A Quantitative Comparison of Prediction Methods for Daily Streamflow Time Series at Ungaged Sites

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The existence of reliable, continuous daily records of natural streamflow enhances our ability to manage our water resources. In many regions, due to a lack of adequate gaging resources, it is necessary to create representative records where none exist. Research on prediction in ungaged basins (PUB) has been very active over the past decade. We report the findings of an ongoing national study by the U.S. Geological Survey, which seeks to provide spatially and temporally continuous 30-year records of historical daily records of natural streamflow (1980-2010) at the watershed scale (HUC-12). Employing data from 182 nearly pristine basins in the Southeast United States, a three-fold validation procedure was used to simulate the ungaged case for each basin. Ungaged flows were estimated using transfer-based methods: standardizing by drainage area, mean flows, means and standard deviations, and using an interpolation of flow duration curves (QPPQ). The effect of index-gage selection was also considered: using the nearest-neighboring gage or the gage with the greatest correlation. These methods were compared with a daily version of the Analysis of Flows in Networks of Channels (AFINCH) model and the Precipitation-Runoff Modeling System (PRMS), a deterministic model. We developed a multi-objective, comparative assessment of PUB methods. The selection of an optimal PUB method is shown to depend on the intended application of the estimated flow record. We identify the PUB methods that perform best across the 32 goodness-of-fit metrics considered.