Geomorphic impacts of the April 25, 2015 earthquake in Nepal: Preliminary assessments

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1. THE EVENT

A magnitude Mw 7.8 earthquake struck Central Nepal on April 25, 2015 at 11:41 am (local time), followed by another Mw 7.4 one on May 12, 2015 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 forceable 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). Still it was very dangerous.

About 3.3 million people were affected (~9 M people) in the mountains and Kathmandu valley (~2.5 M people). 9000 people lost their lives. The economic damage - about $10 billion - is almost half of the country's GDP.

Aggravating factors are many folds. (1) In the Kathmandu valley, the Quaternary lacustrine substrate amplified the vibrations, hence substantially damaged the buildings. (2) After a 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. (3) During the last decades, the construction of earthly, fragile roads accentuated slope steepness. (4) Very short time left between the earthquake and the onset of the next Indian monsoon rains.

2. GEOMORPHIC IMPACTS

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.

The village of Langtang was totally buried under a rock-snow avalanche that came from a glacier several hundred meters above.

Landslides also doomed river valleys, having caused potential for additional disasters to come.

WHAT'S NEXT?

Acknowledgements
Information on earthquake data was provided by Laurent Bollinger (CIA/BASIE). My very deep appreciation goes to him and Dr. Soni Sapkota (Dept of Mining and Geology, KTMU) for their help.

Use of satellite radar helped to calculate how the ground shifted during the earthquake. In addition to vertical movements, the researchers also detected north-south horizontal shifts of nearly 2 meters (German Aerospace Center - DLR).

Misson risk: another aggravating factor, leaving little chance to the population to recover and to live under safer conditions.

25 April 2015 Nepal Earthquake
Landslide Intensity

Map information:
2015 M7.8 earthquake. Landslide are now data available via: https://data.hdx.rw
which have been reactivated by the earthquake. The main map shows landslide distribution. All landslides shown are either new landslides triggered by the earthquake, or those location. All landslides shown are either new landslides triggered by the earthquake, or those

on the Langtang Liiving peak (7227 m): apparently the debris were taken away from the mountains and carried downward by the avalanche.

Detail of mapped landslides in Sindhupalchowk, Rasuwa & Dolakha Districts.