

## **Morphological changes and large wood transport in two torrents during a flash flood in Braunsbach, Germany 2016**

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We present the results of a post-event survey study, addressing the geomorphic response, sediment and large wood budget of two torrents, Grimm bach and Orlacher Bach, in southwestern Germany that were affected by a flash flood on May 29, 2016. The rivers are located in the region of the South German Scarplands and form steep valleys that erode into the limestone plateau. During the event, large amounts of wood clogged and damaged a bridge of a cycling path at the outlet of the Grimm bach, while the town of Braunsbach was devastated by discharge and material transported with the Orlacher Bach. The severity of the event in these two small catchments (30.0 km<sup>2</sup> and 5.95 km<sup>2</sup>, respectively) is remarkable in drainage areas with a relatively low average slope (10.7 and 12.0%, respectively).

In order to gain a better understanding of the driving forces during this flood event an integrated approach was applied including (i) an estimate of peak discharges, (ii) an analysis of changes in channel width by comparing available aerial photographs before the flood with our aerial surveys with an Unmanned Aerial Vehicle right after the flood and validation with field observations, (iii) a detailed mapping of landslides and analysis of their connectivity with the channel network and finally (iv) an analysis of the amounts of large wood recruited and deposited in the channel.

Results show high unit peak discharges ranging from 22.6 m<sup>3</sup> s<sup>-1</sup>km<sup>-2</sup> to 25.1 m<sup>3</sup> s<sup>-1</sup>km<sup>-2</sup> in the Grimm bach while 20 m<sup>3</sup> s<sup>-1</sup>km<sup>-2</sup> have been estimated in the Orlacher Bach. The studied channels have a length of 3.3 km in the Orlacher Bach and 10 km in the Grimm bach catchments and have dramatically changed their geometry. In the Orlacher Bach catchment, the landslides occupy an area of 0.17 km<sup>2</sup> and river width increased on average by 3.4 times (range 1.5-5.9). The observed wood deposited along the Orlacher Bach varies from 90 to 150 m<sup>3</sup>. However, it has to be considered that wood had already been removed during the clean-up process. In the Grimm bach catchment, landslides occupy a smaller area, 0.10 km<sup>2</sup>, while the widening ratio is on average 5.9 (2.3-10.7). This generated a vast amount of large wood recruitment in the catchment (3,500-6,500 m<sup>3</sup> in total), which was deposited along the entire river channel.

The morphological changes in the channels can be explained by hydraulic parameters, such as stream power and unit stream power, and by morphological parameters such as the valley confinement. This is similar for LW recruitment amounts and volume of exported LW since most of it comes from the erosion of the valley floor.

The morphological changes and large wood recruitment and deposit are in the range of studied mountain rivers. Both factors thus need to be considered for mapping and mitigating flash flood hazards also in this kind of low range mountains.