



Historical flood analysis of the Eistlenbach and Farnigraben torrents in the Hasli Valley (Bernese Alps) inferred from sedimentary records, historical maps and remote sensing

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Historical sources report that in 1624 the village of Hofstetten was ravaged by a major debris flow from the Eistlenbach torrent, and in 1797 another event erupted from the Lammbach, Schwanderbach and Eistlenbach torrents, demolishing 37 buildings (Eisbacher and Clague, 1984). Years later there occurred more debris flows and floods in the area, which also affected buildings and farmlands in the valley. Every debris flow and flood leaves its footprint and shapes the morphology of the landscape causing aggradation in the distal area. The knowledge how landforms such as alluvial fans develop and which areas have been repeatedly affected by geomorphic dynamics is crucial for the assessment and management of hydrological hazards in mountain regions. The study aims to reconstruct historical floods and changes in the geomorphology of the distal areas of Eistlenbach and Farnigraben fans.

First results show distinct flood layers which can be related to debris flow and flood events during the last 700 years. Peaks of Log (Zr/Ti) and Ca/Ti correlate with coarse-grained flood layers which can be compared with historical sources, whereas the organic-rich beds and soils indicate higher land surface stability and lower flood activity.

In addition a spatial analysis is conducted to identify geomorphological dynamics and changes of the alluvial fan, particularly those which are related to the village of Hofstetten. Thus, survey of aerial photographs and satellite images as well as the interpolation of historical maps from 1797 to present, provide essential information of landform (e.g channels, levees and debris flow lobes) and land cover changes (vegetation, land-use, reforestation). For example, one of the most remarkable observations is the flow change of the Eistlenbach torrent. Previously to 1949 the channel path was straight to the watercourse of Fulbach in the valley bottom and was blocked by the rock drumlin Ballenberg in the south. But since then the channel started to shift to the eastern side of the alluvial fan producing channel incision in the middle stretch of the fan. The Farnigraben torrent has also experienced changes mostly limited to distal area in 1927, 1945 and 1960. These dynamics archived with detail during the last 90 years occurred also in historical times controlling aggradation processes and should be considered when sedimentary and geochemical proxies of the cores are interpreted. On the other hand, important changes of sedimentation rates and facies observed in the cores may provide evidences to estimate the recurrence interval of the tipping points of the oscillating shifts of the Eistlenbach torrent, thus providing millennia-long information regarding hydrological risks in the area of Hofstetten.