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Global Dynamic Exposure and the OpenBuildingMap - A Big-Data and Crowd-Sourcing Approach to Exposure Modeling

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The substantial reduction of disaster risk and loss of life, a major goal of the Sendai Framework by the United Nations Office for Disaster Risk Reduction (UNISDR), requires a clear understanding of the dynamics of the built environment and how they affect, in the case of natural disasters, the life of communities, represented by local governments and individuals. These dynamics can be best understood and captured by the local communities themselves, following two of the guiding principles formulated by the UNISDR: "empowerment of local authorities and communities" and "engagement from all of society". The two lead to societies increasing their understanding of efficient risk mitigation measures.

Our Global Dynamic Exposure model and its technical infrastructure build on the involvement of communities in a citizen-science approach. We are employing a crowd-sourced exposure capturing based on OpenStreetMap (OSM), an ideal foundation with already more than 375 million building footprints (growing daily by ~150,000), and a plethora of information about school, hospital, and other critical facilities. We are harvesting this dataset with our OpenBuildingMap system by processing the information associated with every building in near-real-time. We are enriching this dataset in a truly big-data approach by including built-up area detection from remote sensing with satellite and radar imagery combined with different sources of road networks, as well as various open datasets and aggregated exposure models that provide relevant additional information on, buildings and land use.

A task of such a scale does not come without challenges, particularly in matters of data completeness, privacy and the merging and homogenizing of different datasets. We are thus investing a large effort on the development of strategies to tackle these in a transparent and consistent way.

We are fully automatically collecting exposure and vulnerability indicators from explicitly provided data (e.g., hospital locations), implicitly provided data (e.g., building shapes and positions), and semantically derived data, that is, interpretation applying expert knowledge. The latter allows for the translation of simple building properties as captured by OpenStreetMap users or taken from

open datasets into vulnerability and exposure indicators and subsequently into building classifications as defined in the Building Taxonomy 2.0 developed by the Global Earthquake Model (GEM) and in the European Macroseismic Scale (EMS98). A task of such a scale does not come without challenges, particularly in matters of data completeness, privacy and the merging and homogenizing of different datasets. We are thus investing a large effort on the development of strategies to tackle these in a transparent and consistent way. With our open approach, we increase the resolution of existing exposure models minute by minute through data updates and step by step with each added building, as we move forward from aggregated to building-by-building descriptions of exposure.

We expect the quality of near-real-time estimates of the extent of natural disasters to increase by an order of magnitude, based on the data we are collecting. We envision authorities and first responders greatly benefitting form maps pinpointing the greatest trouble spots in disasters and from detailed quantitative estimates of the likely damage and human losses.