



Identifying urban infrastructure multi-hazard risk in developing country contexts

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This work presents a method to coarsely zone urban areas into different infrastructure typologies, from which physical vulnerability to a range of natural hazards and multi-hazard interactions can be estimated, particularly for developing country contexts where access to data can be a challenge. This work builds upon techniques developed for urban micrometeorology for classifying 12 urban typologies (Stewart and Oke, 2011) using Landsat 8 30 m × 30 m remote sensing imagery (Betchel *et al.*, 2015). For each of these 12 urban typologies, we develop general rules about the presence, type and level of service of 10 broad categories of infrastructure (including buildings, roads, electricity and water), which we refer to as 'urban textures'. We have developed and applied this technique to five urban areas varying in size and structure across Africa: Nairobi (Kenya); Karonga (Malawi); Mzuzu (Malawi); Ibadan (Nigeria) and Cape Town (South Africa). For each urban area, a training dataset of 10 samples of each of the 12 urban texture classes is digitised using Google Earth imagery. A random forest classification is performed using SAGA GIS, resulting in a map of different urban typologies for each city. Based on >1200 georeferenced field photographs and expert interviews for Karonga (Malawi) and Nairobi (Kenya), generally applicable rules about the presence, type and level of service of 12 infrastructure types (the 'urban texture') are developed for each urban typology. For each urban texture, we are broadly reviewing how each infrastructure might be physically impacted by 21 different natural hazards and hazard interactions. This can aid local stakeholders such as emergency responders and urban planners to systematically identify how the infrastructure in different parts of an urban area might be affected differently during a natural disaster event.