Topic: Understanding the sensitivity of parameters while estimating the streamflow using HEC-HMS

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Introduction:

The focus of my current research is to conduct a comprehensive sensitivity analysis of key parameters involved in estimating streamflow using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS). This study aims to evaluate various datasets to discern the impact of different parameters on the accuracy of streamflow estimation.

Data:

Streamflow in a watershed primarily originates from precipitation. Rainfall data is utilized to estimate and validate streamflow against observed data. Additionally, Digital Elevation Models (DEM) and Soil Survey Geographic Database (SSURGO) data are employed to enhance the accuracy of estimations.

The watershed under investigation is monitored by four gauge stations. Hourly streamflow data were sourced from the U.S. Geological Survey (USGS) in 2016. These gauge stations provide crucial information on both rainfall and discharge, which can be easily downloaded in text format.

Two forms of rainfall data are considered. Firstly, previously available data obtained from the NASA Land Data Assimilation System, where hourly gridded rainfall data were aggregated over the entire watershed to derive a single rainfall time-series. Secondly, 15-minute precipitation data is extracted from the USGS website for various gauges, resulting in datasets available in text format.

In addition to precipitation and streamflow data, DEM, SSURGO soil data, and Land-use Land-cover (LULC) data are incorporated. DEM is obtained as a GeoTIFF file from the Earth Explorer of USGS. SSURGO, a comprehensive database on soil characteristics, is accessed as a geodatabase (gdb). LULC data, in raster format(.tif), is downloaded from the National Land Cover Database 2021.

Missing data is a common challenge in these datasets, stemming from instrument malfunction, in-situ issues, or storage errors. Both streamflow and precipitation datasets may have gaps, while SSURGO gdb may lack soil type information in certain areas. To mitigate this, missing points in the soil data are substituted with nearby soil values.

Proposed Project Results:

In the long-term scope of this project, I aim to leverage the acquired data within ArcGIS and HEC-HMS to derive essential parameters for runoff loss calculation and hydrograph formation. These parameters will be systematically varied to assess their sensitivity and behavior, with resulting hydrographs compared against observed streamflow hydrographs. The ultimate objective is to deepen our understanding of how alterations in input parameters influence streamflow predictions, which is crucial for informed water resources management and flood forecasting efforts.