Surface water demand and supply of Gaborone City and surrounding areas as driven by climate change and population increase

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Abstract

Most governments have implemented laws and water management strategies. However, the adequate supply of the ever-increasing demand of fresh water continues to be a challenge. For example, many regions are facing formidable freshwater management challenges and resultantly allocation of limited water resources. One of the fundamental concerns is the impact of climate change and population increase on the supply and demand of fresh water in urban areas and high population surrounding villages. The anticipation for better lifestyles and improved water supply has resulted in an increase in migration from rural settlements leading to an increase in the populations of many cities globally. This study therefore investigates the variability and trends in the surface water demand and supply of the city of Gaborone and surrounding areas (Tlokweng, Mogoditshane, Kumakwane, Mmopane, Gabane and Gakuto) in response to population growth trends and climate change scenarios using the Water Evaluation and Planning (WEAP) hydrological model. The study includes analysis of population trends, water production and consumption rates, hydrological information as well as historical and projected climate data at a high spatial resolution of 1 km^2. The current General Circulation (GCM) or Regional Climate (RCM) models are not able provide such data. Therefore, the climate data for existing GCMs will be statistically downscaled using the high resolution Worldclim data to spatial resolution of 1 km^2 and bias corrected against Global Climatology Precipitation Center (GPCC) precipitation and Climate Research Unit (CRU) minimum and maximum temperature. The GCM data for historical as well as mid-range Concentration Representative Pathways (RCP4.5) and high emission RCP 8.5 future scenarios of Coupled Model Inter-comparison Project Phase 5 (CMIP5) will be employed in the study. Upon completion, the results of the study could be used for water resources planning and policy analysis, climate change mitigation and awareness creation and educational purposes.