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Dendrogeomorphological reconstruction of past debris-flow activity along the channel of the Geisstriftbach (Valais, Switzerland)

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Debris flows are a common landscape forming process that appears in almost all mountainous regions of the world. They are triggered on slopes steeper than 23 degrees when loose material becomes rapidly water-saturated due to heavy rainfall, snowmelt or high levels of ground water. Their great destructive potential renders research on past debris-flow activity very important. Archival data on past debris flow events is often sparse and only covers events causing fatalities or major damage to infrastructure. Information on the magnitude, frequency and spatial distribution of past debris-flow events is needed in order to define hazard zones for land use planning as well as for structural measures to reduce future damage.

Past debris-flow events have been dated among other methods by lichenometry, aerial photography, carbon dating, stratigraphic methods and dendrogeomorphological approaches. The latter approach allows event dating with seasonal precision, which is a great improvement as compared to the relative dating with other methods. Dendrogeomorphology is based upon the fact that trees react to injury, stem burial or tilting, decapitation or erosion of root mass with the formation of traumatic resin ducts, callus tissue, reaction wood, growth reduction or growth increase. Additionally, even-aged stands growing up on debris-flow deposits allow an estimation of the minimum age of the deposit.

This paper aims at reconstructing spatio-temporal patterns of past debris flows along the current channel of Geisstriftbach torrent (Valais, Swiss Alps). The analysis is based

on a detailed geomorphic map (1:1'000) of the active channel as well as on tree-ring series from 28 heavily affected trees (*Larix decidua* Mill. and *Picea abies* (L.) Karst.). Identification of growth disturbances allowed dating of 18 debris flow between AD 1913 and 2005. The position of trees further indicates preferential locations for breakouts along the torrent. Finally, an estimating of the germination dates of the trees sampled allowed identification of tree cohorts, showing that tree ages gradually increases with growing distance from the cone apex.