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Landslide Deformation Character Inferred from Terrestrial Laser Scanner Data

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The stability of many large landslides is mainly determined by surface deformation and subsurface deformation along buried slip surfaces. Therefore, better understanding of landslide stability and governing processes requires good knowledge of ground deformation but acquiring this information is challenging. Three dimensional point-cloud data from terrestrial laser scanning (TLS) show potential for obtaining 3D ground displacements accurately. Problems arise, however, when estimating continuous displacement fields from TLS data because reflecting points from sequential scans of moving ground are non-unique, thus repeat TLS surveys typically do not track individual reflectors. Here, the cross-correlation-based Particle Image Velocimetry (PIV) method is implemented to derive 3D surface deformation fields with associated errors using TLS data. The method is applied to the toe of the episodically active Cleveland Corral landslide in northern California using the TLS data acquired in June 2005–January 2007 and January–June 2010. Estimated displacements range from decimeters to several meters, and they agree well with independent measurements at better than 9% root mean squared (RMS) error. For each of the time periods, the method provides a nearly continuous displacement field and permits further analysis. The hypothesis that the subsurface slip geometry can be constrained by ground surface displacements is tested. Two mechanically distinct forward models, a 2-D balanced cross-section method and an elastic dislocation model, are applied and the efficacy of these models to estimate slip depth and slip magnitude of the slide is tested. The estimated slip surface depth using both methods matches in situ observations from shear rods installed in the slide within the ±0.45 m misfit indicating that these are valuable approaches for investigating landslide geometry and slip behavior. Such information enables assessment of the hazards posed by large, slow-moving landslides.

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Aftershock sequence of Gorkha Earthquake 2015

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On 25 April 2015 at 11:56 AM local time, a large earthquake of Magnitude M7.8 (ML 7.6) occurred with epicenter at Barpak of Gorkha district, Nepal. Epicenter of this devastating earthquake lies about 75 km north-west of Kathmandu, the capital city of Nepal and at the rim of the High Himalayan rang. The earthquake claimed about 9000 deaths and more than 6,00,000 houses were destroyed. More than 400 aftershocks of magnitude greater than 4 ML have been recorded and still aftershocks are frequent in the region. The distribution of aftershock defines a main 140 km long ESE trending structure, parallel to the mountain range. In addition to the main region illuminated by the aftershocks, we observe a second seismicity belt located southward, under the Kathmandu basin and northern part of the Mahabharat Range. Many aftershocks within this belt have been felt by the 3 million inhabitants of the Kathmandu valley.

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