

# **Towards a Modernized Geodetic Datum for Nepal: Options for Developing an Accurate Terrestrial Reference Frame Following the April 25, 2015 Mw7.8 Gorkha Earthquake**

**Christopher Pearson (New Zealand), Niraj Manandhar (Nepal) and Paul Denys (New Zealand)**

**Key words:** Deformation measurement; Reference frames; Reference systems; Nepal, dynamic datums

## **SUMMARY**

Along with the damage to buildings and infrastructure, the April 25, 2015 Mw7.8 Gorkha earthquake caused quite significant deformation over a large area in eastern Nepal with displacements of over 2 m recorded in the vicinity of Kathmandu. In this paper we consider options for a modernized geodetic datum for Nepal that will have the capacity to correct for the earthquake displacements and ongoing tectonic deformation associated with Nepal's location on the India/Asia plate boundary

The current Nepal datum is a classical datum developed in 1984 by the Military Survey branch of the Royal (UK) Engineers in collaboration with the Nepal Survey Department. It has served Nepal well however the recent earthquakes have provided an impetus for developing a semi-dynamic datum which will be based on the most current available ITRF and have the capacity to correct for tectonic deformation.

In the scenario we present here, the datum would be based on be ITRF2014 with a reference epoch set some time after the end of the current sequence of earthquakes. The deformation model contains a grid of the secular velocity field combined with models of the Gorkha Earthquake and the May 12 Mw7.3 aftershock. We have developed a preliminary velocity field by taking published velocities for Nepal and adjacent parts of China and India from five previous studies and aligning them to the ITRF. We are currently working on developing patches for the co-seismic part of the deformation using published dislocation models. While these models do a reasonably good job of modeling the deformation, there are some significant discrepancies between their predictions and the limited GPS measurements. We hope to improve these models by developing revised grids that will incorporate increased GPS and INSAR measurements of the deformation

---

Towards a Modernized Geodetic Datum for Nepal: Options for Developing an Accurate Terrestrial Reference Frame Following the April 25, 2015 Mw7.8 Gorkha Earthquake (7970)  
Christopher Pearson (New Zealand), Niraj Manandhar (Nepal) and Paul Denys (New Zealand)

FIG Working Week 2016  
Recovery from Disaster  
Christchurch, New Zealand, May 2–6, 2016

field.

Top level control would be based on a CORS network based around the existing Nepal GPS Array. Coordinates for existing lower order coordinates would be determined by readjusting existing measurements and these would be combined with a series of new control stations spread throughout Nepal.

---

Towards a Modernized Geodetic Datum for Nepal: Options for Developing an Accurate Terrestrial Reference Frame  
Following the April 25, 2015 Mw7.8 Gorkha Earthquake (7970)  
Christopher Pearson (New Zealand), Niraj Manandhar (Nepal) and Paul Denys (New Zealand)

FIG Working Week 2016  
Recovery from Disaster  
Christchurch, New Zealand, May 2–6, 2016