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Landscape response to the Mw7.9 Gorkha earthquake

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Strong earthquakes cause transient perturbations of the near Earth's surface system. These include the widespread landsliding and subsequent mass movement and the loading of rivers with sediments. In addition, rock mass is shattered during the event, forming cracks that affect rock strength and hydrological conductivity. Often overlooked in the immediate aftermath of an earthquake, these perturbations can represent a major part of the overall disaster with an impact that can last for years before restoring to background conditions. Thus, the relaxation phase is part of the seismically induced change by an earthquake and need to be monitored in order to understand the full impact of earthquakes on the Earth system. Here, we present first results from the rapid respond earth surface processes monitoring program put in place by several European groups after the Mw7.9 Gorkha earthquake.
To monitor the transient effects of the earthquake on the Earth surface system, we have installed a comprehensive network of 13 river sampling locations for daily water and sediment sampling, covering all major rivers draining the earthquake-affected areas immediately after the event. Nested within this regional network, we have installed an array of 16 seismometers and geophones and 6 weather stations in the upper Bhotekoshi catchment, covering an area of ~50 km2. The field measurements are accompanied by repeated mapping of landslide activities and volumes over subsequent seasons using high resolution optical (RapidEye) and radar imagery (TanDEM TerraSAR-X). The combination of all of these data will help when interpreting our field observation in the regional context of catastrophic failure of hillslopes and their link with sediment transport in the rivers. First river gauging observation show a pronounced increase in river discharge in the order of >20% for the respective pre-monsoon season. We interpreted this as a direct impact of the shaking on the valley-ridge scale sub-subsurface permeability, stressing the large potential effects of strong earthquakes on near-surface processes.

Our instruments and sampling arrangements will stay in place for at least two monsoon seasons and until the Earth surface dynamics have normalized to the known pre-earthquake state.