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Combining social media and remote sensing techniques for natural hazard impact assessments on urban infrastructure

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This paper explores a method to combine social media data and satellite imagery for an improved classification of urban infrastructure risk from natural hazards for data-poor regions. Towns and cities in Africa are rapidly urbanising and accumulating risk to natural hazards. There are numerous examples of infrastructure impacts across urban Africa such as landslides blocking roads, storms damaging power lines and earthquakes affecting buildings. Yet the challenges of informality, rapid growth and lack of capacity mean that there is limited data for understanding this risk to infrastructure. The work here builds upon a methodology to coarsely classify urban areas into 17 different infrastructure typologies based on spectral characteristics, which we call 'urban textures'. Each of these urban textures may be impacted differently by a specific natural hazard based upon the characteristics of the infrastructure in that zone. The urban textures classification is originally performed using freely available Sentinel-2 imagery in a random forest classification to zone urban areas into different infrastructure typologies. The urban textures methodology involves creating a training dataset of approximately 170 samples of areas with known infrastructure typologies across the city. Four multi-temporal Sentinel-2 images are obtained to reflect seasonal differences and all 12 bands degraded to 60 m resolution for the random forest classification. The urban textures methodology has been applied to 4 urban areas across Africa with reasonable levels of accuracy, including Nairobi (Kenya), Karonga (Malawi), Mzuzu (Malawi) and Niamey (Niger). For Nairobi (Kenya,) we are now exploring the addition of Twitter data into the random forest classification as a series of raster layers supplementary to each Sentinel-2 band. Three years (2014-2016) of Twitter data was obtained for the Nairobi region. After data processing, 725,561 valid geo-Tweets were used to extract 13 attributes that represent social space, and aggregated to a 60 m grid to match the scale of the Sentinel 2 imagery used in classification. This paper will present our preliminary results of combining information of physical and social space to better infer urban textures of informal cities.