

# Simultaneous monitoring of a collapsing landslide by video cameras

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Effective countermeasures and risk management to reduce landslide hazards require a good understanding of the processes of collapsing landslides. While the processes are generally estimated from the features of debris deposits after collapse, simultaneous monitoring during collapse would provide more insight into the processes. Such monitoring, however, is usually very difficult, because the time of the events is almost impossible to predict until just before collapse. This study introduces a rare case in which a collapsing landslide (150 m in width and 135 m in height) was filmed by three video cameras in Higashi-Yokoyama, Gifu prefecture, Japan. The cameras were set up in the front and on the right and left sides of the slide in May 2006, one month after a series of small slope failures in the toe and the formation of cracks on the head started indicating its forthcoming collapse.

The filmed images showed that the collapse of the landslide started from rock falls and slope failures occurring mainly around the margin, i.e. the head, sides and toe. The numbers of these rock falls and slope failures, which were counted on the screen by eye, subsequently increased with time. Analyzing the images, five of these failures were estimated to have produced more than 1,000 m<sup>3</sup> of debris respectively. Consequently, the landslide collapsed with several surface failures accompanying with toppling phenomena. The manner of the collapse implied that the slip surface initially stayed on the upper slope, and then extended down the slope as the excessive internal stress was transmitted downwards. Image analysis together with field measurement using ground-based laser scanner after the collapse indicated that the landslide produced 50,000 m<sup>3</sup> of debris in total.

As described above, simultaneous monitoring provides valuable information of landslide processes. Further development of monitoring techniques will help improve our understanding of landslide processes qualitatively as well as quantitatively.