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SEISMIC VULNERABILITY ASSESSMENT OF EXISTING BUILDINGS

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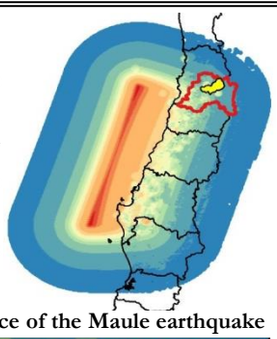
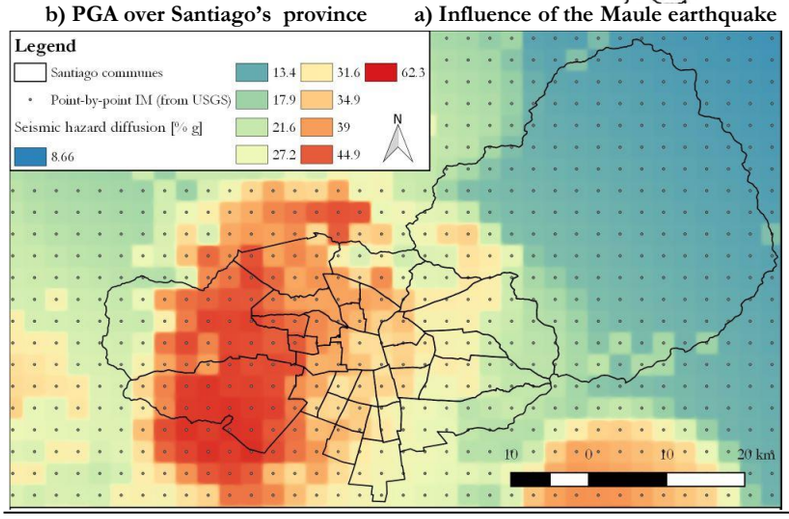
OBJECTIVE: COMPARE THE SEISMIC VULNERABILITY ASSESSMENT APPROACHES OF CHILE AND SWITZERLAND BY ASSESSING SANTIAGO'S BUILDING STOCK.

1. THE SEISMIC HAZARD

Scenario analysis based on the M_w 8.8 Maule earthquake of Feb. 27th 2010. Raw data from the USGS provide point-by-point Intensity Measures (fig. a)). The PGA values were interpolated and sample to each building. This event caused a range of PGA values from 0.1g to 0.6g to Santiago's city (fig.b)).



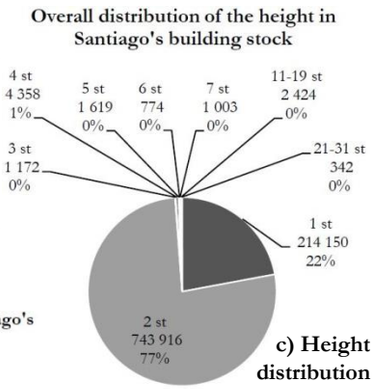
a) Influence of the Maule earthquake



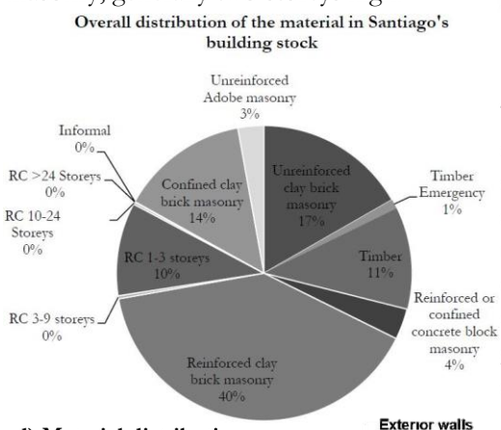
b) PGA over Santiago's province

2. THE EXPOSURE MODEL

Exposure model are fundamental parameters in defining the physical and social inventories subjected to different levels of hazard. The model developed by [Santa María et al.] defines 980 256 buildings. The main construction material is reinforced masonry, generally two storeys high.

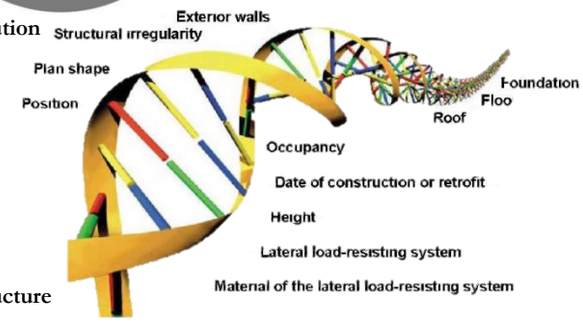


c) Height distribution



d) Material distribution

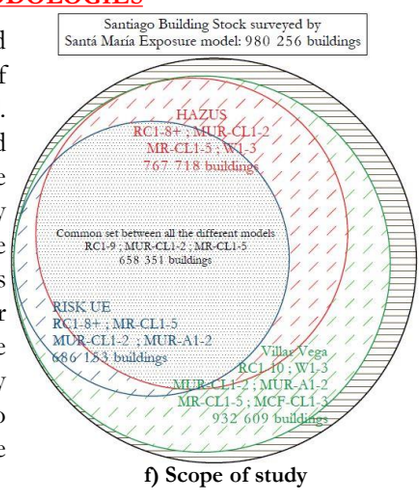
The characterisation of structures is made using some building typologies arising from the GEM taxonomy model [Brzev et al.]. This classification aims at being the global genetic decryption key of a structure (fig. e)).



e) Genome of a structure

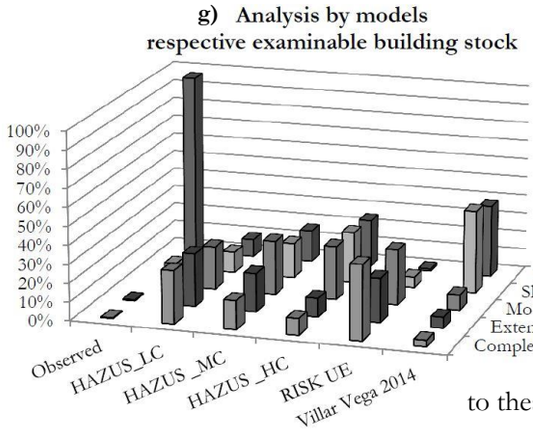
3. THE ASSESSMENT METHODOLOGIES

Two different approaches and three different sources of vulnerability models are used. Both approaches are simplified mechanical methods, yet the "Chilean" one is implemented by means of the OpenQuake Engine using fragility curves from [HAZUS, 2003] and [Villar et al., 2017] models; while the "Swiss" is computed manually through MATLAB, referring to the LM2 methodology from the RISK UE project and to the capacity curves of [Lagomarsino and Giovinazzi, 2006] and [Lestuzzi et al., 2017]. The study scope is captured in fig. f).



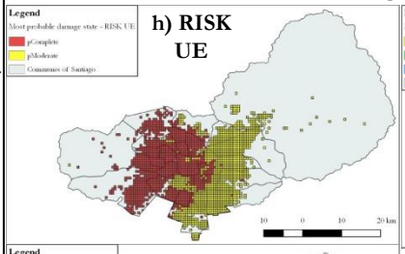
f) Scope of study

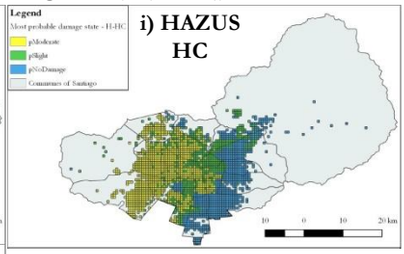
4. ESTIMATED DAMAGE vs. OBSERVED DAMAGE

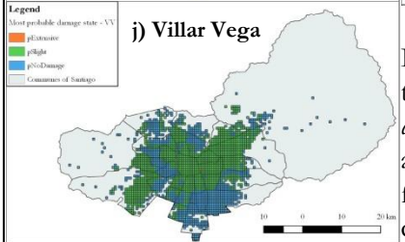


Damage distributions were estimated for the whole Santiago building stock considering the different suited vulnerability models. Damage observed by the Chilean government were compared to these estimations (fig. g)).

Finally, damage maps were carried out to depict the geographic distribution of the estimated damage: figures h), i) and j).







5. CONCLUSION

It seems paramount to improve the *collection process of data* on *damaged structures after a seismic event* and on *new constructions* in order to, first, enable more pertinent comparisons between estimated damage and observed ones, and secondly, develop more resilient *exposure models*. In addition, opting for a certain representation methodology is already an interpretation being made of the results.

To conclude, **local vulnerability models are essential** to conduct relevant vulnerability assessments as regional models do not offer reliable results when implemented out of their geographical scope.