

Spatio-temporal water resource responses to land use land cover change in semi-arid Upper Tekeze Basin, Northern Ethiopia

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Abstract

Water shortage remains a prevalent problem in the semi-arid Upper Tekeze Basin (UTB) due to the short duration of the rainy season and high rainfall variability. This has been resulted in recurrent droughts and the groundwater is also affected, especially in the dry season, with many wells getting drier. The Growth and Transformation Plan (GTP) of Ethiopia envisages more intensive agricultural practices and land use land cover (LULC) changes. The future LULC can exacerbate the water shortage by affecting the complex water fluxes in the surface and groundwater domains. This requires in depth investigations of the spatio-temporal surface-groundwater interactions and groundwater resources changes. This can be realized through the application of an integrated hydrological models (IHM). However, the poor coverage of ground-based hydro-meteorological gauging stations challenged application of the IHM. Therefore, this study proposes research approach consisting of three main objectives to address the aforementioned problems in the UTB. Firstly, relatively high resolution satellite derived rainfall and potential evapotranspiration estimations will be validated. The satellite based products will be merged with in-situ observations to improve their quality and these will be used to address the spatio-temporal input for the IHM. Secondly, an IHM will be conceptualized and calibrated to quantify the surface-groundwater interactions and groundwater resources in a spatio-temporal manner. Thirdly, LULC change will be predicted and afterwards used as constrain in the IHM to predict future water resources changes. This study is part Ethiopian Education Network to Support Agricultural Transformation (EENSAT) project and it will contribute to the objective of integrating geo-spatial data and earth observation techniques for water resource applications. The output of this study will contribute to sustainable water resource management and as a pilot study that can be followed in other Basins in Ethiopia.

Keyword: Satellite rainfall and potential evapotranspiration, surface-groundwater interaction, integrated hydrological modeling, Land use land cover change prediction, Upper Tekeze Basin, Ethiopia