The role of thrust faults with incohesive clayey fault materials to generate deep-seated gravitational slope deformations and catastrophic landslides in the Shimanto accretionary complex

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The purpose of this study is to clarify the geological and geomorphological background of deep-seated catastrophic landslides (DCLs) and related gravitational slope deformations (DGSDs) that occur in mountain areas of accretionary complexes. We performed the detailed geological survey for the area of 25 km^2 in the Shimanto accretionary complex in the middle of the Kii Mountains, Japan. In this area, six DCLs were induced by the heavy rain of Typhoon Talas in 2011. Using the 1-m DTMs made from LiDAR data taken before and after the landslides by the Kinki Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism, and Nara Prefecture, we investigated the distribution of the thrust faults with the incohesive clayey fault materials in the mountain slopes and the inner structures of these thrusts. Mineralogy, permeability and shear strength were measured for the fault gouge.
As a result, we obtained the following results and conclusions.
1. Low-angle thrust faults with incohesive fault rocks thicker than approximately 1 m were newly found to develop at intervals of a few km in the study area.
2. Many of these thrust faults were different from previously reported thrust faults. The thrust faults with incohesive fault rocks include clayey crush materials that form a weak and impermeable layer, which becomes the base of a DGSD and would accommodate a sliding surface of a DCL.
3. The DGSDs and rain-induced DCLs in the study area preferentially occur in the hanging walls of those thrust faults and their areal alignments are controlled by the thrust faults.
4. Thrust faults commonly extend for kilometers as planar features but are sometimes locally folded with their nearby rocks. When a syncline involving thrust faults plunges valleyward, this structure also facilitates DGSDs.

Keywords: deep-seated catastrophic landslide, gravitational slope deformation, incohesive clayey fault material, accretionary complex

