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GEOMORPHIC IMPACTS OF THE APRIL 25, 2015 EARTHQUAKE IN NEPAL: PRELIMINARY ASSESSMENTS.

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A magnitude Mw 7.9 earthquake struck Central Nepal on April 25, 2015 at 11:41 am (local time), followed by another Mw 7.4 one on May 10, 2014 at 12:30 pm (local time). The first rupture took place along the Main Frontal Thrust, a main structure interface between Indian and Eurasian plates: it has occurred at a depth varying from 10 km (USGS) to 29 km (Geoscope) corresponding to a relative slip of 4-5 m. It was a predicted disaster, with continuous seismic monitoring (Seismology Laboratory of Kathmandu) and preparedness actions such as infrastructure strengthening, development of early warning systems, plans for evacuation and recovery (thanks to the NSET NGO). Yet the quake struck all the more sadly since Nepal is among the ten poorest countries in the world (about ¼ Nepal population affected, ~8 M people, both in the mountains and in the Kathmandu valley, ~2,5 M people). Even if extra food, water, medical and other supplies were ready in case of such a catastrophe strikes, it has turned out to be a situation even more disastrous than expected.

Though many fatalities are due to buildings collapses, a large part of them are also related to slope processes: snow avalanches, rock falls (including very large blocks), debris avalanches and landslides. If the ice- and snow-avalanches in Everest area were largely commented in the media, some other areas North and West of Kathmandu were also severely impacted. (1) In the Langtang valley, the village of Langtang was totally buried under a rock-snow avalanche that came from a glacier several hundred meters above, on the Langtang Lirung peak (7227 m); apparently the debris were taken away from the moraines and entrained by the avalanche. (2) Sited North of Gurkha, the locus of the seism hypocentre, other villages such as Laprak and Barpak, settled upon old landslide material, were >90% destroyed after the slope movement was reactivated by the quake. (3) Landslides also dammed river valleys (Budhi Gandaki, Melamchi and Sunkosi valleys), hence causing potential for additional disasters to come. (4) Road network is very affected (cracks, collapses), such as the strategic Arniko road along the Sunkosi, impeding emergency rescues.

Aggravating factors are many folds. Firstly, after an unusually dry winter, snowfalls and rainfalls were abundant during March and April, hence increasing the pore pressure and the potential instability of slopes and/or snow cover. Secondly, in the Kathmandu valley, the Quaternary lacustrine substrate amplified the vibrations and caused locally the occurrence of liquefaction that resulted in substantial damages to buildings. Thirdly, the steepness of natural slopes was during the last decade accentuated by the construction of earthy, fragile roads. Eventually, the very short time left between the earthquake and the onset of the next Indian monsoon rains will definitely be another aggravating factor, leaving little chance to the population to recover and to live under safer conditions.