Geophysical Research Abstracts, Vol. 9, 07463, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07463

Unraveling the patterns of late Holocene debris-flow activity on a cone in the Swiss Alps: chronology, environment and implications for the future

M. Stoffel, D. Conus, M.A. Grichting, I. Lièvre and G. Maître

Laboratory of Dendrogeomorphology, Department of Geosciences, Geography, University of Fribourg, Fribourg, Switzerland (markus.stoffel@unifr.ch / Fax: +41 26-3009746 / Phone: +41 26-3009015)

Debris-flow activity on the forested cone of the Ritigraben torrent (Valais Swiss Alps) was assessed from growth disturbances in century-old trees, providing an unusually complete record of past events and deposition of material. The study of 2246 tree-ring sequences sampled from 1102 *Larix decidua* Mill., *Picea abies* (L.) Karst. and *Pinus cembra* ssp. sibirica trees allowed reconstruction of 123 events since A.D. 1566. Geomorphic mapping permitted identification of 769 features related to past debris-flow activity on the intermediate cone. The features inventoried in the study area covering 32 ha included 291 lobes, 465 levées and 13 well-developed debris-flow channels. Based on tree-ring records of disturbed trees growing in or next to the deposits, almost 86% of the lobes identified on the present-day surface could be dated. A majority of the dated material was deposited over the last century. Signs of pre-20^{th} century events are often recognizable in the tree-ring record of survivor trees, but the material that caused the growth anomaly in trees has been completely overridden or eroded by more recent debris-flow activity.

Tree-ring records suggest that cool summers with frequent snowfalls at higher elevations regularly prevented the release of debris flows between the 1570s and 1860s; the warming trend combined with greater precipitation totals in summer and autumn between 1864 and 1895 provided conditions that were increasingly favorable for releasing events from the source zone. Enhanced debris-flow activity continued well into the 20^{th} century and reconstructions show a clustering of events in the period 1916–1935 when warm-wet conditions prevailed during summer in the Swiss Alps. In

contrast, very low activity is observed for the last 10-yr period (1996–2005) with only one debris-flow event recorded on August 27, 2002. Since sediment availability is not a limiting factor, this temporal absence of debris-flow activity is due to an absence of triggering events, which not only shifted from June and July to August and September over the 20^{th} century, but also seemed to occur more frequently in the form of cyclonic rainstorms in autumn rather than convectional rainfall in summer. From the reconstructions, based on RCM simulations, there are indications that debris-flow frequencies might continue to decrease in the future, as precipitation events are projected to occur less frequently in summer but become more common in spring or autumn.