Calibration of a hydrological model using sediment proxy data.

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ABSTRACT:

Lack of sediment yield records has always been one of the most important limitations for the use of sedimentological models. In some catchments, this problem may be overcome by using reservoir deposits as an estimation of the mean sediment yield during the reservoir life or the period included between two bathymetries. This technique has already been employed in the past 20 years, although only a few times for calibration and validation of distributed sediment models. In order to improve the information provided by reservoir deposits, palaeohydrological techniques can help identifying layers deposited by different flood events (flood units) within a deposit, similarly to what is done for slack-water deposit descriptions. Quantifying the volume of each flood unit will possibly allow calibrating and validating a sediment model, and, in some case, also a hydrological model, given some initial hypotheses on the catchment hydrological regime. In this study we investigate the possibility of using a stratigraphical profile made across a check dam deposit for calibrating a distributed hydrological model.

Check dam sedimentation deposits are used as proxy data for the calibration of the hydrological model TETIS-SED in the "Rambla del Poyo" Mediterranean catchment (Valencia, Spain). In order to obtain detailed information about sediment yield, a 3.5 m trench was made across the deposit accumulated behind a 4.5 m tall check dam with a drainage area of 12.9 km^2. A stratigraphical description of the depositional sequence was carried out, identifying 15 flood units, i.e. 15 distinguishable layers, each corresponding to a flood event or to a single peak into a multi-peak flood event. For each event, the sediment volume was calculated, and a date was assigned based on traces of charcoal found in some of the deposited layers. The charcoal content is due to wildfires occurred in 1994 and 2000.

The TETIS-SED model was calibrated using sediment proxy data, and making the hypothesis of no flow base and hortonian infiltration mechanism (both hypotheses are confirmed by field observations). Sediment trap efficiency and dry bulk density of the check dam deposit were taken into account.

The obtained results were compared to discharge records available in a downstream stream gauge, with a drainage area of 184 km^2. The results show a good agreement between simulation and observation, although some errors were found, due especially to the lack of precision in estimating deposited sediment volumes.