

Deep-seated catastrophic landslides induced by typhoon 12 and their precursory gravitational slope deformation

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Typhoon 1112 crossed the Japanese Islands from 2 to 5 September in 2011, inducing more than 50 deep-seated catastrophic landslides of Jurassic to Palaeogene sedimentary rocks. These landslides hit houses, made landslide dams, or induced Tsunami by rushing into swollen rivers. The areas of landslides ranged from 36,000 m² to 54,900 m² and the maximum volume is estimated to be 15 million m³. Nine landslides have been surveyed by Lidar before the events as well as after the events, which clearly showed that eight of the 9 landslides had small scarplets near their future crowns beforehand as precursory topographic features. These scarplets are made by gravitational slope deformation that preceded the catastrophic landslides. The strains accompanying the deformation are estimated to be from 5 to 21 %, which suggests that these landslides were under the critical condition just before failure. Fourteen landslides we surveyed in the field had sliding surfaces along faults made during accretion or along bedding.

Lower photographs are slope images of Akatani landslide, one of the largest landslides induced by the typhoon. Comparing these images, we clearly identify scarplets along the future crown, which is indicated by black arrows. The landslide slope had a failure at the lower part beforehand, destabilizing the upper portion of slopes. Similar scarplets have been identified in most landslides before the events.

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Keywords: deep-seated landslide, typhoon 12, slope development, geology, mass rock creep, gravitational slope deformation

