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Earth Observation Techniques for Spatial Disaggregation of Exposure Data

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Exposure describes elements which are imperiled by natural hazards and susceptible to damage. The affiliated vulnerability characterizes the likelihood to experience damage regarding a given level of hazard intensity. Frequently, the compilation of exposure information is the costliest component (in terms of time and labor) in risk assessment. Existing data sets and models often describe exposure in an aggregated manner, e.g., by relying on statistical/census data for given administrative entities. Nowadays, earth observation techniques allow to collect spatially continuous information for large geographic areas while enabling a high geometric and temporal resolution. In parallel, modern data interpretation tools based on Artificial Intelligence concepts enable the extraction of thematic information from such data with a high accuracy and detail. Consequently, we exploit measurements from the earth observation missions TanDEM-X and Sentinel-2, which collect data on a global scale, to characterize the built environment in terms of fundamental morphologic properties, namely built-up density and height. Subsequently, we use this information to constrain existing exposure data in a spatial disaggregation approach. Thereby, we compare different methods for disaggregation and evaluate how different resolution properties of the earth observation data affect the risk assessment result. Results are presented for the city of Santiago de Chile, Chile, which is prone to natural hazards such as earthquakes. We present loss estimations and corresponding sensivity with respect to the resolution properties of the exposure data used in the model. Thereby, it can be noted how loss estimations vary substantially and that aggregated exposure information underestimates losses in our scenarios. As such, this study underlines the benefits of deploying modern earth observation technologies

for refined exposure estimation and related loss estimation.