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Characterization of the Jure (Sindhupalchok, Nepal) Landslide by TLS and field investigations

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On August 2nd 2014, a huge rockslide of approximately 5 million m3 blocked the Sun-Koshi River upstream of Jure village (Northeast of Kathmandu, Nepal). This landslide killed approximately 155 people, destroying approximately 120 houses completely and 37 partially. The main road leading to China was cut and the Sun-Koshi hydropower plant was affected. The landslide dammed the river, creating a 2 km long lake. During the whole month of August the authorities and the army managed to drain the lake in order to avoid a potential dam collapse and a disaster by flooding downstream. In addition, a road was built very quickly in the opposite slope of the rockslide. The main road was reopened in November 2014 crossing the rock avalanche deposit to reach China border. Rocky steep slope on right bank of lake is used for earthen road construction.

After the quick draining of the lake water on October 5, 2014, many landslides were induced or reactivated on the slopes along the lake shore. Some are affecting the slopes over several hundred in uphill section. However, the roads are also promoting shallow landslides or old landslides reactivation.

The DEM extracted from merging 16 terrestrial laser scanner (TLS) acquisitions permits to analyse the rock fall avalanche volume, scar structure and deposits. The rockslide was developed in phyllites, quartzite and sandstones. The stratification is folded but mainly subhorizontal in the scar area, while the scar is defined by several faults and visible joint sets. Using TLS and SRTM data the volume of the rockslide can be approximated at 5 million m3. From TLS data it is also possible to identify regional faults, which form the back scar with a dip of approximately 165°/60°. The discontinuity sets ∼250°/60° and 075°/45° are forming oblique shallow wedges. In addition, subvertical joints which are cutting the whole scar are oriented north 145°. All these structures permits to define the volume involved in the rockslide.

Satellite images since 2000 indicate an increasing rock fall and scarp development activity of the landslide before this catastrophic event and scarp development. In addition, it seems that some ephemeral springs developed below the unstable mass. The rockslide generated a rock avalanche, which is documented by the effect of volume on the travel distance. This Farböshung varies between 22° and 24° depending on the type of substratum, which is a bit above the standard values. The spreading of the rock mass can be also reproduced by simulations. It seems that the rockslide ran up the opposite slope and then receded as proposed by Crosta et al. (2003) for Val Pola. Furthermore the upper layer of soils on the failure area created an area of “mud splash” in the frontal part of the rock avalanche. Mud splash is supported by the mud and dust cover found in the trees on the opposite slope near the landslide dam. The analysis of this rock avalanche confirmed the general observation that can be made for present rockslides in general. It reactivated large scale instabilities. In addition, the location of such rockslide developed in complex structures accompanied by a degradation of the rock mass conditions. In addition, the impact of the lake on slope stability in and around the reservoir can be noticed.

References:
Crosta G.B., Imposimato S. and Roddeman D. G. (2003): Numerical modelling of large landslides stability and runout. Natural Hazards and Earth System Sciences, 3: 523–538
ICIMOD (2015): Eye on the Sun Koshi Landslide: Monitoring and Infrastructure Planning Key to Minimizing Scale of Disasters. http://www.icimod.org/?q=14356
NRSM (2014): Landslide on River Sun Koshi, Nepal. http://www.nrsc.gov.in/Nepal_Landslide.html

Petley D. (2015): Sunkoshi landslide in Nepal - still no reduction in the lake. The landslide Blog.Blogs.agu.org.
SANDRP (2015): Massive landslide blocks Sunkoshi River, Downstream Nepal-India under threat. http://sandrp.wordpress.com/2014/08/02/massive-landslide-blocks-sunkoshi-river-downstream-nepal-india-under-threat/