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Assessing discharge measurement errors at a gauging station in a small catchment (Vallcebre, Eastern Pyrenees)

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The Cal Rodó catchment (4.17km^2) is located in a Mediterranean mountain area. Land cover is dominated by pastures and forest and badlands represent 2.8% of the surface of the catchment. Elevation ranges between 1100m and 1650m and average annual precipitation is about 900mm with heterogeneous distribution along the year. Autumn and spring are the seasons with more precipitation. Flash floods are relatively frequent, especially in autumn and are associated with high sediment transport. The period of observation ranges from 1994 to 2008. Discharge is measured in a gauging station controlled by a two levels rectangular notch weir with two different widths and contraction conditions that ensure a unique relationship between flow depth and discharge. The structure, designed to flush sediment, enables to capture a wide range of discharge. Flow depth is measured using a pressure sensor. Instantaneous discharge was lower than 0.1m^3/s approximately 95% of the time and higher than 0.5 m^3/s approximately 1% of the time. The largest runoff event measured produced instantaneous discharge of approximately 10m^3/s. The second level of the gauging station was rarely reached since it was flooded in average 1.5 times per year but the corresponding events contributed to approximately 60% of the sediment transport. The structure is efficient as it was never submerged over the observed period and sediment deposition was negligible but it has a complex shape that makes difficult to relate accurately water depth to discharge, especially for large runoff events. In situ measurement of discharge by current meters or chemical dilution during high water stages is very unfeasible due to the flashiness of the response. Therefore, a hydraulic physical model (scale 1:11) was set up and calibrated to improve the stage-discharge curve and estimate the measurement errors of discharge. Sources of errors taken into account in this study are related to the precision and calibration of the pressure sensor, the effect of sediment concentration on water pressure, the geometry of the hydraulic model, and the shape of the embankments at the entrance of the gauging station.