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Dynamic Susceptibility of Rainfall-Induced Landslides: A Gated Recurrent Unit Approach

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Globally, there is an urgent need for accurate and effective Landslide Early Warning Systems (LEWS). Most LEWS are currently based on a single aggregated measure of rainfall derived from either *in-situ* measurements or radar estimates. Relying on a summary metric of precipitation may not capture the intricacies of rainfall dynamics that could improve landslide prediction. Here, we present a proof-of-concept for constructing a LEWS that is based on an integrated spatio-temporal modelling framework. Our proposed protocol builds upon a recent approach that uses the entirety of the rainfall time series instead of the traditional cumulated scalar approximation. Specifically, we use a Gated Recurrent Unit to process the whole rainfall signal and combine the output features with a second neural network dedicated to incorporating terrain characteristics. We benchmark this approach against a baseline run that relies on terrain and a cumulative rainfall metric. Our protocol leads to better performance in the context of hindcasting landslides which uses past rainfall estimates from CHIRPS. This provides a stronger case to repeat the same experiment using weather forecasts. If analogous results are produced in the forecasting context, this could justify adopting such models for operational purposes.