Climate Change and the Vulnerability of Water Resources in Northern Cameroon

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Introduction

Debates about climate change continue to dominate the world science and policy agenda of recent time. And one fundamental concern is the impact of climate change on water resources and the health of ecosystems that depend on their timely supplies. Northern Cameroon is threatened by extreme water shortage and climate variability. There are visible evidences of such occurrences. For example; Lake Chad rapidly shrinking; Lake Fianga dried up completely in December 1984; in January 1984, there was a total crop failure which necessitated the distribution of food relief aid (Molua and Lambi, 2006). Human activities as well have facilitated the shrinking processes of water resources in the region. Major catchment areas as well as rivers courses have been modified significantly by human activities. For this study, time series analysis for precipitation and temperature data, and the Standardized Precipitation Index (SPI) were used to show the variation of rainfall within the context of climate change.

Methodology

Data base

The study is based on datasets provided by the University Cooperation for Atmospheric Research (UCAR) (http://dss.ucar.edu/datasets). The data set include observed daily temperature and precipitation data for the time period of 1957-2006 from three weather stations in Maroua, Garoua and Ngaoundere. Data quality control was done by using ClimDex Version 1.3 software developed by Byron Gleason from NCDC/NOAA, U.S.A.

Time Series Analysis

A Time Series Analysis with the above data base was computed using Microsoft excel program. Trend lines were generated on the graphs automatically by using the same software package. With the trend lines, the direction of change were observed for temperature and precipitation

over the given time period. Observational comparison and literature analysis were compared with the obtained results to assess the current water situation in Northern Cameroon.

Standardized Precipitation Index (SPI)

Standardized Precipitation Index (SPI) is use to determine the effects of precipitation shortages to ground water level, river discharges and soil water content (Ceglar et al., 2008). SPI requires a continuous monthly precipitation data for 30 years or more in order to obtain a reliable result. SPI could be computed for different time scales: 1-month SPI, 3-month SPI, 6-month SPI, 9-month SPI, 12-month SPI and even 24-month SPI. For this study, a 12-month SPI for hydrological drought was computed, given that long time scales are very effective to investigate the variation of groundwater and surface water storage. Using SPI, McKee et al. (1993) defines a drought event when the SPI becomes -1.0 or less. But drought begins when SPI first went negative then ends when SPI goes back to positive.

Results

Results of the Time Series Analysis

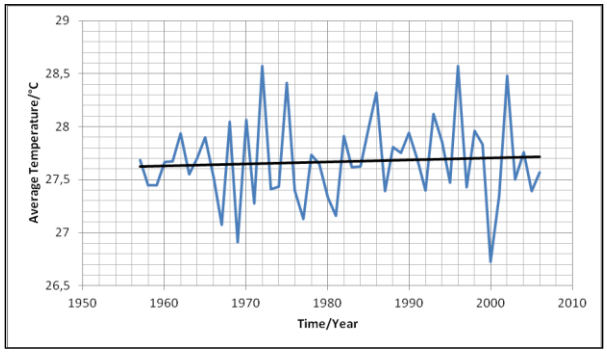

Figure 1: Ngaoundere Annual Average Maximum Temperature

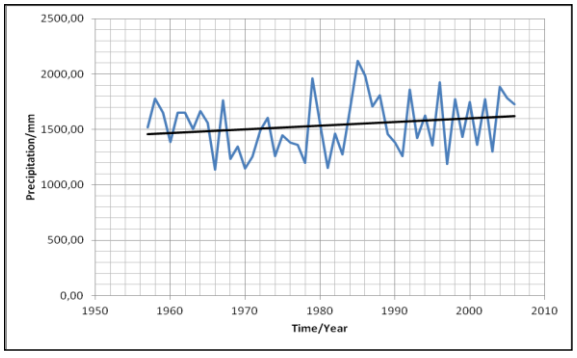

Figure 2: Ngaoundere Total Precipitation per Year

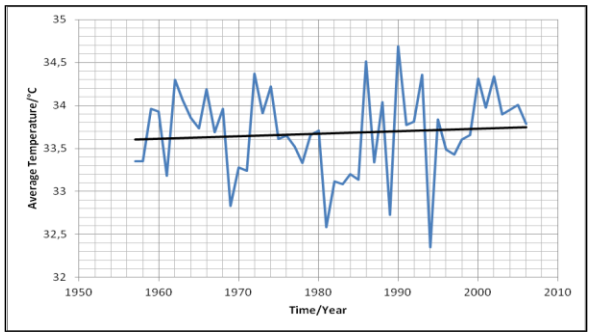

Figure 3: Garoua Annual Average Maximum Temperature

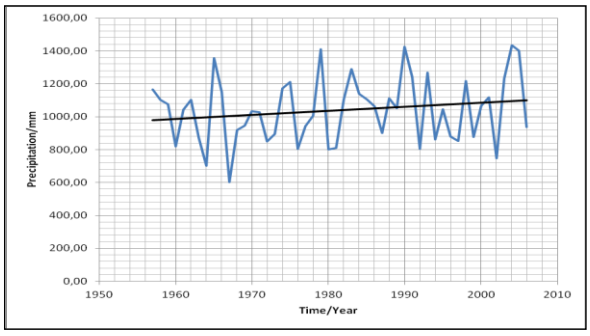

Figure 4: Garoua Total Precipitation per Year

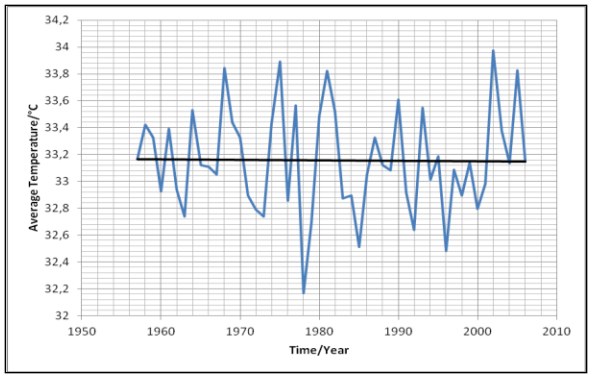

Figure 5: Maroua Annual Average Maximum Temperature

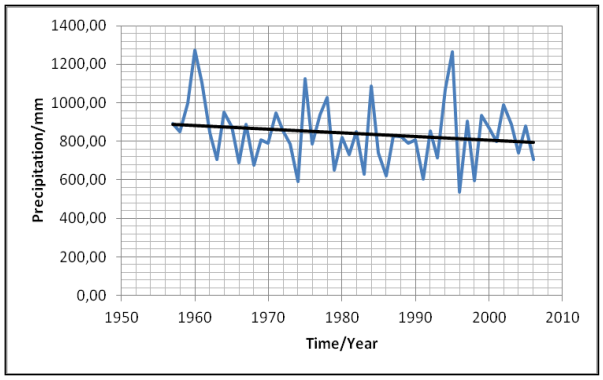

Figure 6: Maroua Total Precipitation per Year

Results for the Hydrological Drought analysis using Standardized Precipitation Index

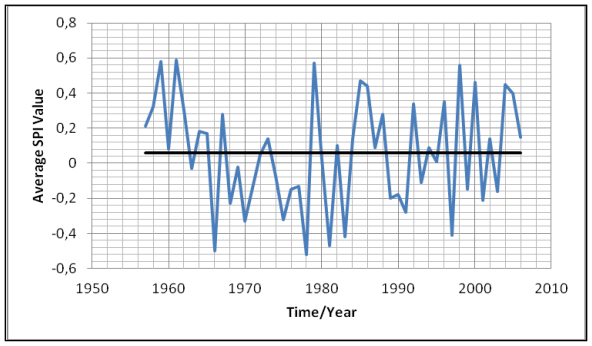

Figure 7: Average SPI Value for the Different Years in Ngaoundere

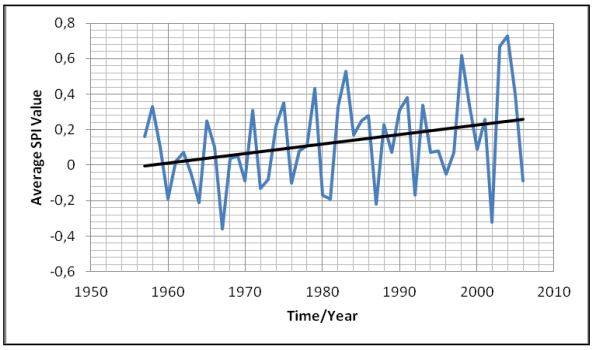

Figure 8: Average SPI Value for the Different Years in Garoua

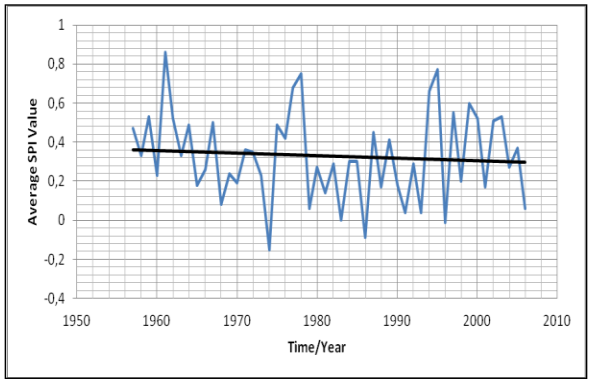

Figure 10: Average SPI Values for the Different Years in Maroua

Conclusion and Outlook

The results for this study suggest the following conclusion: 1. Northern Cameroon is a fragile region with vulnerable water resources. Even though there is the occurrence of climate change, this might not be the cause of the increasing water deficiency; 2. High temperature might have impacted the allocation of water in the different path way of the hydrological due to higher evapotranspiration rate; 3. Poor water management and the unsustainable use of water resources might be the principal cause for water deficiency in the region; 4. The increasing populations without putting forth efforts to understand, adapt and mitigate the problems of the already stressed water resources might have also contributed to the increased water shortage in Northern Cameroon.

Therefore, understanding water balance and the different components of water input and output are very essential for a reliable water resource planning for the region. Our next step is to quantify rainfall, quantify groundwater recharge, characterize the different pattern of recharge, characterize water resources, characterize water demand, calculate evapotranspiration, exploit different water harvesting techniques and then test adaptation model for the region.

References

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