Peruvian Landslides Monitoring: Geodesy as a mitigation and reduction measure of mass movement disasters

Gael Araujo[*†1], Edu Taipe[1], and Pascal Lacroix[2]

[1]INGEMMET – Av. Canadá 1470, San Borja, Lima - Peru, Peru
[2]ISTerre - IRD/CNRS/Universite de Grenoble – Université Grenoble Alpes – 1381, rue de la piscine / 38400 Saint Martin d'Heres, France, France

Abstract

Peruvian landslides have caused many destructions to the communities and infrastructures, due to high susceptibility of the Peruvian territory. Taking into account the repercussion of the effects of these natural disasters, the Peruvian Geological Survey (INGEMMET) and the Research Institute for Development (IRD), through the Environmental Geology and Geological Risk department has been monitoring active landslides in southern Peru, using geodetic monitoring techniques (GNSS - RTK).
To the date, the monitored landslides involve rainy and arid areas, located in the most seismic region of the south of Peru (Arequipa), in the Colca valley (Maca, Madrigal, Lari), and in the Siguas and Vítor valleys (Siguas and Pie de Cuesta). The Siguas landslide is considered the most active and destructive mass movement of anthropic origin for its high rates of monthly displacement and the importance of the infrastructures affected as a consequence of its retrogressive main scarp. The Siguas landslide is a rotational mass movement of 1 x 1 km size and 60 m of height in its exposure main scarp, that initiated in 2005.

Facing the necessity of monitoring the landslide, a red of 26 markers was set up at the end of 2015 to monitor the displacement of the landslide body, measured every 3 months using GNSS - RTK. The geodetic reiteration of the 26 monitored points in a period of 2.5 years (November 2015 to May 2018) show annual horizontal displacements of ⌐~34 m, in its accumulation zone, and a vertical displacement from ⌐~ 0.7 to 11 m per year. Since May 2017, a permanent GPS - CORS was implemented on the Siguas landslide body, as part of the first real-time monitoring network of landslides in Peru. The displaced mass constantly dams the Siguas river, creating lakes.
The landslides geodetic monitoring as a measure of mitigation and reduction of disasters, allows us to understand the behavior of the active mass movement, to determine a possible affected scenarios and exceptional displacement rates, in order to make this information available as a tool of risk management in the decision of corresponding authorities before the disaster's occurrence.

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[*]Speaker
[†]Corresponding author: garaujo@ingemmet.gob.pe