Geophysical Research Abstracts
Vol. 14, EGU2012-12741, 2012
EGU General Assembly 2012

A transferable approach towards rapid inventory data capturing for seismic vulnerability assessment using open-source geospatial technologies

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Geospatial technologies are increasingly being used in pre-disaster vulnerability assessment and post-disaster impact assessment for different types of hazards. Especially the use of remote sensing data has been strongly promoted in recent years due to its capabilities of providing up-to-date information over large areas at a comparatively low cost with increasingly high spatial, temporal and spectral resolution. Despite its clear potentials, a purely remote sensing based approach has its limitations in that it is only capable of providing information about the birds-eye view of the objects of interest. The use of omnidirectional imaging in addition can provide the necessary street-view that furthermore allows for a rapid visual screening of a buildings façade.

In this context, we propose an integrated approach to rapid inventory data capturing for the assessment of structural vulnerability of buildings in case of an earthquake. Globally available low-cost data sources are preferred and the tools are developed on an open-source basis to allow for a high degree of transferability and usability. On a neighbourhood scale medium spatial but high temporal and spectral resolution satellite images are analysed to outline areas of homogeneous urban structure. Following a proportional allocation scheme, for each urban structure type representative sample areas are selected for a more detailed analysis of the building stock with high resolution image data. On a building-by-building scale a ground-based, rapid visual survey is performed using an omnidirectional imaging system driven around with a car inside the identified sample areas. Processing of the acquired images allows for an extraction of vulnerability-related features of single buildings (e.g. building height, detection of soft-storeys). An analysis of high resolution satellite images provides with further inventory features (e.g. footprint area, shape irregularity). Since we are dealing with information coming from different sources at different scales with different accuracies Bayesian networks are used for data integration and vulnerability classification following EMS-98 scale.

The proposed procedure can provide a supplement to commonly used screening techniques (e.g. FEMA 310) to adequately cope with the high spatio-temporal variability in present day cities. Due to the underlying multi-scale structure and a stratified sampling the geographical analysis focus can be narrowed in a guided and structured way. Therefore only necessary data is acquired and analysed which reduces time and costs for a survey. Preliminary results from applications to study sites in Central Asia and Germany will be presented.