



Characterization of landslides on mud volcanoes in Japan by using high resolution DEM data

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We applied airborne laser altimetry to mud volcanoes in Niikappu, Hokkaido, northern Japan, obtained high resolution DEM (digital elevation model) data with a mesh size of 1 m, and successfully characterized the morphology of the mud volcanoes and the landslides on them even though some mud volcanoes were hidden by trees. The landslide shapes visualized by using the DEM data had horseshoe peripheral outlines on plan view and were shallow and tabular in cross sections. The morphology indicated by the DEM data was confirmed by field investigation including measurement; the landslide depths ranged from a few to 4 meters, the width from 15 to 80 m, and the length from 20 to 200 m. The shallow and tabular morphology may suggest and could be due to slope-parallel stratification of mud ejected. By analyzing slope inclination in detail with the DEM data, we found there is a critical slope gradient for the slopes of the mud volcanoes. The slopes with inclinations of 15° or less are stable and not subjected to landslide. On the other hand, slopes with inclinations of 20° or more were invariably within landslide scars. This indicates that slopes on the mud volcanoes would slide if the inclination exceeds 20°, which could be an index of slope stability for the mud volcanoes in the study site. Airborne laser altimetry is thus effective in characterizing small geomorphological features like shallow landslides in a wide area.