Landslide Forecasting: Contour Shape as a Major Factor in Slope Failure

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The Great East Japan Earthquake caused serious damage due to many mountain slope failures, indicating the necessity of predicting the locations and extents of such failures in advance. In this study, sand mounds were formed by dropping sand from a funnel to the centers of foam plates having various geometric shapes and their slope angles, weight, and heights were measured during shaking and at rest to determine the effect of the plate shapes on these parameters. The shapes of sand mounds formed on plates corresponding to real mountains' level surfaces were quite consistent with the shapes of the corresponding mountains. In addition, many of the sites of slope failures on shaken sand mounds were consistent those observed on the real mountains. Thus, slope angle and level surface shape significantly influence the shape and stability of mountains. The height of a general sand mound corresponded with the height of that created within the circle inscribed in its level surface. From this result, ridge lines of sand mounds having different level surface shapes correspond to Voronoi boundaries when seeds are placed on the contour lines. The proposed SFL Map standing for Slope Failure Landslide Map which indicates the sites of slope failures on the model, is very useful for deciding land development plans and evacuation routes. This research also has a wide range of applications for areas for which little geological information is available. These include but not are limited to disaster prevention for emigrating to Mars or the Moon, prediction of the stability of oceanic landforms during natural resource extraction, and construction of underwater bases near an oceanic ridge in the deep sea.

Awards Won:
Third Award of $1,000