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THE EFFECTS OF GEOLOGICAL SURROUNDINGS ON EARTHQUAKE-INDUCED SNOW AVALANCHE PRONE AREAS IN THE KOPAONIK REGION

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ABSTRACT:

In most seismic hazard analyses, ground motion prediction equations consider only the effects of the top ~30 m of local soil and fail to consider the effects of the deep geological surroundings of sites. However, a series of recent seismic microzonation studies in the Kopaonik region showed that geological formations of several hundreds of meters to a few kilometers in depth strongly affect the severity of both short and longer period waves. This paper presents the results of a study conducted at a ski resort located in Kopaonik National Park, the most seismically active region in the Republic of Serbia. For the past 50 years, small to medium avalanches have occurred at the ski resort. Most recently, a non-earthquake–induced avalanche was observed in 2012. In the present study, a series of alternative maps of earthquake-induced snow avalanche prone areas were produced using terrain slope and snow thickness data, the probabilistic estimates of peak ground acceleration (PGA) values, and three different scenarios with differing snow density and shear strength values. The results showed that, when all other parameters remained the same, standard seismic hazard assessments that considered only the shallow geology conditions of local soil sites (and not the deep geology conditions of the sites) significantly underestimated the risk of earthquake-induced avalanches. This occurs as the PGA estimates of the deep geology rock sites (such as those commonly found in the highest parts of mountain regions) are ~30–70% larger than the PGA values predicted by empirical equations that only take into account the effects of the local soil conditions.

Key Words: Seismic hazard analysis; peak ground acceleration; deep geological site surroundings; Kopaonik region; earthquake-induced snow avalanche prone areas.

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