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Large wood recruitment and transport during a severe flash flood in North-western Italy

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Understanding and modelling the dynamics of large wood (LW) in rivers during flood events has spurred a great deal of research in recent years. Whereas most of the research on LW has focused on its spatial distribution and geomorphologic role at longer time scales, only few studies have documented the effect of high-magnitude flash floods on LW recruitment, transport and deposition.
On October 25th2011, the Magra river basin (North-western Italy) was hit by an extreme meteorological event, with hourly rainrates up to 130 mm h-1 and event rain accumulations up to 540 mm. Such large rainfall intensities originated flash floods in the main river channels and in some of the tributaries, with unit peak discharges up to around 20 m3s-1km-2 in catchments of 10-20 km2, causing severe damages and loss of lives. Numerous landslides were triggered and the morphology of the tributaries was highly affected in response to intense lateral and vertical channel dynamics. Besides, many bridges were partly or fully clogged by LW jams.
A post-floodsurvey was carried out in November 2011 and February 2012 along four of the tributaries most severely affected by this event. The total length of surveyed channels is 9.5 km. These channels were divided into reaches of similar morphological characteristics (slope, width, vegetation cover), and in every reach the volume of LW deposited was estimated by a combination of field surveys and interpretation of aerial photos. In addition, LW recruited from hillslopes and floodplains was estimated by comparing pre and post-event orthophotos.
Preliminary results show very high rates of LW recruitment (1127 m3km-1 on average ranging from 569-2001 m3km-1) along the analysed channels, the majority (about 80%) stemming from floodplain erosion and the rest from the colluvial processes (predominantly landslides). Channels width has increased on average 10 times (ranging from 4 to 23 times). Despite the large variability among the channels, LW dynamics seems to be related to reach characteristics. In fact, LW deposition was higher - and LW recruitment was smaller - in the wider reaches, and the presence of newly-formed islands or even of single standing trees was key in increasing the trapping efficiency of a reach. Also, the steeper the channel, the lesser is LW deposition and the larger is LW supply. Finally both LW recruitment and deposition show a positive relation with drainage area (for basins > 10 km2).
These observations suggest a conceptual model for LW dynamics in mountain rivers different from others recently put forward that have analysed LW storage data alone, at few snapshots in time long after the occurrence of extreme events like the one described here. The lessons learned from this event may be useful for a management of mountain catchments which should explicitly take into account the crucial role of LW during extreme events, especially for its interaction with infrastructures.