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Coupling between hillslope processes and river system. Case study of "La Tinière", southwestren Switzerland

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Following a major event, the realization of sediment budget at the catchments scale shows how the sediment supply could evolve during the next years. This study provides also to balance the concept of magnitude-frequency for floods occurring with high sediments content.

The 7th of July 2006, La Tinière experiences a strong flooding. In this catchment of 11 km2, most of the smaller tributaries produce debris flows or intense bedload. In La Tinière itself, most of the length of the river is concerned by bedload and hyperconcentrated flow. Surprisingly, the observation of deposits indicates that a debris flow was reformed downstream in a sector where the river has a slope of approximately 10%.

Sediment budget made at the event scale shows that an important masses of sediment travelled trough the river. However, approximately the half of the sediment put into movement in the tributaries didn't reach the mouth of the basin (Lake of Geneva). These sediments were stocked in the middle reach of the torrent. These observations let supposing that next important meteorological event will produce a new flood with intense sediment transport.

Soon after, the 5th of August and the 17th of September, floods of quite the same magnitude than the one of the 7th of July occur. The survey of the river bed after each of these floods shows that the stock of sediments evolves in space and in characteristics (i.e. grain size distribution). The main mass deposited the 7th of July was displaced downstream letting the grain size distribution of the bed coarsening. In the upper reach of the river, the last flood enters in contact with coarse rock particle that are difficult to move and incision takes place on some reach.

Outside the qualification of the rainfall of summer 2006, the historical analysis of the "functioning" of La Tinière show that this rivers presents often some replicas. This was the case for the floods of 1824, 1927 and 1932. This year, two replicas have followed the first flood within two and a half month. This leads us to propose for this river an alternative definition of the term event to be used in the magnitude-frequency analysis. Moreover, the detailed analysis of the sediment budget, allows us to semi-quantify the predisposition of the catchment for future flood events.