Geophysical Research Abstracts
Vol. 21, EGU2019-1563, 2019
EGU General Assembly 2019

Earthquake induced sediment supply in Himalayan rivers

David Puhl (1,2), Jens Turowski (1), Christoff Andermann (1), Michael Dietze (1), Kristen Cook (1), and Odin Marc (3)

(1) German Research Centre for Geosciences - GFZ, 5.1 Geomorphology, Telegrafenberg, 14473 Potsdam, Germany , (2) Department of Earth Sciences, Physical Geography, Freie Universität Berlin, Malteserstr. 74-100, 12249 Berlin, Germany, (3) École et Observatoire des Sciences de la Terre – Institut de Physique du Globe de Strasbourg, Centre National de la Recherche Scientifique UMR 7516, University of Strasbourg, 67084 Strasbourg Cedex, France

In the active mountain belt of the Himalayas, strong earthquakes are known to causes extensive mass wasting by landsliding, which is a dominant erosional agent. Yet, the impact of large earthquakes on Earth surface systems is not well understood. The aim of this study is to investigate the impact of co- and post-earthquake landslides on river sediment transport, by using data of a field observatory from 2015 to 2017, installed shortly after the Mw 7.9 Gorkha Earthquake in April 2015.

We exploit data from a nested catchment study along the Bhotekoshi-Sunkoshi-Saptakoshi river system. The smallest catchment, the Kahule Khola, drains 32 km2 and joins the Bhotekoshi in northern Nepal. The largest catchment, the Saptakoshi, drains 58000 km2, mainly located in the high Himalayan range. Two further catchments, Bhotekoshi (2400 km2) and the Sunkoshi (10000 km2) are located between these two stations. The study area has a well-defined monsoon climate, with distinctive annual wet and dry seasons. The Bhotekoshi catchment, as well as other catchments draining into the Sunkoshi-Saptakoshi system were hit by numerous coseismic landslides in the Gorkha Earthquake.

We analyzed the temporal and spatial variability of the grain size distribution of suspended load samples collected at all four stations. These were processed with the R Package EMMAgeo, to separate the data in four to six statistically distinct and meaningful end-members.

Based on the temporal resolution and under the assumption that landslide deposits deliver coarser grains, we assigned the end-members, from coarse to fine, as landslide, river bank, abrasion and soil. We see a high presence of the landslide end-member in the Bhotekoshi and Kahule Khola samples during the first monsoon season, which could not be observed during the second monsoon season in 2016. At Sunkoshi and Saptakoshi it is less clear. The water levels at each station are high during monsoon and low during dry season. The water level from the Kahule Khola and the Bhotekoshi correlates with the occurrence of larger grains. At Sunkoshi this correlation is not as strong.

The coseismic landslides in the Bhotekoshi catchment area dominate the sediment flux in the first monsoon season. Then the signal becomes weaker during the second season, probably because the majority of the intermediately mobilized material was already transported out and the delivery process on the slopes slowed down and was temporally delayed. The samples of the Kahule Khola and the Bhotekoshi show large grains at high water levels. These rivers at high altitude with small catchments are sensitive to sediment supply due to local precipitation events. The Sunkoshi and Saptakoshi have large catchment areas with high and mixed sediment supply, which makes a separation difficult.

During the monsoon 2015 we see a high earthquake caused sediment supply to the rivers, which are directly affected by mass wasting. After the first mobilization, hillslope processes control the sediment supply.