POLICY BRIEF

Climate change impact on Meteorological hazards in the Volta River Basin, West Africa

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Context to the study

- Slightest changes in temperature and rainfall pattern could have a significant effect/influence on the frequency and intensity of meteorological hazards (e.g. floods and droughts).
- Changes in frequency and intensity of meteorological hazards could have significant implications on economic activities of every nation.
- Projected changes in temperature and rainfall patterns over the next decades are not well documented.

Summary of findings

- The mean annual rainfall is expected to increase marginally across the Volta basin over the next three decades.
- The mean annual temperature is expected to increase significantly across the Volta basin over the next three decades. The temperature increase could have dire consequence on economic activities of the people in the Basin.
- Extremely wet days and consecutive wet days are projected to increase in the coastal and Sahel zones respectively in the basin.
- Significant increasing trends in flood related indices (i.e. very heavy rainfall and extremely wet days) are expected across the Basin, but a decreasing trend for consecutive wet days in the Sahel, Savannah and Coastal zones is projected to occur.
- No significant change in drought related index (i.e. consecutive dry days), is expected across the basin.

Introduction

Climate change has increasingly become a serious threat to meteorological hazards such as drought and flood. The slightest changes in temperature and rainfall patterns could have a significant implication on economic activities in many countries around the world. In West Africa, the Volta river basin (Fig 1) is an important transboundary basin in the region shared by six riparian countries (i.e. Burkina Faso, Togo, Benin, Côte d'Ivoire, Niger and Ghana). These countries over the last few decades have been affected by increased intense rainfall events and long dry spells which often resulted in floods and droughts, causing many losses and damages. This makes the basin with a population of over 24 million vulnerable to the impact of climate change and extreme events.

In the basin, experiences in the past have shown that there are occasional erratic rainfall periods that characterize the three zones (Ndehedehe et al. 2017). Previous studies in Ghana indicate that climate extremes such as floods have resulted in drastic reduction in the national output of maize (6.3%) and rice (9.3%) (Stutley, 2010). This is problematic as it has serious implications on household food security, as a result of the rising prices of food commodities (Wossen et al., 2018), thereby affecting the attainment of sustainable development. However, only a handful of studies (e.g. Aziz, 2015; Larbi et al 2018; Okafor et al. 2021) on changes in climate and extremes under different climate scenarios over the basin exist. In order to address this gap, this study aims to contribute to the basic understanding of climate change, its impact on meteorological hazards and make policy recommendations that will contribute to achieving Sustainable Development in the Volta basin, West Africa. Specifically, to: (i) analyze the changes in rainfall and

temperature under Shared Socioeconomic Pathways (SSP) scenarios (SSP2-4.5 and SSP5-8.5) for the period 1985-2014 relative to 2021-2050 period over the Volta basin; and (ii) assess the spatio-temporal changes in meteorological extreme indices at the Basin between two periods (i.e. 1985-2014 and 2021-2050).

Information derived from this research is useful for planning and designing climate change adaptation measures to achieve Sustainable Development at the Basin.

Summary of research

The focus of the present research was to obtain comprehensive knowledge on the future impacts of climate change on the frequency and intensity of climate extremes across the Volta River Basin in West Africa over the next three decades. Temperature pattern in the basin was projected under two Shared Socioeconomic Pathways Scenarios (SSP2-4.5 and SSP5-8.5) of possible global warming. An ensemble mean of three climate models data for rainfall and temperature for the historical (1985-2014) and for two scenarios of climate change were used. The climate data were analysed using indices such as consecutive dry days, consecutive wet days, very heavy rainfall and extremely wet days. Annual rainfall and temperature were computed and their projected changes over the basin were also determined.

Figure 1: The Volta river basin and spatial distribution of rainfall and temperature

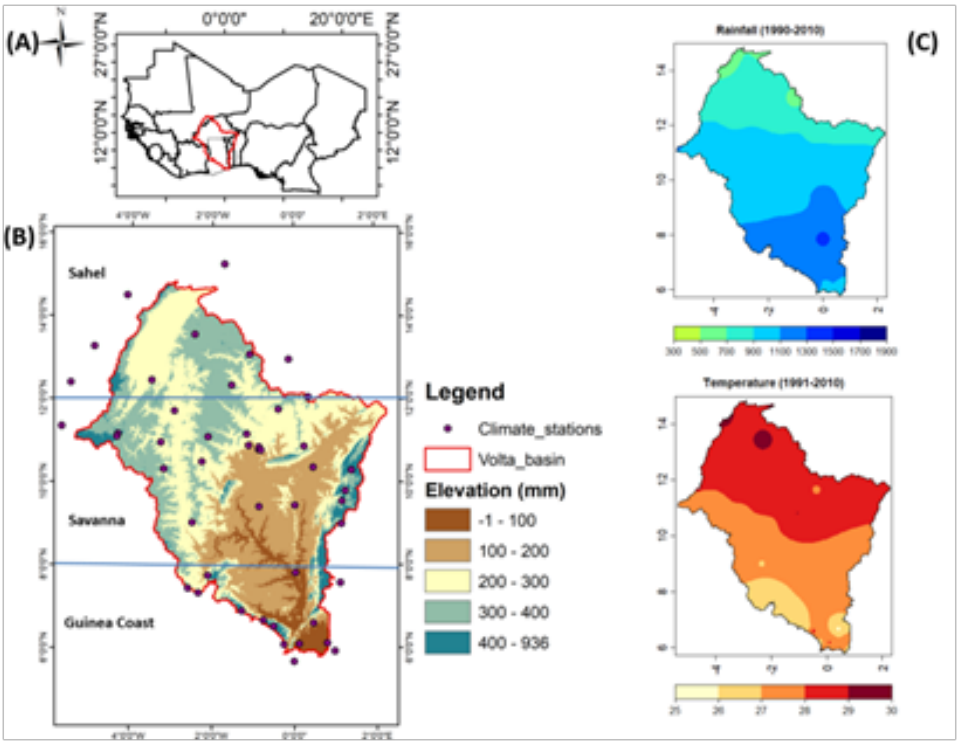
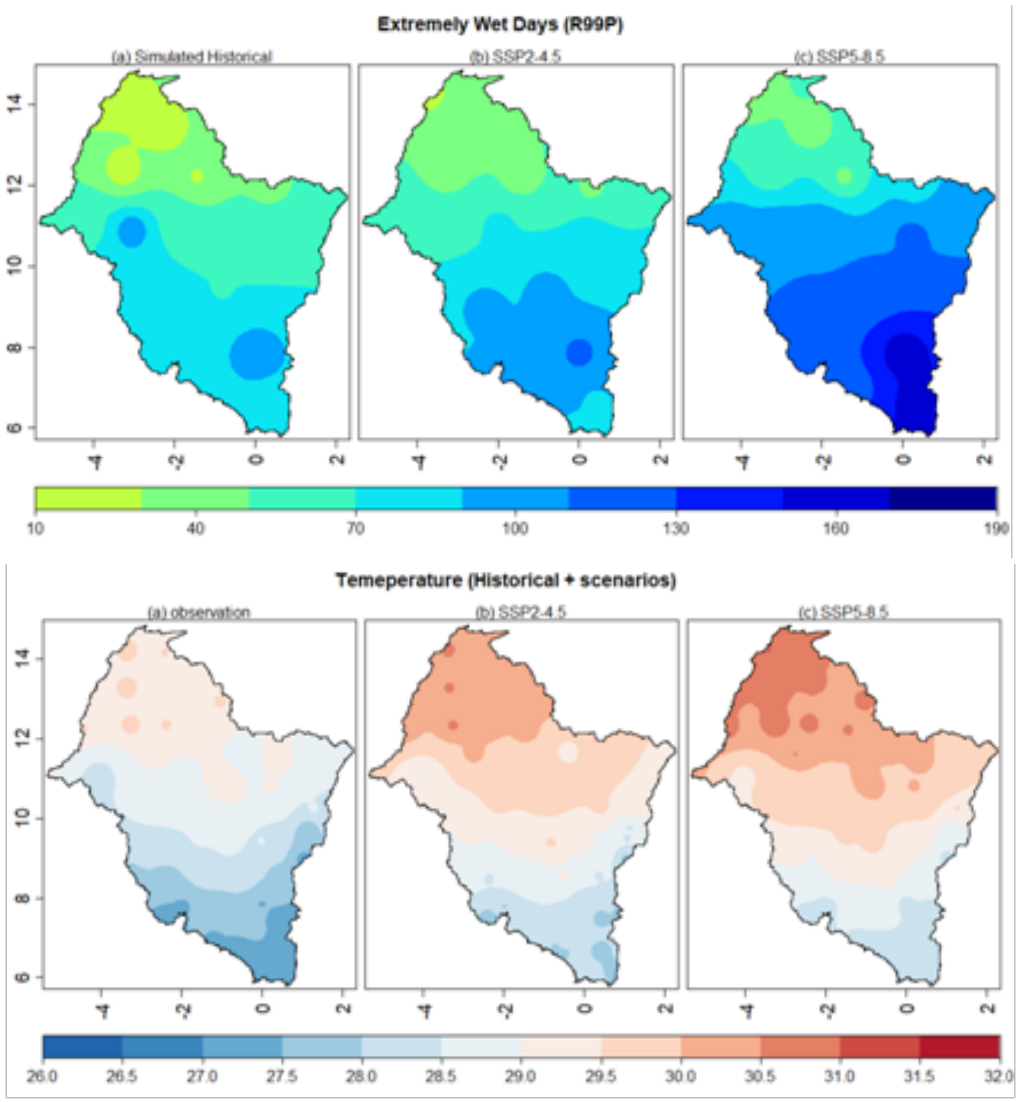


Figure 2: Spatial distribution of extreme wet days and temperature.



Policy recommendations

The outcome of the study indicates a projected increase in temperature under both SSP2-4.5 and SSP5-8.5 scenarios. The rainfall projections in the Volta basin are also expected to have a significant impacts on the availability and accessibility of basic human needs such as food and water. This means there is the need for some measure to be put in place to minimised the advese impact of higher temperatures on economic growth. Some of these measures includes;

- Improvement in meteorological extremes monitoring and early warning systerms at the basin. There is the need for non-conventional Environmental monitoring systems (EMS) based on open technology for disaster risk reduction at the basin. The adoption of non-conventional EMS can potentially increase the capacity of the countries within the basin to fast react against meteorological induced extreme events and associated hazards, better understands natural phenomena, and increase the reliability of climate models.

- Capacity building of key stakeholders at the basin. Integrated water resources management framework should also enhance the capacity of competing interest groups, especially smallholder farmers and the fishery communities through education and the provision of adequate socioeconomic resources to ensure effective and efficient usage of the water resources in the Volta River basin.

- Intensification of afforestation projects. The Sahel is already noted to be hot. To minimize the effects of the projected high temperature in the region, we recommend that the governments and their development partners intensify afforestation projects, particularly those involving less-water consumption plants.

- Intensive education and robust/resilient infrastructural development. Very high rainfall is projected in the Sahel and Savannah zones. Therefore, intensive education and robust/resilient infrastructural should be strengthened by governments and the Volta Basin Authority to minimize the effects of flood events that may occur.

- Innovative methods of water harvesting and storage, exploring alternative water resources such as groundwater, and improved irrigation methods during the dry seasons should be encouraged among households in the Coastal zone.

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