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Comparison of local and regional methods to estimate peak flow quantiles based on synthetic records

Gabriel Perez (1), Ricardo Mantilla (1), Witold Krajewski (1), and Daniel Wright (2)

(1) IIHR—Hydroscience & Engineering, Department of Civil and Environmental Engineering, The University of Iowa, Iowa City, Iowa 52242, USA, (2) Civil and Environmental Engineering, University of Wisconsin-Madison, Madison, Wisconsin 53706, USA

Multiple studies have evaluated different Peak Flow Quantile (PFQ) estimation methods. Most of these studies, however, rely on short observational records. Since the "true" underlying asymptotic distribution of peak flows is not known, the actual contributions to PFQ estimation uncertainty from sampling error and model error cannot be reliably quantified. This research examines PFQ estimation using synthetic peak flow data at 5,000 sites in the Turkey River basin with respect to the "true" PFQs by means of four well known methods. Data was generated using a distributed hydrologic model that considers heterogeneity in land surface properties and river drainage network structure. The model is forced with randomly generated rainfall fields using the data-driven Stochastic Storm Transposition (SST) framework. First, we use At-site Flood Frequency Analysis using the Pearson Type III probability distribution and L-moments. Then, we pool regional information using (1) the Index Flood Method; (2) the Quantile Regression Technique; and (3) the Parameter Regression Technique. The results in this synthetic "world" in which the "true" PFQs are known, allow us to quantify the magnitude of the errors in PFQs induced by estimation method, record lengths of sample data, and the number of sites pooled in regional approaches.