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Improving the early-warning of a mud-debris flow using radar rainfall data

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The timely and accurate warning of mud-debris flows including landslide hazards is very important to protect life and property. The rainfall estimation uncertainty makes it difficult to issue accurate warning. Traditionally rain gauges have been the main source of surface rainfall measurements. The rain gauges provide an accurate point rainfall estimates, but their spatial resolution is limited by the low-density of a gauge network. The errors associated with interpolation schemes to fill in the missing data over the ungauged sites can introduce significant error due to the long distance between the rain gauge stations and the hazard site (ungauged sites), particularly over rough terrain. The radar system can provide rainfall information at higher temporal and spatial resolutions than was previously possible from rain gauge measurements. While radar provides accurate spatial and temporal resolution of the rainfall field at significant heights above the surface of the earth, numerous measurement errors can result in an inaccurate rainfall depth at the ground. This study attempts to improve mud-debris flow early-warnings through accurate rainfall depth estimation by applying an innovative artificial neural network method. The first scenario uses the nearest rainfall observing site from an ungauged hazard site. The second uses the radar rainfall data and improves the rainfall estimation compared to the first scenario. The third scenario integrates the above two scenarios using both radar and observed rainfall at the sites around the ungauged hazard site, and improves the rainfall estimation by the largest margin. This methodology is applied to the Seoul metropolitan area. The proposed methodology can be applied to improve the confidence in the early-warning of the mud-debris flow hazard in other areas.

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