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Climate Change Impact on Lake Ziway Watershed's Water Availability, Ethiopia

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Abstract

Lake Ziway, an Ethiopian Rift Valley Lake, is located about 160kms south of the capital city, Addis Ababa, between 7°51'N to 8°7'N and 38°43'E to 38°57'E. It has an open water area of 434km² and average depth of 4 m. The area is characterised by semi-arid to sub-humid climate with mean annual precipitation and temperature of 650mm and 25°C, respectively. The lake watershed, which covers an area of about 7300km², is composed of two main rivers flowing in to the lake, Meki and Katar, and one river flowing out of the lake, Bulbula. To estimate the level of impact of climate change on the watershed's water availability, climate change scenarios were developed for four future periods of 25 years until the year 2099 using the outputs of HadCM3 coupled atmosphere-ocean GCM model. These outputs were downscaled to the watershed scale through the application of the SDSM model. Generally, both precipitation and temperature show an increasing trend from the 1981–2000 (base period) level. It is estimated that the average monthly and annual precipitation in the watershed might increase by up to 29 % and 9.4 %, respectively. Besides, the average maximum temperature might rise up to 3.6°C, and 1.95°C; and the average minimum temperature 4.2°C and 2°C monthly and annually, respectively. These changes of the climate variables were applied to SWAT hydrological model to simulate future flows. The simulation result reveals that, except during the 2001–2025 period, the total average annual inflow volume into Lake Ziway might decline significantly by up to 19.47 % for A2a- and 27.43 % for B2a-scenarios. This combined with the unbalanced supply-demand equation in the watershed is expected to have significant impact on the lake water balance. This could even worsen the recent lake level fluctuation and aerial coverage contraction. Hence, in Lake Ziway Watershed, runoff is likely to decrease in the future and be insufficient to meet future demands for water of the ever increasing population in the region.

Keywords: A2a, B2a, Ethiopia, GCM, HadCM3, Lake Ziway, Rift Valley, Scenario, SDSM, SWAT, Water balance, Watershed