

CEE 574. Advanced Hydrology (Due May 21st)

Homework assignment 3:

Question. Generation of annual streamflow data.

Download the entire annual mean daily flow data for USGS 05389500 Mississippi River at McGregor, IA. In the data you will see a positive trend with time. A positive trend maybe caused by two potential reasons, either, (a) there is change in the climate and/or land use; or (b) internal system dynamics with the groundwater memory leading to persistent trends without change in the external forcing. In this question you will explore if the latter may be the cause of the trend.

- a) Calculate the lag-1 correlation of the data and the Hurst coefficient. Is the lag-1 correlation significant and does the data show persistence?
- b) Perform the Mann-Kendal test and identify if the observed trend is statistically significant at $\alpha=0.05$.
- c) Use 1st order autoregressive model available on canvas for annual flows in this river. The model requires log transformation. The Excel spreadsheet called Matalus.xls can be used for that. Report the calculated mean, standard deviation, and the “ a ” calibration parameter of the model.
- d) Experiment with the model and generate time series of 300 years. Because a sample size of 300 is not so large, you may not get a very close skewness in your first set of generated data with that of the observed annual data. Therefore, repeat your model runs until you get a closer value to the calculated skewness of the data set. Estimate the lag-1 correlation coefficient and the Hurst exponent, H , and compare with those of the observed data.
- e) By screening the time series you generated try to see if the generated data sequence contain a period that look like a long-term trend as observed in the data. You can use the correlation coefficient and the observed range of the data in screening your data. Could the model reproduce the observed trend in data? Can you find a period, in the generated data, that looks similar both visually and statistically to observations? Can you rule out the causes due to climate/land use change in this data?