An attempt to construct hazard maps based on distribution characteristics of past failures

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Construction of hazard zonation map on slope failures is one of fundamental subjects and is strongly required for mountainous countries all over the world. However, it is generally difficult to make such maps, because methodology is not established. Such hazard maps should express the information on susceptibility to the occurrence of slope failures in each location under any rainfall intensities. Considering that numerous data on the distribution of past slope failures are available in addition to detail topographic data in Japan, such distribution data may give the valuable information on susceptibility of future failures in each locations. Then, we have attempted to construct such maps based on distribution data of the 1983 Sanin heavy rainfall disaster, which gave big damages to western Shimane, Japan.

Regarding slope failures in the region, a distribution map of a 15 km2 area was made by the interpretation of large-scale aerial photographs. Converting the distribution data to a digital raster file through high resolution scanning, the raster data allows the combination of slope failure data with DEM for analyses. Most of failures are shallow, and occurred just after intense rainfall. Therefore, they strongly depend on slope gradient of topography.

Statistical analyses were made on the basis of these digitized data. The occurrence ratio of slope failures, which is defined as the ratio of the area of failure to total area of same gradient, tends to increase with slope gradient. Therefore, the relation is expressed by simple linear equation such as, $r = a + bT$. Here, r and T are the occurrence ratio and slope gradient, respectively. And a and b are coefficients. Coefficient b may also depend on lithofacies. For example, b is high in schistose rocks and granitic rocks areas whereas low in volcanic rocks area. This difference in lithofacies may also include the difference in weathering characteristics of each rock. Consequently, the ratio r depends on both slope gradient and lithofacies.

If enough data on slope gradient and lithofacies in any region were obtained, we can construct a distribution map of the probability of occurrence using the relation mentioned above and coefficients depending on lithofacies. The map gives the information of susceptibility for the occurrence of failures in each location. Expressing the probability of the occurrence by any color on map, it may become a slope hazard map for future occurrence under same rainfall intensity.