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Dyke failure scenarios in Ubaye River, France using hydraulic modeling

Azadeh Ramesh (1), Thomas Glade (1), Gabriel Parodi (2), and Dinand Alkema (2)

(1) Geomorphic System and Risk Research Unit, Department of Geography and Regional Research, University of Vienna, Vienna, Austria (azadeh.ramesh@univie.ac.at), (2) ITC - Faculty of Geo-Information Science and Earth Observation of the University of Twente, Enschede, The Netherlands

In case of dyke failure, it is essential to evaluate possible effects in advance. In this context, simulations of different failure scenarios applying various hydrograph propagations are useful to investigate the river behaviour during a flood event. This study has been carried out for the Ubaye River, Southeast of France which has a modified and natural river bed. These two parts include a canalized channel in the city and the undisturbed river bed without any infrastructures. The dykes are located in urban reach of the river having an approximate height of 2 m and a length of 3.5 to 4 km. The applied analysis include the scenarios (1) and (2): Modeling of the 2008 flood having a maximum discharge of 209 m^3/s with and without the dykes, respectively and scenario (3): Modeling of flood event of 1957 with maximum discharge of 490 m^3/s considering of the dyke. HEC-RAS (US Department of Defense, Army Crops of Engineers) was used to model the dyke breach. Input of the geometry was achieved with HEC-GeoRAS (ArcGIS extension) and additionally, ArcGIS 9.3.1 was applied for spatial processing of the input and model of data, and to visualize the outputs.

In case of scenario (1) a normal retention depth of water and velocity were shown in the channel. The model indicated that maximum water depth and velocity in Ubaye River were approximately 2 m and 2.90 m/s respectively. This corresponds to the field reports of the flood 2008. The scenario (2) is affected by the channel maintenance and dyke structural integrity. The results showed that the banks were overtopped by the flood. In scenario (3) the effects were much more disastrous than in case of scenarios (1) and (2), with the dykes being overtopped on several sections in both banks in the urban sectional area and the natural reach of the river, assuming the same river morphology which was applied for scenarios (1) and (2). In scenario (3) it has been evaluated that if a severe flood happens both the structure of the dyke and its height are not sufficient to protect the area from inundation. So definitely overtopping of the dyke with current morphology of the river and current dyke structure could not protect the area in case of such design flood events. It is strongly recommended that the flat areas in both the city and natural sectors should be protected with dykes. Additionally, the channel modifications/improvements are foreseen.

Keywords: Dyke breaks scenario, hydraulic simulation, flooded area, channel maintenance.