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Estimating the effect of climate change on the hydrology of River Ssezibwa catchment, Uganda

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One of the most potential impacting consequences of climate change will be the alteration of regional hydrological cycles, which will affect nearly every aspect of human well being. African countries are most vulnerable to these changes due to lack of institutional capacity and economic development. However, many climate change impact studies on hydrological regimes especially in Africa have relied on use of direct GCM outputs, which are too course and do not accurately predict local climate. The purpose of this study was therefore to estimate the effect of downscaled climate change scenarios on the hydrology of the Ssezibwa catchment (Uganda). The first part of this study examined the current trends in climate in the study area. The basin's hydrology was then analyzed for climate change using both hypothetical and downscaled climate change scenarios. Hypothetical scenarios were used to investigate the sensitivity of the catchment to climate change. Climate change scenarios were developed for three future periods 2020's, 2050 and 2080's by statistically downscaling rainfall and potential evapotranspiration using GCM outputs taken from the Hadley climate model (HAdCM3) for the high (A2) and low (B2) IPCC SRES scenarios. The results were used as inputs to the WetSpa hydrological model, a physically based distributed rainfall-runoff model which was used to simulate the resulting hydrological changes. One of the key findings was that climate change is actually taking place in the study area. The results further showed that precipitation in the study area will generally decrease while temperatures will increase reaching average daily values of 33°C in the dry periods. These changes were shown to significantly impact the river discharge by reducing the flows in the dry periods especially between May and September, while heavy floods are expected in the wet months between November and March. In the 2020's these changes were shown to be small, but they will increase significantly in the beginning the 2050's. Since the downscaling process is associated with much uncertainty, the results of this study should provide a basis for further research of especially the downscaling of precipitation data.

Key words: Climate change, downscaling, hydrology, WetSpa