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Early recognition of high elevation landslides in mountainous regions: the 2017 Xinmo landslide in China

Xuanmei Fan, Qiang Xu, Gianvito Scaringi, and Lanxin Dai

Chengdu University of Technology, State Key Laboratory of Geohazard Prevention and Geoenivronment Protection (SKLGP), Chengdu, China (fxm_cdut@qq.com)

Landslides developed at high elevation and densely vegetated mountainous regions is very hard to be detected before failure, as they are normally inaccessible and also almost invisible on optical remote sensing imagery. However, once such kind of landslides happen, they often cause devastating impact, such as the Xinmo landslide occurred June 24th 2017, at the eastern margin of the Tibetan plateau in Sichuan, China. The landslide of 13 million m3 of rock, debris and water submerges an entire village, killing 93 people and rushing towards the river, blocking it for 1 km and forming a dammed lake. Extensive field investigation, satellite remote sensing, UAV aerial photography and seismic analysis allowed to identify the main kinematic features, the dynamic process and the triggering mechanism of the event. The deformation history was analysed first by optical imagery, showing that the landslides was probably legacy effect of the 1933 Diexi earthquake in the same region. Visible cracks had developed in the source area before sliding, though they were not detected before the event due to its high elevation. InSAR data clearly demonstrated that the landslide underwent obvious deformation about a month before failure. Early reconnaissance, warning and alarming of such kinds of “hidden” landslides are hot issues which are worth discussing. We suggest that a combination of different approaches at different scale is helpful for the early recognition of such type of landslides. InSAR data with improved temporal and spatial resolution can be used for detecting candidate landslides over a large area. However, detailed survey with other type of high-resolution remote sensing imagery, such as UAV images and field investigation need to be carried out to further confirm the suspicious sites at local scale.