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Hydrological and hydraulic characterisation of floodplain and its former channels from LiDAR imagery and GIS

Katarina Dzubakova (1,3), Jeremie Riquier (2), Herve Piegay (2), Ondrej Budac (4), and Milan Trizna (1)

(1) Comenius University in Bratislava, Department of Physical Geography and Geoecology, Bratislava, Slovakia (dzubakova@fns.uniba.sk), (2) UMR 5600 EVS / Site ENS de Lyon, Lyon, France, (3) Institute of Environmental Engineering, ETH Zurich, Zurich, Switzerland, (4) Faculte de Sciences de Base, Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland

In the past decades the availability of LiDAR has enabled occurrence of numerous studies profiting from one of the most precise representation of the surface. The aim of our study is to introduce a methodology for characterization of the hydrological regime of the floodplain, and its former channels using statistical raster (LiDAR) based model for calculation of inundation and its frequency, duration and shear stress in overbank flow channels.

In the following study, 4 by-passed reaches (Brégnier Cordon, Belly, Chautagne, Pierre Bénite) located on the upper Rhône river (southeast of France) were studied. All study reaches are old river channels whose hydrological regimes are influenced by dam structure build upstream studied area. Their average length is 10km. Simultaneously, 4 studied former channels are located in above mentioned four sectors. All of them are permantenly connected to the main channel at their downstream end with temporary upstream connections.

The inundation model, based on LiDAR and rating curves, computes the frequency, the duration and the shear stress of the inundation for each pixel of the floodplain for given time steps of discharge. For frequency and duration computation, 25 years old daily discharge time series were used (1986-2005). Our area of interest was defined as zone affected by inundation with 10 years frequency. The higher inundations were not considered due to the lack of data. The average and maximal discharge in the studied period of time were used for calculation of the shear stress. The error of calculation was estimated as a sum of LiDAR's precision and precision of hydrologic data.

The results point out the differences in the inundation dynamics of all four study reaches in volume, extent, frequency, and duration of inundation activity. The analysis of the former channels regimes gives an approximation of the water fluctuation in the study time period. The evaluation of the used methodology offers an indication to the former channels attributes (vegetation presence, morphology of the former channel corridor, etc.) that can help to assess the credibility of the modeled results.