Chapter 10
Impact of Climate Change on Water Resources in Eastern Africa

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ABSTRACT
Climate change is causing great impact on water resources in Eastern Africa, and there is need to establish and implement effective adaptation and mitigation measures. According to IPCC, less rainfall during the months that are already dry could increase drought as well as precipitation, and this has great impact on both permanent and seasonal water resources. Increased sea surface temperature as a result of climate change could lead to increased drought cases in Eastern African and entire equatorial region. Climate change will also result in annual flow reduction in various river resources available within the region such as the Nile River. IPCC predicts that rainfall will decrease in the already arid areas of the Horn of Africa and that drought and desertification will become more widespread, and as a result, there will be an increased scarcity of freshwater even as groundwater aquifers are being mined. Wetland areas are also being used to obtain water for humans and livestock and as additional cultivation and grazing land. This chapter reviews the climate change impacts on water resources within the Eastern Africa Region. The climate change impacts on different water resources such as Ewao Ngiro have been highlighted and projection of future climate change on water resources examined. Stream flow for Ewaso Ngiro was found to have a significant increasing trend in 2030s of RCP4.5 and non-significant decreasing trend in stream flow in 2060s for RCP4.5.

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INTRODUCTION

Climate change will affect the water balance, and particularly the amount of runoff and recharge, which in turn determines the water resources available for human and ecosystem uses. Some parts of the world will experience a reduction in resource availability, while others will see an increase (Urama and Ozor, 2010). Here we assess the effects of climate change on water resources both globally and regionally, comparing these effects with other stresses on the environment.

Interest in global water resources has risen significantly in recent years as increasing population and its concentration within urban areas have increased pressures on the amount and quality of water resources (Kisaka et al., 2015). The Comprehensive Assessment of the Freshwater Resources of the World estimated in 1997 that approximately one third of the world’s population lives in countries experiencing moderate to high water stress, and forecast that by 2025 as much as two thirds of a much larger world population could be under stress conditions simply due to the rise in population.

The contrast between recent observed and simulated trends in a global climate warming has inspired a debate about conceivable events and indications for future climate fluctuation projections. The illustration of the mean state and inconsistency of recent changing climate is indispensable for various purposes in local, regional and global change studies. These incorporate the observation and identification of environmental change and climate model assessment (Orimoloye et al., 2018).

The projection of future climate change involves careful evaluation of models, taking into account uncertainties in observations and consideration of the physical basis of the findings, in order to characterize the credibility of the projections and assess their sensitivity to uncertainties. Different climate models have varying degrees of success in simulating past climate variability and mean state when compared to observations. Verification of regional trends provides further information on the credibility of model projections (IPCC, 2013). With one-third of the population living in drought-prone areas, Africa is considered the most vulnerable continent to climate change (Adhikari et al. 2016). This chapter attempts to discuss the temperature projections in the African context within the 4 continental sub regions (Eastern, Western, Southern and Northern Africa) and highlights how those projections will impact on the changes in precipitation.

INDICES OF WATER RESOURCES STRESS

There are many possible indices of water stress, considering different aspects of use and availability. The basic measure used in the Comprehensive Assessment is the ratio of
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