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Developing a methodology for the delineation of regions into landslide domains with a case study in East Sikkim, India

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Here we present a methodology for the mapping of landslide domains, using as a case study East Sikkim district (964 km², population of 283,583 in 2011), a landslide-prone region in northeast India. Landslide domains are defined as regions with similar physical and environmental characteristics that specifically drive landslide dynamics. The methodology given here is more systematic than what has previously been used and draws on information on landslide factors inferred from landscape variables. Commonly used landslide factors are divided into three groups: preconditioning, preparatory, and triggering factors. Elevation data, geology, and landslide inventory information are used to provide information on the landslide factors in the study region. Data from the neighbouring and geologically similar regions of East Sikkim district are used to enhance landslide inventory information in the study region, effectively doubling the number of landslides in the inventory from 210 to 440 mapped landslides. We iterate over each of the landslide factor groups and for each iteration either map a new landslide domain boundary or enrich the information of the landslide domains. As a result, we map four landslide domains in East Sikkim district, India, with a size ranging from 81 km² to 394 km². The domains have been further enriched using information on rainfall and earthquakes. Each landslide domain describes the typology of landslides and the general geomorphology and land use. The landslide domains in East Sikkim district can be used for (i) describing landslide processes homogeneously; (ii) illustrating landslide processes for training or stakeholder engagement; and (iii) as a starting point for the construction of landslide susceptibility maps and landslide early warning that actively draws from the landslide processes that can be found in the region.