Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HDS25-P07 Room:Convention Hall Time:May 27 18:15-19:30

Study on developing process of valley by deep-seated catastrophic landslides

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The Typhoon Talas (T1112) induced many large and deep-seated landslides in the Kii Peninsula. The Shimanto group (an accretionary complex) is widely distributed on the Kii Peninsula, and deep-seated landslides are known to occur often in this kind of accretionary complex. Also, many of the deep-seated landslides caused by Typhoon Talas occurred on dip slopes, and it is thought that such geological structures also had a possible factor to the occurrence of deep-seated landslides. However, until now, there was no widely used physical-based model for describing deep-seated landslide rapid (catastrophic) occurrence.

Recently, we have proposed a physical-based model for describing the process of widening water channel that accompanies the overtopping erosion of landslide dams. In the model, we assumed that the channel widening was induced by side slope collapses due to channel bed degradation, and we used slope stability analysis to describe side slope collapse. We confirmed that the proposed model was able to effectively describe the side slope geometry of water channels of actual landslide dams.

We considered that there is the possibility that the development process for valleys that occur with deep-seated landslides can also be describe during our proposed model. Accordingly, in this study, with the deep-seated landslides caused by Typhoon Talas and the slopes where did not occur as our focus, we used the detailed topological data (LiDAR data sets) measured before and after Typhoon Talas to sort bank grades and relative heights, and to evaluate the applicability of the model.

As a result, for areas where geological structures and soil strength were thought to be generally uniform, the relations between gradient and relative height of side slope of Tostugawa River were effectively described by the proposed model. This seems to suggest the possibility of using fundamentally measurable physical values to predict, to a degree, the slopes that are at risk of deep-seated landslides and the scale of those landslides.

Keywords: Deep-seated catastrophic landslides, Slope stability analysis, Soil property, Typhoon Talas (T 1112), Kii peninsula