

## **Management, visualization and comparison of multiple hazards and risk using free software: the ByMuR tool**

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ByMuR is a Python Free Software tool developed to manage, analyze, visualize and compare multiple risks and related inputs. The tool has been developed within a project focused to (i) provide a quantitative and objective general method for a comprehensive long-term multi-risk analysis in a given area, accounting for inter-model epistemic uncertainty through Bayesian methodologies, and (ii) apply the methodology to volcanic, seismic and tsunami risks in Naples (Italy). The software manages pre-computed results, and GUI based procedures are provided to import/export XML datasets. The used XML schema is based on Natural hazards' Risk Markup Language defined by GEM (Global Earthquake Model). Data is stored using a MySQL relational database, ByMuR-DB, designed to be compatible with existing databases such as DIVO (Selva et al. 2009) and WOVODat (Ratdomopurbo et al., 2013). The ByMuR software can handle, separately, the probabilistic hazard assessments of different kinds of hazardous phenomena, the relative fragility and loss models, exposure data, as well as the corresponding probabilistic risk assessments. The software supports also an additional inventory management, which contains an accurate target area partitioning and a building characteristics classification. When the user selects a phenomenon, a hazard model and a set of relevant parameters, the relative hazard map (the intensity having a given exceedance probability in the selected exposure time) and the probability map (exceedance probability corresponding to the selected intensity threshold in the selected exposure time) are visualized. By selecting one or more areas on the map, corresponding hazard/fragility/inventory/loss and risk curves are plotted and it is possible to compare multiple risk indexes. ByMuR offers also the possibility to define new ensemble models and export the resulting curves in XML files. The development of ByMuR package has been funded by Italian Ministry of Education, Universities and Research (MIUR), "Futuro in Ricerca 2008" FIRB Project [RBFR0880SR].