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Structural control of the seismicity in Western Nepal revealed by the Hi-KNet seismological network

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According to historical chronicles as well as preliminary paleoseismological trenches, the latest devastating great earthquake in Western Nepal happened more than 500 years ago in 1505 AD. Despite its inescapable repeat in the future, the seismic behaviour of the Main Himalayan Thrust fault segments ruptured during this earthquake are poorly known. Among others, large uncertainties remain on the downdip extent and geometry of the locked fault zone and its lateral variations as well as their relations with large and great earthquake ruptures.
A first temporary seismic experiment, the “Himalaya-Karnali-Network” (Hi-KNet), was therefore deployed for two years in western Nepal in order to image the thrust at depth and reveal the behaviour of the seismicity along the brittle-ductile transition zone. A total of 15 temporary seismic stations were installed above the main seismic belts in Bhajang and Karnali regions, complementarily to the Regional Seismological Network.
More than 2000 local earthquakes were located below the network during the first year of experiment. Most of these events were clustered within pluri-kilometric long swarms that lasted a few days or weeks. The finest relocations of the local earthquakes reveal a complex pattern of variations of the seismicity along strike. Most clusters develop at the intersection between the megathrust and contacts between Lesser Himalayan tectonic slivers. Some of the seismic swarms migrate with time.
Altogether, the swarms and individual earthquakes reveal ramps and flat geometry of the megathrust. Some of these structures, among them the largest active ramps, are likely to partially control the rupture of intermediate to large earthquakes.
The structural segmentation revealed by the seismicity leads us to propose a fault model involving intermediate, large and great earthquakes in West Nepal.