Study project/master's thesis @HFM:

Can modeled river flow errors be explained by changes in the rating curve?

Problem description

To determine river flows on a regular basis, measurements are made during various conditions where depths of flows are unique. The flows are then linked to the depths based on a non-linear relationship called the rating curve. Afterwards, flow depths are used as a proxy to obtain discharge without any cumbersome river flow measurements. There are problems with this approach. If the cross-section of a channel is not maintained over time, the performance of the rating curve deteriorates. These "erroneous" values are used as truth by users (such as us modelers). The model is calibrated using these as a reference without taking into consideration their uncertainty. The manner is which a river cross-section evolves is not known in advance and cannot be taken into account in real-time. The rating curves are updated regularly but the time of updating them does not coincide with that of the channels being modified.
When a rating curve is updated, one can visualize how it is different than the previous one by plotting the depth of flow against river flow. Using this information, a mapping can be prepared that holds the evolution of the rating curve from the old one to the new one. The manner of evolution can be continuous, discharge volume dependent or discrete in time. Using this mapping, new discharge values can be estimated and then used for calibration. An evaluation can be made to see if the performance of the model has changed.

Steps

The plan would be roughly as follows: Prepare model inputs such as precipitation and temperature. Collect river flow and depth data. Find periods where a given rating curve is applicable by an automatic procedure. Mappings are prepared that define the evolution of the rating curve in time. These can be numerous. Next, the model is calibrated using the observed flows and the flows resulting from the new rating curves. Comparisons are drawn between the performance of the various calibrations and validations.

Requirements

The student is expected to have some background in rainfall-runoff modeling, statistics and programming in python as everything mentioned above is coded in it. The required background could be acquired before and/or during the study.

Contact

Interested students may write to me **(faizan.anwar@tum.de)** for further discussion. The work load can be adjusted depending on the student if they want to pursue a study project or a master's thesis.