

Subsurface water flux as an indicator of landslide preparatory factor

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Recent and foreseen population growth lead to urbanization, including in regions prone to landslides. The risk assessment is essential for efficient land use and hazard mitigation. Due to the complex relationship between the potential risk factors and the actual hazard occurrences, practical approaches are heavily weighed on local landslide inventory and temporal precipitation which is one of primary triggering factors and is readily available. Although the weathering grade of soils and rocks are often considered, the chronic effect of subsurface rock alteration and weakening by infiltrated rain water may also contribute as preparatory factor. In this study, we investigated the hydrological budget and geospatial distribution of landslides of Reunion Island. The simple lithology and abundant landslides make this island ideal for examining the importance of subsurface water infiltration as an indicator of the preparatory factor.

Watershed-scale hydrological budget was determined using precipitation, evapotranspiration, and surface discharge data from database provided by MeteoFrance and Office de l'eau Réunion. Landslide geospatial distribution was compiled from BRGM catalog and from aerial imagery analysis. We found that the mean inter-annual precipitation averaged over watershed scale vary from 1500 to 6000 mm/year among the seven primary watersheds, whereas the flux of water infiltrating to the subsurface ranges from zero up to 2200 mm/year. The areas with limited infiltration coincide areas of by far fewer landslide occurrences, despite high precipitation. It suggests that the subsurface infiltration of water may increase the landslide risk, presumably by chemical alteration of subsurface rocks. Consequently, the rate of subsurface water infiltration may serve as a credible risk assessment factor in the regions where landslide records are scarce or in the regions with potential risks in future.