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Characterising regional landslide initiation thresholds in Scotland, UK using NIMROD c-band precipitation radar and the BGS National Landslide Database.

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Forecasting changes in slope stability and the location and timing of landslide events is of great scientific and societal interest. This is particularly the case in the context of critical infrastructure systems as these can cross many geological and hydro-geological domains and provide essential societal services. An established area of enquiry is that of characterising site, regional and national scale hydro-meteorological proxies (e.g. precipitation intensity/duration, antecedent precipitation or soil moisture deficit) to distil antecedent and initiation landslide threshold conditions. However, the application of such methods often suffers from limited spatio-temporal availability of meteorological data and landslide inventories. There are relatively few studies applying remotely sensed meteorological data to examine precursory conditions at national, regional and local scale. This study seeks to address this by applying remotely sensed meteorological data to examine precursory conditions at national, regional and local scale in combination with information derived from the BGS National Landslide Database. There are a total 115 landslides in Scotland, UK with recorded date of failure in the BGS National Landslide Database covering the period 2004 to 2015. To determine landslide initiation thresholds high resolution (15 minute 5km2) c-band precipitation intensity (mm/hr) radar data are analysed leading to the establishment of precipitation intensity time series for each landslide location. These time series enable calculation of derived explanatory variables including daily mean, max, volume and the aggregation of antecedent values at 3, 6, 18, 36 and 72 days. The statistical significance of each variable is determined, with the lowest probability of the observed occurrences being due to chance taken as indicating the best explanation. Combinations of thresholds and various spatial scales are examined to identify national and regional triggering conditions. Initial national scale results indicate that the most powerful predictor is constructed by combining thresholds for mean 1 day precipitation intensity > 17.28 mm/hr, 1 day precipitation volume sum of > 414.28 mm and 3 day precipitation volume sum of > 1015.17 mm