Geophysical Research Abstracts
Vol. 13, EGU2011-13693, 2011
EGU General Assembly 2011

Advanced Tsunami Risk Assessment through Integration of Temporal Aspects in Population Exposure Modeling

Sergio Freire (1) and Christoph Aubrecht (2)

(1) e-GEO, FCSH, New University of Lisbon, Lisbon, Portugal (sfreire@fcsh.unl.pt, +351 217908300), (2) AIT Austrian Institute of Technology, Vienna, Austria (christoph.aubrecht@ait.ac.at, +43 50550 4599)

The Lisbon Metropolitan Area (LMA), Portugal, is subject to significant risk of tsunami, as confirmed by the occurrence of numerous events in the past. Although the probability of occurrence is lower than for other natural hazards, impacts can be extremely high. Assessment and mapping of communities' tsunami risk requires estimation of social vulnerability, with population exposure probably being the most critical variable. However, more effort has been put into understanding of tsunami hazard than into estimating potential impacts on people and infrastructure. Step one of tsunami preparedness includes assessing and mapping concentrations of population present, since all human beings are equally vulnerable in case of tsunami. The spatial distribution of population, and hence exposure to hazards, is time-dependent, especially in metropolitan areas. Therefore a more accurate population exposure assessment and risk analysis requires going beyond residence-based census maps and figures.
This effort aims at improving the assessment of tsunami risk and contributing to more efficient and effective disaster management by modeling and mapping the spatio-temporal distribution of local population in the daily cycle and integrating it with a tsunami hazard map for quantitative analysis of human exposure in the LMA. A Tsunami Inundation Susceptibility map for the area was obtained from the Regional Plan for Territorial Management for the Lisbon Metropolitan Area (PROTAML). This map depicts areas susceptible to inundation caused by tsunami using two classes or levels, High and Moderate.
New high-resolution (50 m) daytime and nighttime population distribution raster surfaces are developed using 'intelligent dasymetric mapping' to combine best-available census data and statistics with land use and land cover data. The nighttime distribution is obtained by further refining detailed census data through re-allocation of residential population to effective residential areas. Mobility statistics are considered for mapping daytime distribution, and empirical parameters used for interpolation are obtained from a previous modeling effort. Validation procedures show that the approach yields realistic distributions. Finally, the population distribution surfaces are combined with the Tsunami Inundation Susceptibility map to summarize nighttime and daytime population counts by each susceptibility zone and hence assess potential human exposure to tsunami in both periods.
Results show that a significant amount of population is potentially at risk, and its numbers increase from nighttime to daytime, especially in the zones of high susceptibility. These findings reflect the location of human economic activities closer to the coastline, and the more intensive occupation of these areas during the daytime period. We believe this improved characterization of vulnerability and risk can benefit all phases of the disaster management process where human exposure should be considered, namely emergency planning, risk mitigation, preparedness, and response to an event.