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Gauging the ungauged catchment: a flow-duration curve approach

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Already a few discharge measurements may contain enough information to be useful for calibrating a hydrological model. Taking a few measurements might therefore be a good strategy for reducing model predictive uncertainties in ungauged catchments. However, more guidance is needed regarding when and how to take measurements, and how uncertainties can be accounted for when these data are used to constrain model simulations.

In this study we investigated how much a few discharge measurements together with the installation of a water-level recorder can reduce the simulation uncertainty at an ungauged site. We used water-level and discharge measurements from the Brue catchment in England together with simulated discharge at an hourly time step from TOPMODEL. The discharge measurements and the water-level data were used to estimate the flow-duration curve for the period of water-level record, which was then used to calibrate the model in GLUE accounting for observational uncertainties in discharge. We investigated how the simulation uncertainty was constrained depending on both the number of discharge measurements within different flow intervals and the length of the water-level record. With an appropriate choice of flow intervals, the simulation reliability was often comparable to using the complete discharge record for calibration. Some discharge measurements were associated with large errors, and when these were used the reliability of the calibration was significantly degraded, which emphasises the importance of high-quality discharge data.