Progress Towards a Semi-Dynamic Datum for Nepal After the 2015 Gorka Earthquake

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SUMMARY

The April 25, 2015 Mw7.8 Gorkha earthquake caused significant deformation over a large area in central Nepal, with displacements of over 2 m recorded in the vicinity of Kathmandu. In order to correct the resulting distortions in the geodetic reference system, Nepal is in the process of introducing a new semi-dynamic datum that is aligned with ITRF2014 (epoch 2016.0) which may replace the existing static Nepal Everest datum. The new geodetic datum will incorporate a national deformation model (NDM) that will have the capacity to correct for earthquake displacements as well as ongoing tectonic deformation associated with Nepal's location on the India/Eurasian plate boundary. The NDM discussed here contains models of the velocity field and both co-seismic and post seismic deformation for the Gorka earthquake plus co-seismic deformation for the Mw 7.3 12 May Aftershock. The velocity field for Nepal is based on a compilation of published velocity measurements from previous studies for Nepal and adjacent regions of China and India combined with the published ITRF2014 velocities for IGS stations. The co-seismic deformation associated with the Gorkha earthquake and its 12th May Mw7.3 aftershock determined by evaluating published dislocation models. The post-seismic relaxation was estimated using an exponential function with a uniform 43 day time constant. The NDM is implemented as a series of grid files allowing the secular velocities, co-seismic displacements and the post-seismic relaxation coefficients to be interpolated for any point in Nepal. Using these grid files it is possible to correct both survey measurements and coordinates to 2016.0, our proposed reference epoch.

Implementing the new datum requires that coordinates are determined for points in Nepal's control network, starting with the active stations of the Nepal GNSS Array, which will act as top level control during a readjustment. We have determined coordinates for 27 of these stations at epoch 2016.0 by processing about two and a half years of data using Bernese 5.2. We are readjusting the Nepal first order network using GNSS baselines derived from occupations spread over 9 years

between 2008 and 2017. Comparing the new “semi-dynamic” coordinates and the existing “Nepal-Everest” coordinates will allow us to derive an accurate datum transformation between the two systems including a distortion grid.