Impact of Resolution and Source of Digital Elevation Model on Topological Attributes and Simulated Runoff by SWAT Model

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Abstract

The Digital Elevation Model (DEM) of a watershed is one of the most important inputs in most hydrological analyses and plays a key role in the accurate prediction of various hydrological processes. Comprehensive knowledge of the impact of different DEM sources on the performance of a model is essential before utilizing the model. In this study, we evaluated the influence of TOPO1:25000, ASTER, and SRTM DEMs, as input, on the performance of the Soil and Water Assessment Tool (SWAT) model for the prediction of surface runoff. We also investigated the effect of the resolution of the studied DEM sources on the accuracy of the SWAT model in the estimation of runoff. The second objective of this study was to identify the most influential and the least impactful input parameters on the performance of the SWAT model. We studied the Zarrineh River watershed in Iran as a case study to compare the effect of the aforementioned DEM types and DEM resolution on the output of the SWAT model. The outcomes of the study demonstrated that influential parameters on predicted runoff as well as a few watershed parameters, such as reach lengths, reach slopes, number of sub-basins, and the number of hydrologic response units (HRU), differs noticeably when the DEM source and resolution changes. It was also observed that simulated results over-predict the runoff during low precipitation periods and under-predict the runoff during high precipitation months, and the accuracy of the simulated results decreases by reducing the DEM resolution. The results showed that the SWAT model had the best performance when the TOPO1:25000 DEM was used as the input source. Low-resolution DEMs are available to a wider range of researchers. The outcomes of the current study can be employed to estimate the impact of low-resolution input data on the simulated result as well as substantially reduce the computation time by decreasing the input DEMresolution with only a minor reduction of accuracy.

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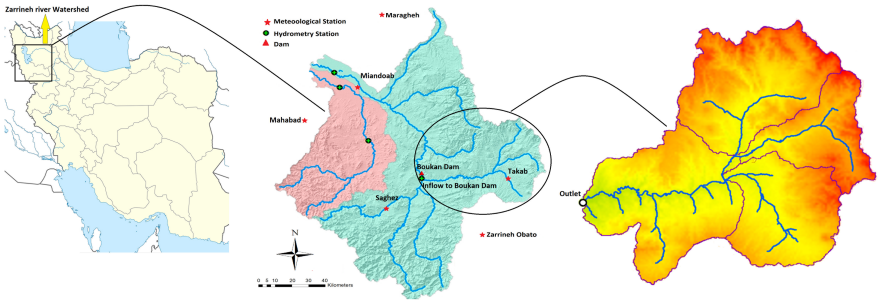

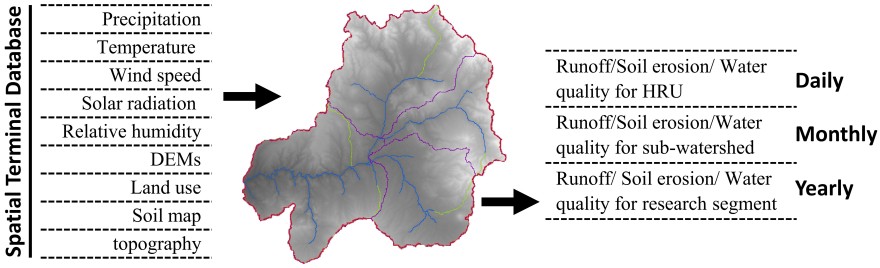

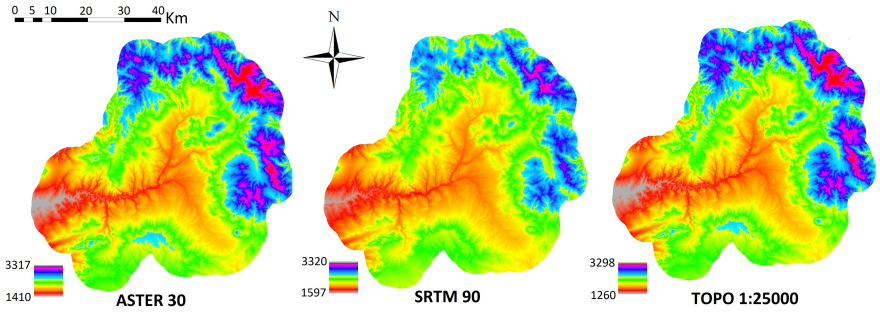

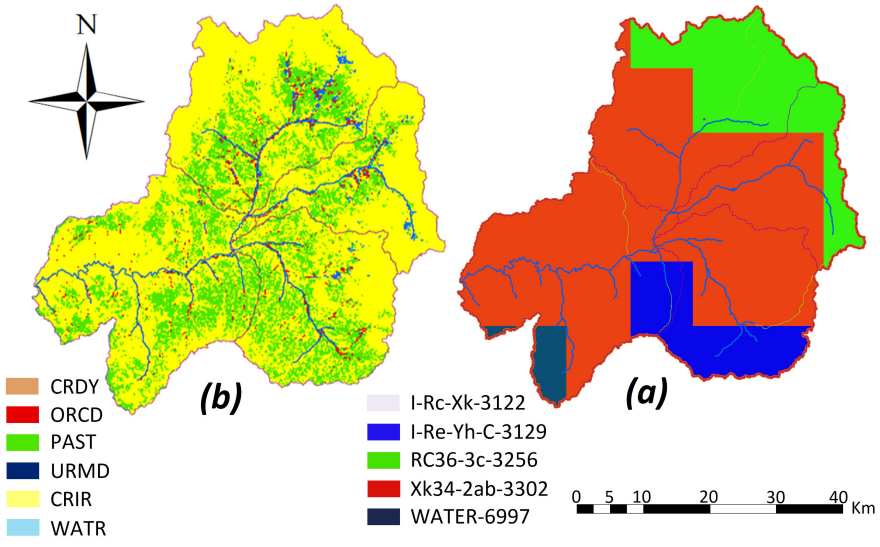

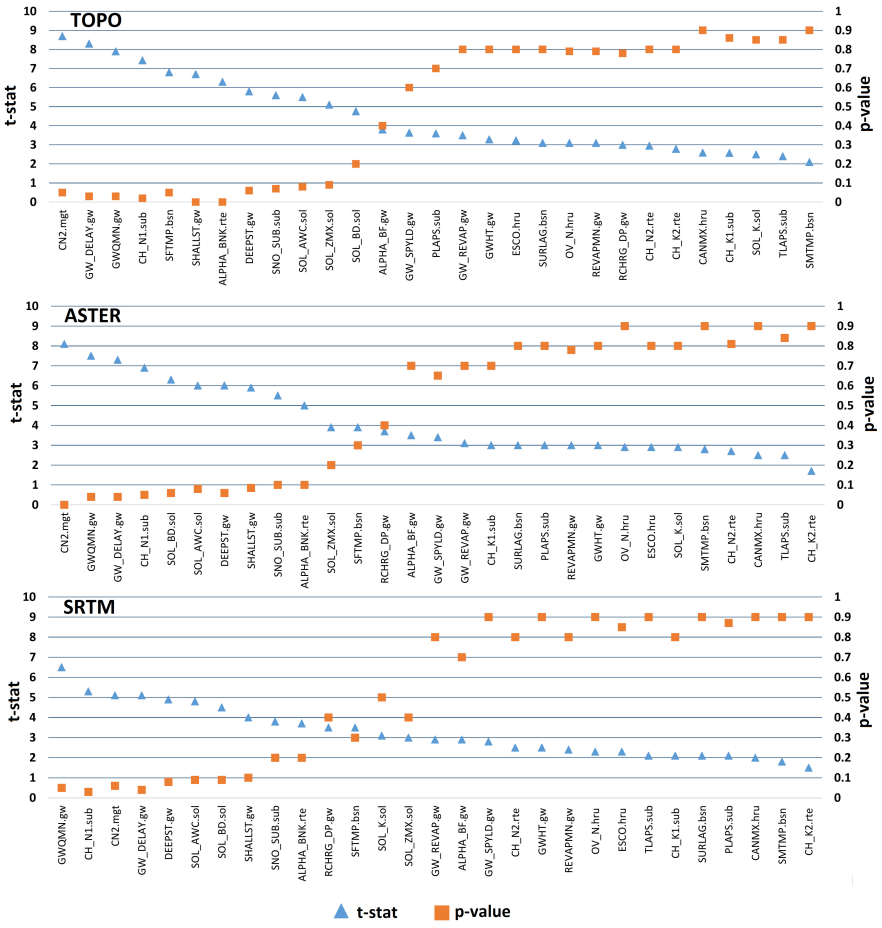

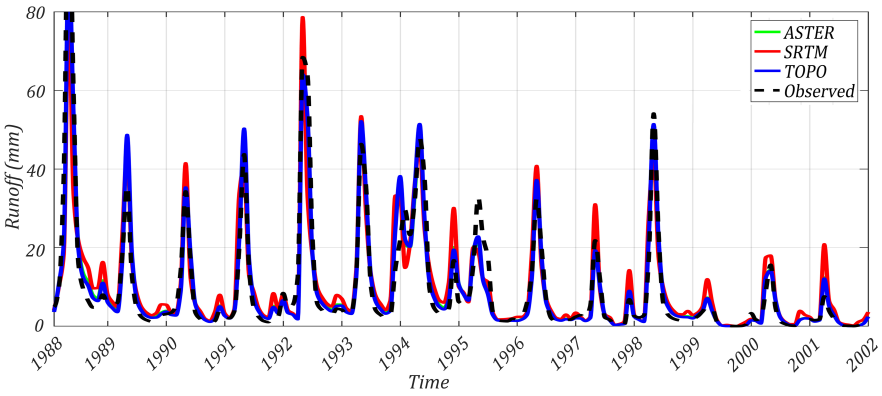

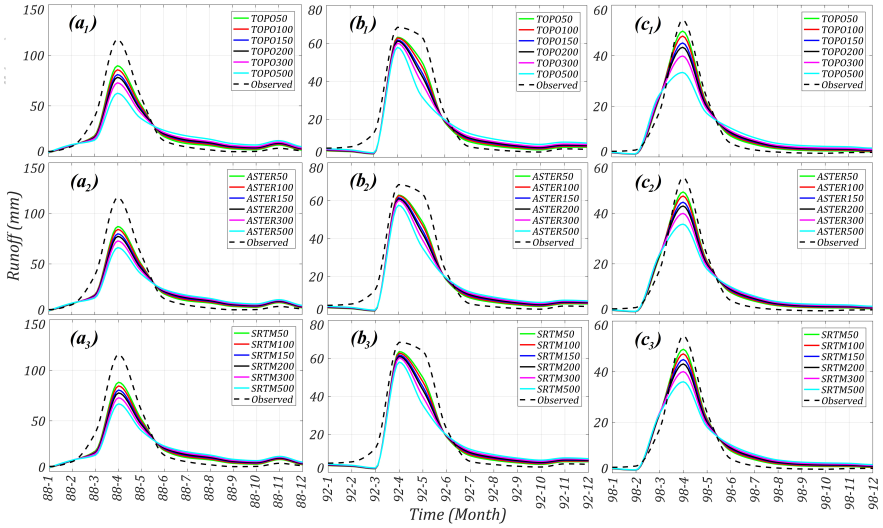

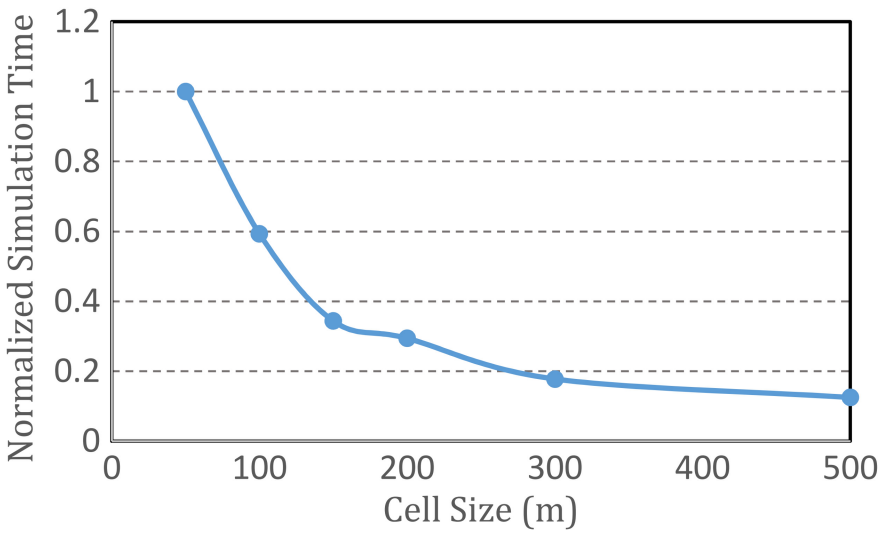

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