Geophysical Research Abstracts
Vol. 14, EGU2012-13310, 2012
EGU General Assembly 2012

Measuring debris flows in the proglacial area of the Gepatschferner/Austrian Alps using repeat ground-based and airborne LiDAR data

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Since the end of the little ice age (LIA) the glaciers of the Alps have been shrinking and creating a rapidly changing environment, e.g. by exposing steep and highly erodible moraine deposits. The geomorphic development of these deposits is effected by the interaction of paraglacial processes, as e.g. landslides, fluvial processes or debris flows. The joint research project PROSA (High resolution measurements of the morphodynamic in rapid changing PROglacial Systems of the Alps) aims at a quantification of the sediment budget within the proglacial area of the Gepatschferner (Austrian Alps) by using repeat Ground-based (TLS) and airborne LIDAR data (ALS). The present study forms part of this joint project; it deals with the quantification of sediment fluxes on steep moraine deposits, especially with the activity of debris flows.

In August 2011, one of the largest rainstorm events ever measured in the area triggered several slope type debris flows on the steep moraine deposits (of LIA age). Since there are high resolution TLS data available before and after the event (surveyed in summer of 2010 and 2011) and high resolution Airborne LIDAR data before the event, erosion and deposition of the single debris flows could be detected, mapped and quantified very accurately using pre-event ALS data as well as pre-event TLS data as a baseline. The quality of these cut-and-fill analyses is assessed and compared for both types of pre-event datasets. Volume calculations with pre-event ALS data have lower accuracy and a lower level of detection, which is mainly due to differences in point density and a more difficult coregistration caused by different acquisition geometries of TLS and ALS data. However, as ALS data are available for large if not most parts of the Alps, the possibility of rapidly quantifying mass movements with flexible, relatively inexpensive local TLS surveys is considered a perspective for geomorphological research.