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Improving flood damage assessments in data-scarce areas by retrieving building characteristics through automated UAV image processing

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Reliable information on building stock and its vulnerability is important for understanding societal exposure to flooding and other natural hazards. Unfortunately, this often lacks in developing countries, resulting in flood damage assessments that use aggregated information collected on a national- or district level. In many instances, this information does not provide a representation of the built environment, nor its characteristics. This study aims to improve current assessments of flood damage by extracting structural characteristics on an individual building level and estimating flood damage based on its related susceptibility. An Object-Based Image Analysis (OBIA) of high-resolution drone imagery is carried out, after which a machine learning algorithm is used to classify building types and outline building shapes. This is applied to local stage-dependent damage curves. To estimate damage, the flood impact is based on the flood extent of the 2019 mid-January floods in Malawi, derived from satellite remote sensing. Corresponding water depth is extracted from this inundation map and taken as the damaging hydrological parameter in the model. The approach is applied to three villages in a flood-prone area in the Southern Shire basin in Malawi. By comparing the estimated damage from the individual object approach with an aggregated land-use approach, we highlight the potential for very detailed and local damage assessments using drone imagery in low accessible and dynamic environments. The results show that the different approaches on exposed elements make a significant difference in damage estimation and we make recommendations for future assessments in similar areas and scales.