Geophysical Research Abstracts
Vol. 13, EGU2011-6427, 2011
EGU General Assembly 2011

Roughness calibration and peak discharge estimation based on scars on trees inflicted by woody sediments

Juan Antonio Ballesteros (1), Jose María Bodoque (2), Andrés Díez-Herrero (1), Mauricio Sanchez-Silva (3), and Markus Stoffel (4)

(1) Department of Research and Geoscientific Prospective, Geological Survey of Spain (IGME), Ríos Rosas 23, Madrid E-28003, Spain, (2) Mining and Geological Engineering Department, University of Castilla-La Mancha, Campus Fábrica de Armas, Avda. Carlos III, Toledo E-45071, Spain, (3) Department of Civil and Environmental Engineering, Universidad de Los Andes, Bogotá Colombia, (4) Laboratory of Dendrogeomorphology, Institute of Geological Sciences, University of Berne, 3012, Berne, Switzerland; Climatic Change and Climate Impacts, Environmental Sciences, University of Geneva, 1227 Carouge-Geneva, Switzerland

Flooding has been a concern for people living in river valleys throughout history and represents one of the costliest natural events worldwide. Flood studies require the knowledge of past events, but systematic data are usually scarce or normally are not representative. Tree ring research is among different existing palaeohydrological and documentary approaches to extend the flood-frequency in short or ungauged catchments and it has recently used to flood dating and discharge reconstruction. However, some issues must still be addressed. An example of this is to study the mechanism of generation of scars, since it has important consequence for their use in flood studies. Scars inflicted by floating elements (i.e. ice or woody) are showing the maximum flood stage at a given time, so their may be used as benchmark for calibration of floodplain roughness as well as it has implications in palaeoflood discharge estimations.

In this study, we have studied the genesis of scar heights on trees found along the Alberche River in order to reconstruct an unrecorded flood discharge in this basin of Central Spain. To this end, we have used multiples scars on trees (non-systematic data) as benchmark for roughness calibrations and it is compared with results derived from systematic data (flow gauge). Therefore, our study is based on the combined use of dendrogeomorphologic evidence (i.e. scars on trees), data from the Navaluenga flow gauge, as well as a 1D/2D coupled numerical hydraulic model. A total of 49 scars have been analyzed with dendrogeomorphologic techniques.

Scar dates were related with 7 flood events documented in the systematic record (i.e. 1989; 1993; 1996; 2000; 2002; 2003; 2005), but we also could identify an additional unrecorded flood event that took place in 1970, which is before the flow gauge was installed at Navaluenga. Based on hydraulic modelling and observed flood stage derived from annually rating curves, we could not find a statistically significant difference between water depths registered at the flow gauge and scar heights on trees (p-value= 0.368). This finding is indicating that scars heights fit adequately with the water profile observed, so allowing us to think that, in our study site, scars could be generated through the impact of floating woody sediment. Under this premise, we have estimated the hypothetical real peak discharge of the 1970 flood event to 1684.3 $\pm$ 519.2 m3 s–1; which renders this event the largest known event for the Alberche River at the Navaluenga area. Finally, we discuss the use of scars on trees as benchmark for roughness calibration in ungauged or shortly recorded basins and the added value of dendrogeomorphologic data in flood frequency analysis addressed.