

Longitudinal variation in hummock size of the freely-spreading volcanic debris avalanches in Japan

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Hummocky hills are the characteristic topographic features for debris avalanche deposits. Due to a shortage of quantitative achievements with regard to hummocky topography, there remains to be satisfactorily examined the geomorphological significances of debris avalanche hummocks more than just the evidence of the sector collapse. This geomorphological study examines the size distribution of debris avalanche hummocks, implying an availability of hummocky topography for further understanding of the debris avalanche events. We selected four debris avalanches originating from Shiribetsu, Usu, Iwaki, and Nasu volcanoes, Japan. These allowed us to study the typical case of a freely spreading debris avalanche through the interpretation of aerial photographs and GIS techniques, in perspective of comparative and quantitative discussion.

In this study, total numbers of the debris avalanche hummocks are, 172 at Shiribetsu volcano, 262 at Usu volcano, 200 at Iwaki volcano, and 643 at Nasu volcano. These hummocks are mainly distributed on the volcanic skirts with a slope of around less than 5 degrees. And the distance from source varies each other to getting appeared the hummocks in clusters. This difference is good accordance with that of source volcano size, controlling the hummock size being appeared at the proximal area. In addition, there are fewer of the larger hummocks toward the distal end of the deposits in every case, with the similar size-distance relationship within the depositional areas. There is little necessity to allow for the influence of the difference of the geological conditions, nor the volumetric magnitude among the four selected cases. Consequently, it is highly expected that the runout distance is the major controlling factor of the above systematic size variations of hummocky hills, reflecting the fracturing of the debris avalanche blocks along the runway.