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Tracking and evolution of irrigation triggered active landslides by multi-source high resolution DEM: The Jiaojiacun landslide group of Heifangtai (Northwest of China)

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The construction of three large hydropower stations, i.e. Liujia, Yanguo and Bapan, resulted in the immigration of the impacted people to Heifangtai from 1960s. To support the living and farming of the immigrated people, a large amount of water has been pumped from the Yellow River to Heifangtai, which has changed the former underground water budget and led to 111 landslides from 1968 in this area. To reveal the deformation process of landslides in Heifangtai, a quantitative deformation analysis model of landslide based on multi-source DEM data is established using four periods of topographic maps obtained in 1970, 2001, 2010 and 2013 respectively, including two 1:10000 topographic maps and two 1:1000 data acquired from 3D Laser Scanner. The whole study area was divided into two sections based on the two distinct kinds of landslide patterns. The selected morphometric parameters, residual topographic surface and surface roughness, extracted from three typical landslides, and the statistical analysis (Box-plot diagrams) of the temporal variations of these parameters, allowed the reconstruction and tracking of these landslides. We monitored the changing of landslide boundaries, average vertical and horizontal displacement rates and zones of uplift and subsidence. The volumes of removed and/or accumulated material were estimated as well. We can then demonstrate the kinematics of landslides based on information from high-resolution DEM, and the changing table of underground water, ring-shear test and soil-water characteristic curve referenced from other researchers. The results provide a new insight on the use of multi-source high resolution DEM in the monitoring of irrigation-triggered landslides.