Geophysical Research Abstracts
Vol. 13, EGU2011-1548, 2011
EGU General Assembly 2011

From source to sink: analysis of debris flow events assessed by Dendro-geomorphology.

Sara Savi, Michelle Bollschweiler, Markus Stoffel, and Fritz Schlunegger
University of Bern, Institute of Geological Sciences, Bern, Switzerland (sara.savi@geo.unibe.ch)

We quantify the frequency distribution of the ca. 2.5 km^2-large Schimbrig catchment that is located in the central Swiss Alps. We assess this distribution using patterns of tree ring records that register growth perturbations caused by external forcing such as landsliding and debris flows. In particular, tree-ring analyses represent a very helpful tool for the dating of natural hazards and can provide a better understanding of the modality of sediment transfer and of the connectivity between sediment sources and sinks.

The study catchment can be divided into two distinct tributaries: the eastern area, occupied by an active earth slide (Schimbrig landslide) that underwent high slip rates several centimetres to meters per day between September 1994 and May 1995 translating a total of 350,000 m^3 of material, and the western segment, characterize by a deeply incised network of mixed debris flow and alluvial channels (50 m maximum incision) bordered by hillslopes that host shallow and deep-seated landslides less than 15,000 m^2 large. The entire catchment is mainly underlain by sandstone-mudstone alternations of the Eocene Subalpine Flysch that have been reworked by glaciers during the LGM. The unconsolidated sediments left by ice retreat are one of the main sediment sources causing instability in this region. The climate in the Schimbrig area is dominated by a very high precipitation rate.

Intense rainfall events may trigger landslides and debris flows from the steepest slopes of the channel network. Therefore we focused our study to this area of the catchment with the aim to reconstruct frequency and magnitude of debris-flow events occurring in the channel using dendro-geomorphic techniques. We collected a total of 500 tree cores on the fan, along the main channel and in the catchment area. Results from the fan area indicate that more than 20 events occurred during the past 170 years with an average return interval of 7 years. The most relevant event, affecting more than one-fourth of the trees, occurred in 1994-1995 and seems to be related to the highest activity of the Schimbrig landslide. Others important events, involving between 15 and 20% of the trees, occurred in 1997, 1966, 1956, 1951; 1883 and 1859. Spatial analyses of affected trees indicate different flow tracks for the different events. Interestingly, the 1997 event affected a large portion of the fan (ca. 40%) but not its entire length, indicating a source area somewhere in the central part of the fan (i.e. sediment sourced from a tributary stream or from channel erosion farther upstream and subsequent sediment remobilization on the fan.). The 1994-1995 event created damage to trees on the entire fan and is linked to the highest activity of the Schimbrig landslide that most likely represents the sediment source for this particular event. The 1966event was more probably related to a lateral landslide occurring on the slope of the left river bank where the trees registered most relevant damages. Further analyses will focus on the assessing in more detail the sediment sources in the catchment's headwaters.