

Construction of GNSS monitoring system in Nepal for the earthquake potential evaluation in the Himalayan Frontal Zone

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We have deployed 10 continuous GNSS stations in central Nepal since 2016 under the SATREPS project of “Integrated Research on Great Earthquakes and Disaster Mitigation in Nepal Himalaya (NERDiM)” (2016-2021). The main purpose of the GNSS observation is to monitor ongoing crustal deformation for estimating earthquake generation potential in the Indian-Eurasian plate boundary zone. We focus especially on the crustal activity of the “Central Seismic Gap” located just west of the source region of the 2015 Gorkha earthquake (Mw 7.8), where no destructive event has been recorded since 1505. Prior to our project there were about 50 continuous GPS stations distributed over the whole of Nepal, most of which were constructed and maintained by universities and institutions in USA and France. We determined station deployment so as to reinforce such pre-existing networks. One-second and 30-second interval data collected at each station are automatically transmitted on a semi-daily basis to a data server at Kathmandu via domestic cell phone network. In addition, we have already introduced a high-performance machine that has the ability of automated GNSS data processing and archiving. Soon we will start daily baseline processing using GNSS data from the SATREPS NERDiM stations and also from the pre-existing domestic and international networks.

In parallel to the station construction, we collect all available GNSS data in Nepal and process them using PPP-AR method of GIPSY/OASIS II ver.6.4. Total number of stations is less than 10 as of 2004 and gradually increased year by year. Since the 2015 Gorkha earthquake, many stations have been added in and around the Kathmandu Valley. However, the number of stations where stable data collection is still ongoing may be less than 30. The result shows that roughly N-S contraction of about 0.1 ppm/yr is significant over the whole of the country, implying that about half of the relative Indian-Eurasian plate motion (36-37 mm/yr) is taken up in crustal shortening of the Himalayan frontal zone due to strong coupling on the plate boundary. Occurrence of the 2015 Gorkha earthquake disturbs deformation field in the source region in central Nepal but does not seem to affect further west. It means that large amount of strain has remained unreleased in “Central Seismic Gap”. We need to cope with high potential of earthquake generation in this region in the near future. New SATREPS NERDiM GNSS stations will contribute to enhance spatio-temporal resolution of the deformation field in the region concerned.

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