Geophysical Research Abstracts, Vol. 10, EGU2008-A-02605, 2008 SRef-ID: 1607-7962/gra/EGU2008-A-02605 EGU General Assembly 2008 © Author(s) 2008



Sediment transport and debris flows during the floods of August 2005 in Switzerland

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During the period 21 to 23 August 2005 severe floods occurred in many torrents and mountain rivers along the northern Alps of Switzerland. High flood discharges with intense sediment transfer processes were observed in particular in the catchments upstream of the large lakes at the foot of the mountain chain. In smaller catchments several debris flows occurred which transported more than 5000 m3 of solid material to the fan area. For the documentation and analysis of these processes, a summary data base was set up. In total almost one 100 single events have been registered, and for about 80 cases information is available on transported sediment volumes.

A quantitative analysis of the data shows that the transported sediment volumes are related to the flood runoff volume and the relevant channel gradient. This general relation is in qualitative agreement with a simple sediment transport equation. For steep channel gradients observed sediment volumes transported by fluvial processes are smaller than values predicted by simple sediment transport equations, which likely results from non-accounted energy losses and supply limitation. For events with debris flows as the dominant sediment transfer mechanism, sediment volumes show a large variability for given flood runoff volume and channel gradient. Considering additionally the geotechnical conditions in the affected debris-flow catchments, a clear effect on the mobilized debris volume could only be detected only for a subgroup of the analyzed events.