Comparative Analysis of Baseflow Separation using Conventional and Deep Learning Techniques

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Abstract

Accurate quantitative evaluation of baseflow contribution to streamflow is imperative to address seasonal drought vulnerability, flood occurrence and groundwater management concerns for efficient and sustainable water resources management in watersheds. Several baseflow separation algorithms using recursive filters, graphical method and tracer or chemical balance have been developed but resulting baseflow outputs always show wide variations, thereby making it hard to determine best separation technique. Therefore, the current global shift towards implementation of artificial intelligence (AI) in water resources is employed to compare the performance of deep learning models with conventional hydrograph separation techniques to quantify baseflow contribution to streamflow of Piney River watershed, Tennessee from 2001-2021. Streamflow values are obtained from the USGS station 03602500 and modeled to generate values of Baseflow Index (BI) using Web-based Hydrograph Analysis (WHAT) model. Annual and seasonal baseflow outputs from the traditional separation techniques are compared with results of Long Short Term Memory (LSTM) and simple Gated Recurrent Unit (GRU) models. The GRU model gave optimal BFI values during the four seasons with average NSE = 0.98, KGE = 0.97, r = 0.89 and future baseflow volumes are predicted. AI offers easier and more accurate approach to groundwater management and surface runoff modeling to create effective water policy frameworks for disaster management.

Keywords : Baseflow, Disaster preparedness, Groundwater management, Flood, Deep learning

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