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Large scale flood risk assessment for urban and rural areas using building material based vulnerability curves

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In this study, we developed an enhanced approach for large scale flood damage and risk assessment that uses object-based information to represent exposure and vulnerability to flooding. Most current large scale flood risk assessments use aggregated land use data to represent these two components of risk, as these data are more widely available than object-based data. Our approach draws upon common practices in large scale earthquake risk assessments. We use exposure data that include different construction types and relate vulnerability to building materials, and present a method to differentiate urban and rural flood risk globally.

The use of object-based information is beneficial, because a single land use class, such as ‘urban’, cannot reflect the heterogeneous structure of the built environment. Land use categories cannot be easily related to relevant vulnerability curves and are only an indirect proxy to express the intensity of the flood damage. Construction type and building material may be more important and are a direct relation to the elements of the built environment. They are commonly used in earthquake risk research and have been applied for flood risk assessments on local scales.

In our approach we use the construction type classification data from the PAGER project and define and develop new construction and building material based flood vulnerability classes and combine them with information from the JRC’s Global Human Settlement Layer. We demonstrate the feasibility of this novel flood vulnerability method in the case of several African countries and compare it to the usually applied land use based approach. The developed approach allows physical vulnerability assessment of buildings in areas with limited information about the exposed elements. It further not only permits a differentiation between damages in urban and rural areas, it also considers that the building stock between these areas can be drastically different particularly in developing countries. The method enables the comparison of vulnerability to other natural hazard types in which material based vulnerability curves are used.