Geophysical Research Abstracts
Vol. 16, EGU2014-3526, 2014
EGU General Assembly 2014

Full implementation of a distributed hydrological model based on check dam trapped sediment volumes

Gianbattista Bussi and Félix Francés

Universitat Politècnica de València, Research Institute of Water and Environmental Engineering (IIAMA), Valencia, Spain (gbussi@upvnet.upv.es)

Lack of hydrometeorological data is one of the most compelling limitations to the implementation of distributed environmental models. Mediterranean catchments, in particular, are characterised by high spatial variability of meteorological phenomena and soil characteristics, which may prevents from transferring model calibrations from a fully gauged catchment to a totally o partially ungauged one. For this reason, new sources of data are required in order to extend the use of distributed models to non-monitored or low-monitored areas. An important source of information regarding the hydrological and sediment cycle is represented by sediment deposits accumulated at the bottom of reservoirs. Since the 60s, reservoir sedimentation volumes were used as proxy data for the estimation of inter-annual total sediment yield rates, or, in more recent years, as a reference measure of the sediment transport for sediment model calibration and validation. Nevertheless, the possibility of using such data for constraining the calibration of a hydrological model has not been exhaustively investigated so far.

In this study, the use of nine check dam reservoir sedimentation volumes for hydrological and sedimentological model calibration and spatio-temporal validation was examined. Check dams are common structures in Mediterranean areas, and are a potential source of spatially distributed information regarding both hydrological and sediment cycle. In this case-study, the TETIS hydrological and sediment model was implemented in a medium-size Mediterranean catchment (Rambla del Poyo, Spain) by taking advantage of sediment deposits accumulated behind the check dams located in the catchment headwaters. Reservoir trap efficiency was taken into account by coupling the TETIS model with a pond trap efficiency model. The model was calibrated by adjusting some of its parameters in order to reproduce the total sediment volume accumulated behind a check dam. Then, the model was spatially validated by obtaining the simulated sedimentation volume at the other eight check dams and comparing it to the observed sedimentation volumes. Lastly, the simulated water discharge at the catchment outlet was compared with observed water discharge records in order to check the hydrological sub-model behaviour.

Model results provided highly valuable information concerning the spatial distribution of soil erosion and sediment transport. Spatial validation of the sediment sub-model provided very good results at seven check dams out of nine. This study shows that check dams can be a useful tool also for constraining hydrological model calibration, as model results agree with water discharge observations. In fact, the hydrological model validation at a downstream water flow gauge obtained a Nash-Sutcliffe efficiency of 0.8. This technique is applicable to all catchments with presence of check dams, and only requires rainfall and temperature data and soil characteristics maps.