EXPOSURE MAPPING

Towards up-to-date and accurate large-area exposure models

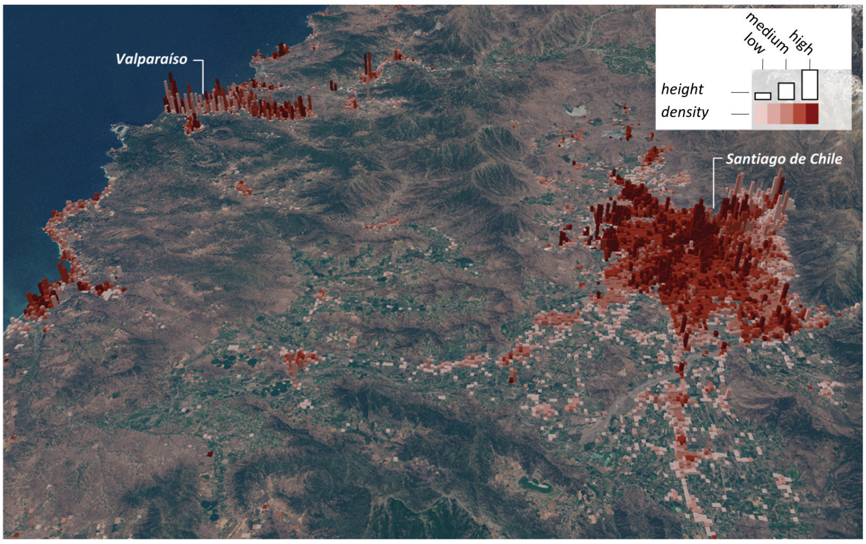
Natural hazard risk assessment requires the consideration of three distinguishable components: **hazard**, **exposure**, and **vulnerability**. In contrast to the fuzzy concept of vulnerability, exposure can be considered as a highly tangible component of risk: it comprises the assets potentially adversely affected by a hazardous event such as people, properties, infrastructure, and economic activities. Consequently, RIESGOS provides novel techniques for characterization of built environments with respect to exposure properties.

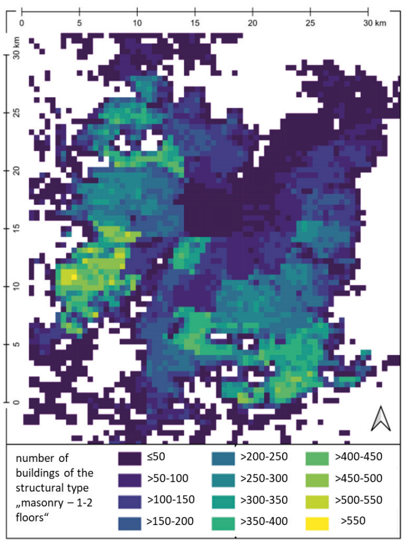
LARGE-AREA EXPOSURE MAPPING WITH EARTH OBSERVATION DATA

One major component comprises an automatic processing chain for computing **built-up density and height for large areas** by jointly using **earth observation data** from the **TanDEM-X** mission and **Sentinel-2** constellation. These two parameters are subsequently deployed for the spatially highly accurate disaggregation of exposed population and risk-related building typologies.

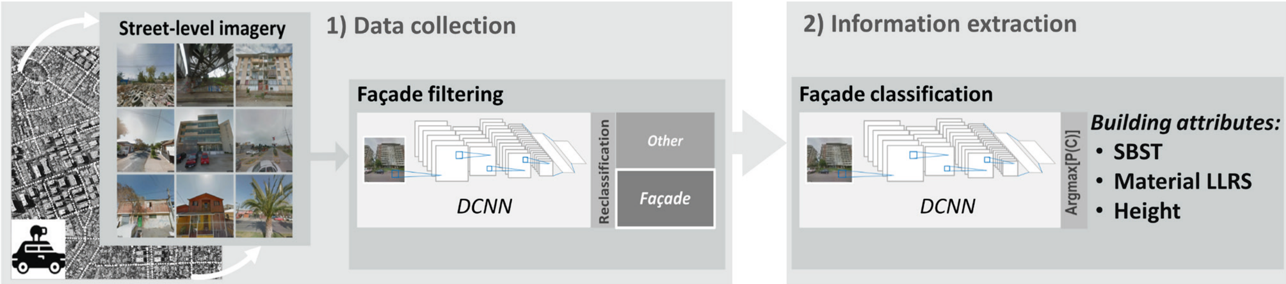
BUILDING CHARACTERIZATION WITH STREET-LEVEL IMAGERY

Knowledge on the key structural characteristics of exposed buildings is a prerequisite for accurate seismic risk modeling. The acquisition of such data by conventional field surveys, however, is highly expensive in terms of time and money and thus prohibitive for a spatially continuous large-area monitoring. Within RIESGOS an automated and thus efficient methodology for the collection of vulnerability-related structural building characteristics based





Left: built-up density and height derived from earth observation data by deploying the TanDEM-X mission and Sentinel-2 constellation covering the region Santiago de Chile - Valparaíso - Viña del Mar; right: exemplified exposure information with respect to a building structural type (i.e., "masonry 1-2 floors") for the city of Santiago de Chile.



Building characterization with street-level imagery: 1) Automated collection of geolocated façade imagery; 2) information extracion via DCNN-classification.

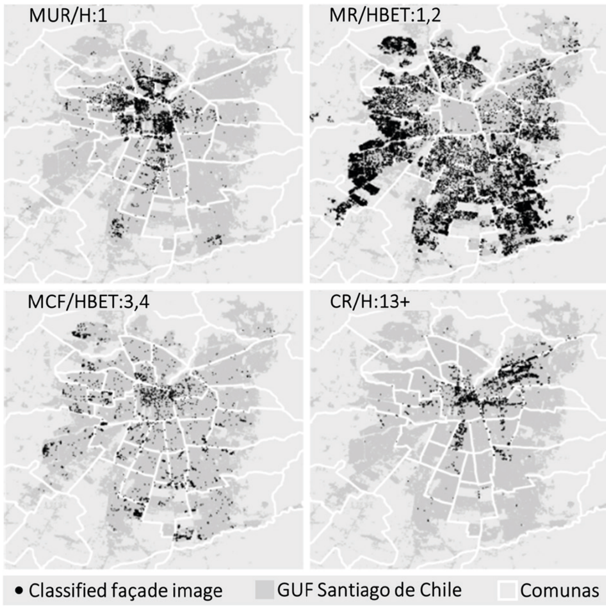
on state-of-the-art **Deep Convolution Neural Networks (DCNNs)** and ***in-situ* street-level imagery** such as provided by Google Street View was developed.

Based on the façade view of a building, the established method allows to infer the **Seismic Building Structural Type (SBST)**. The SBST reflects the main-load bearing structure of a building and thus its behaviour under seismic forces. In addition, the approach is deployed to determine other important target variables such as the **material type** of the lateral load resisting system (LLRS) as well as the **building height**.

APPLICATION

Example façade imagery for four of the 14 addressed SBSTs: Unreinforced masonry, one storey (MUR/H:1), reinforced masonry, 1-2 storeys (MR/HBET:1,2), confined masonry, 3-4 storeys (MCF/HBET:3,4) and reinforced concrete, ≥13 storeys (CR/H:13+).

The approach was applied and evaluated for the Chilean capital Santiago. This involved the automated acquisition of >200.000 building façade images and their automated categorisation among 14 SBSTs, 7 LLRS material types and 6 height classes.



Spatial distribution of SBST classified façade images across Santiago de Chile.

More information about the project:
www.riesgos.de

Dr. Christian Geiß, Patrick Aravena Pelizari
German Aerospace Center (DLR)
Earth Observation Center (EOC)
christian.geiss@dlr.de,
patrick.aravenapelizari@dlr.de

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