

Streamflow Modeling Using the PyTOPKAPI Model with Remotely Sensed Rainfall Data: A Case Study of Gilgel Ghibe Catchment, Ethiopia

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Abstract : Remote sensing contributes valuable information to streamflow estimates. Usually, stream flow is directly measured through ground-based hydrological monitoring station. However, in many developing countries like Ethiopia, ground-based hydrological monitoring networks are either sparse or nonexistent, which limits the manage water resources and hampers early flood-warning systems. In such cases, satellite remote sensing is an alternative means to acquire such information. This paper discusses the application of remotely sensed rainfall data for streamflow modeling in Gilgel Ghibe basin in Ethiopia. Ten years (2001-2010) of two satellite-based precipitation products (SBPP), TRMM and WaterBase, were used. These products were combined with the PyTOPKAPI hydrological model to generate daily stream flows. The results were compared with streamflow observations at Gilgel Ghibe Nr, Assendabo gauging station using four statistical tools (Bias, R², NS and RMSE). The statistical analysis indicates that the bias-adjusted SBPPs agree well with gauged rainfall compared to bias-unadjusted ones. The SBPPs with no bias-adjustment tend to overestimate (high Bias and high RMSE) the extreme precipitation events and the corresponding simulated streamflow outputs, particularly during wet months (June-September) and underestimate the streamflow prediction over few dry months (January and February). This shows that bias-adjustment can be important for improving the performance of the SBPPs in streamflow forecasting. We further conclude that the general streamflow patterns were well captured at daily time scales when using SBPPs after bias adjustment. However, the overall results demonstrate that the simulated streamflow using the gauged rainfall is superior to those obtained from remotely sensed rainfall products including bias-adjusted ones.

Keywords : Ethiopia, PyTOPKAPI model, remote sensing, streamflow, Tropical Rainfall Measuring Mission (TRMM), waterBase

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