater or equal 10mm (R10) over Makurdi stood at an average of 35.97 days, while it ranges between 21 and 50 days. Figure 27 showed that number of heavy rainfall days when rainfall is greater than or equal to 20 mm (R20) over Makurdi stood at an average of 20.47 days, while it ranges between 9 and 31 days. Figure 28 displayed that maximum number of consecutive dry days when rainfall is less or equal to 1 mm (CDD) over Makurdi ranges between 52 and 107 days, and stood at an average of 75.10 days. In the same vein, Figure 29 showed that maximum number of consecutive wet days when rainfall is greater or equal to 1mm (CWD) over Makurdi ranges between 3 and 12 days, and stood at an average of 6.17 days. Also, Figure 30 depicted that annual total rainfall from days greater than 95th percentile (R95P) ranges between 74 and 412.1 mm, with an average of 266.2 mm over Makurdi. Likewise, Figure 31 revealed that annual total rainfall from days greater than 95th percentile (R99P) ranges between 45.2 and 125.3 mm, with an average of 82.83 mm over Makurdi. Finally, Figure 31 showed that annual total rainfall from days greater than or equal to 1mm (PRCPTOT) over Makurdi stood at an average of 1153.9 mm, and ranges between 556.4 and 1608.2 mm.

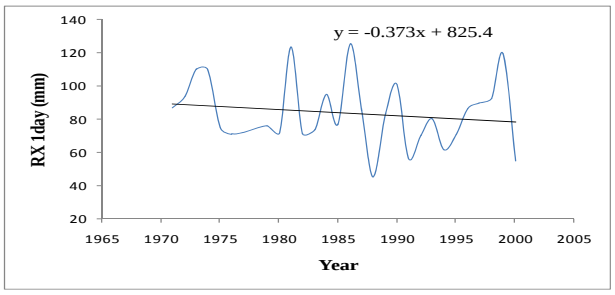

Figure 22: patterns and variations in Maximum 1-day rainfall (Rx 1 day) over Makurdi

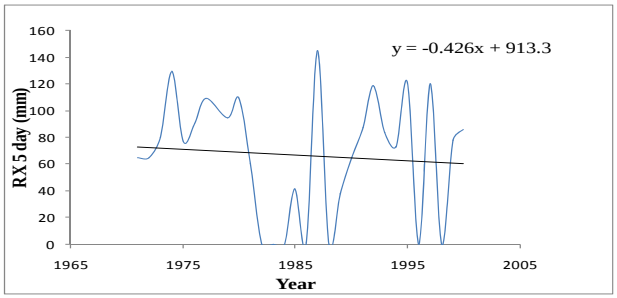

Figure 23: maximum 5-days consecutive rainfall amount (Rx 5-day) over Makurdi

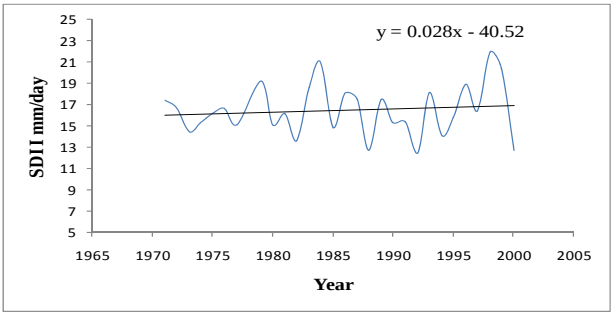

Figure 24: daily intensity index (SDI I) over Makurdi

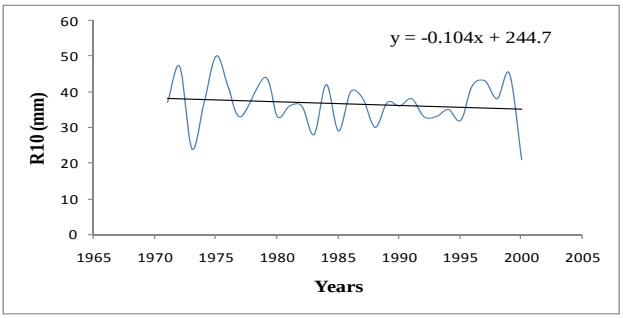

Figure 25: number heavy rainfall days when rainfall is greater or equal 10mm (R10) over Makurdi

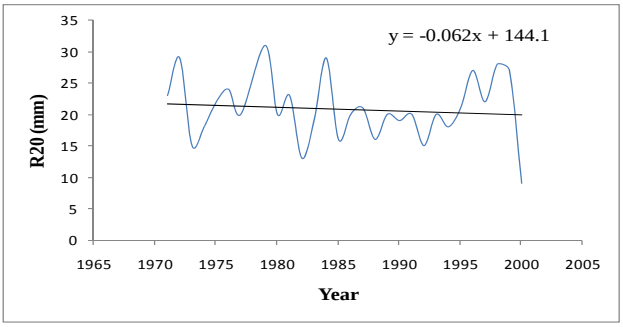

Figure 26: number heavy rainfall days when rainfall is greater or equal to 20mm (R20) over Makurdi

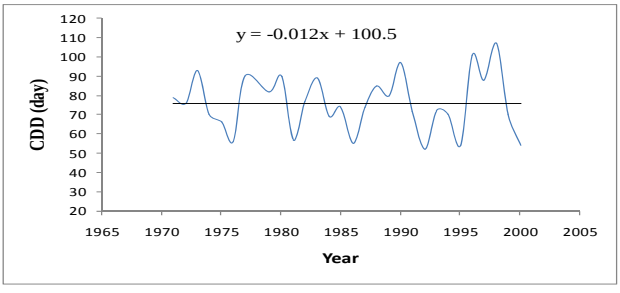

Figure 27: maximum number of consecutive dry days when rainfall is less or equal to 1mm (CDD) over Makurdi

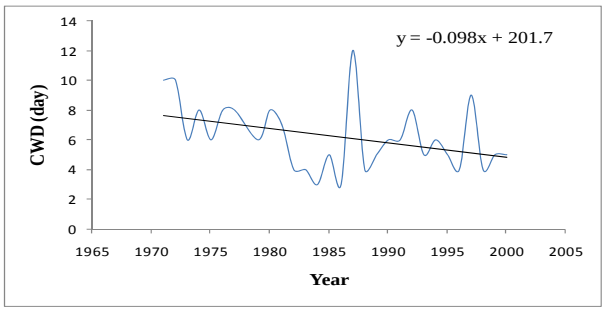

Figure 28: maximum number of consecutive wet days when rainfall is greater or equal to 1mm (CWD) over Makurdi

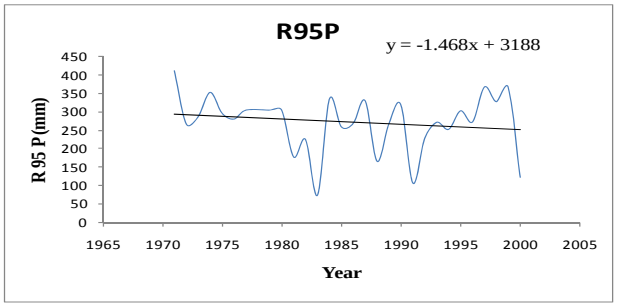

Figure 29: annual total rainfall from days greater than 95th percentile (R95P) over Makurdi

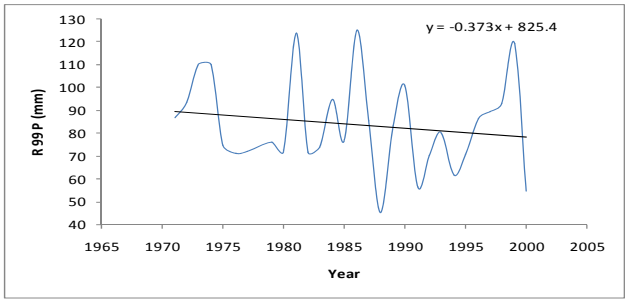

Figure 30: annual total rainfall from days greater than 99th percentile (R99P) over Makurdi

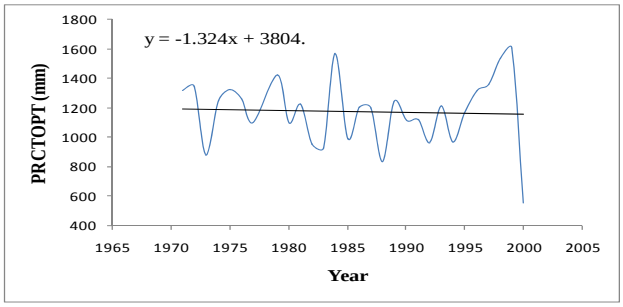

Figure 31: annual total rainfall from days greater than or equal to 1mm (PRCPTOT) over Makurdi

3.2 Discussion

To gain an insight into the nature of climatic variability within the climate system, it is necessary to study its components in a systematic way. In this study, emphasis was placed on precipitation, which was analyzed in terms of changes in the statistical distribution of the local rainfall. The study identified decreasing trends in some indices of extreme rainfall event across the middle-belt of Nigeria. At Jos, the study specifically found significant negative trends in R20, and PRCPTOT, while other indices: Rx5-day, SDII, R10, and R95P also showed decreasing trend. Furthermore, at Lokoja, the study identified decline trend in Rx5-day, R10, CDD and CWD although none of these indices was statistically significant. At Makurdi, significant negative trend was specifically found in CWD. While other indices: Rx1day, R10, CDD, R95P, R99P, and PRCPTOT also showed negative trend but not at a significant decrease rate. This finding is in line with the study of Abdukadri *et. al*. (2009) who had earlier reported that ‘’decline trend was identified in moisture effectiveness that intensified moisture stress across the belt in the last six decades signifying the fact that decrease moisture effectiveness is a prime aridity factor in the sub-region. By this result, the Sudan-sahelian belt is increasingly vulnerable to crops failure due to increased aridity (AI), late onset, and early retreat of rainfall resulting to shorter hydrologic growing season already obvious across the belt. The trend confirm the effect of climate change and is disastrous to agriculture, as delayed onset often leads to late planting of crops, while premature cessation leads to wilting and dryness of the crops before maturity, there by endangering food security in the belt’’.

5 CONCLUTION

The information provided by the indices not only includes how the mean values changed over time but how the statistical distribution of the data changed. In addition, the analysis gives us very important information about the trends in extremes. The results showed that Rx 5-day, SDII, R10, R20, R95P, and PRCPTOT have decreased at Jos. Likewise, Rx5-day, R10, CDD, and CWD have decreased at Lokoja. In the same vein, Rx1-day, R10, CDD, CWD, R95P, R99P and PRCPTOT have also declined at Makurdi. The results from the analysis, presented scientific information on magnitude, departures from long-term conditions and trends in rainfall in all the three stations but with a varying value due to population and size distribution, these inevitable climate effects, which

needs to be adapted to may cost excessive spending in order to make life and environment worthwhile. To monitor indices of any extreme events accurately across each state in Nigeria, the Nigerian Government needs to invest in setting up weather station in every local government to cover for the lags in accuracy of data acquired when showing the spatial distribution of weather parameters. In addition, results of rainfall studies in any region can help the decision maker to manage their water resources, agricultural, environment and other water related projects.

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