Geophysical Research Abstracts
Vol. 17, EGU2015-2075, 2015
EGU General Assembly 2015

Long-term entrenchment and consequences in present flood hazard in Garona River (Val d'Aran, central Pyrenees)

Ane Victoriano-Lamariano, Marta Garcia-Silvestre, and Gloria Furdada-Bellavista

RISKNAT Research Group, Dpt. Geodinamica i Geofisica, Facultat de Geologia, Universitat de Barcelona, Barcelona, Spain (gloria.furdada@ub.edu)

Flood risk is one of the most dangerous natural disasters in mountainous areas. Risk management and mitigation have to be based on exhaustive risk evaluation. Moreover, hazard analysis requires a multidisciplinary approach to achieve a complete understanding of the dynamics of the phenomena.
The Val d'Aran valley is located in the axial part of the Pyrenees and is drained by the Garona River. Flooding events are relatively frequent there. The last extraordinary episode occurred in June 2013. Considering both the main effects of this flooding and the geomorphology, the long-term dynamics of the Garona River was studied in two different areas (Arties-Vielha and Era Bordeta-Les), which are representative of the whole length along the Val d'Aran. In fact, present short-term processes can be partly explained as a result of the long-term fluvial tendency.
During the analysis of the 2013 flood effects, several entrenchment and incision indicators were found. Under the hypothesis that the fluvial network tends to incise, an entrenchment indicator analysis was carried out. Firstly, we considered the geomorphologic features, such as two generations of alluvial fans, two generations of alluvial terraces and, incisions on geomorphologic features and in Paleozoic bedrock. Secondly, we found out that erosion dominated over overflow and deposition during the 2013 flooding. Finally, great erosion was identified in engineering structures, for instance, in bridges, channelization dikes, gauging stations and dams.
The geomorphologic analysis and the entrenchment indicators are essential to perform a post-glacial evolution interpretation. During the last Pleistocene glacial retreat, a fluvio-torrential network was developed at the bottom of the ancient glacial valley. An early post-glacial phase with a high sediment transport lead to the formation of first generation alluvial fans and alluvial terraces (nowadays located $\approx$15m above the channel). As sediment transport decreased, fluvial incision became preponderant while second generation alluvial fans and floodplains were formed.
Therefore, the specific analysis of entrenchment indicators shows evidence of a vertical incision tendency of the drainage network. The obtained data allowed us to estimate an approximate mean entrenchment rate of 1,07 mm/year since the end of the Pleistocene glacial period. Compared with the 0,08-0,19 mm/year regional uplift rate, the dynamics of the Garona River is probably a combination of climatic (interglacial period), tectonic (uplift and erosional tendency of the axial Pyrenees since the Miocene), topographic (high gradients) and anthropic (engineering structures) factors, and also an intense glacial deposits erosion.
In conclusion, the incision tendency hypothesis was confirmed, which is directly related to the geomorphological response after the last glaciation and is probably related to the evolution of the Pyrenean axial zone. Moreover, the long-term entrenchment dynamics determines present short-term fluvial processes, produces changes in flood hazard and controls the flood effects (see Garcia-Silvestre et al., also presented in EGU 2015). Thereby, this entrenchment tendency has consequences that must be considered when designing structural mitigation measures against flooding events.