The medium-term seismic hazard model for Italy

Licia Faenza, Warner Marzocchi, Pamela Roselli, Giuseppe Falcone, Matteo Taroni

The aim of this project is the quantification of the seismic hazard in the medium-term for Italy within the INGV Seismic Hazard Center (Centro di Pericolosità Sismica – CPS). The medium-term models represent the transition between short-term models, characterized by Omori-Utsu cluster occurrence, and the long-term ones that are mainly based on time-independent processes. In the first case, the forecasting time window is of a few days / weeks, whereas in the latter case the time window is usually tens of years. The long-term model constitutes the basic ingredient for the seismic hazard estimates and it is related to the definition of the national seismic code. The medium-term models fill the gap between these two time intervals with time windows ranging from a few months (e.g., six months) to a few years (e.g., 5 years). Besides the pure scientific aspects, we also explore the needs of a wide range of potentially interested stakeholders, such as citizens, the media, decision makers of civil protection or municipalities, and the formats that may satisfy these needs.

At this early stage, we rely exclusively on models submitted to EU CSEP Testing Center. The choice to use only these models is motivated by the need to have models already reviewed and accepted by the scientific community and with homogeneous data input and output. This last aspect is crucial to be able to compare and combine the results of the various models.

Our strategy consists in the weighting different hazard models in order to create an ensemble model. Noteworthy, the ensemble model is meant to describe the aleatory variability and the epistemic uncertainty in a consistent way. In particular, we describe in detail how this ensemble model is built merging different models of earthquake rate and GMPEs. Finally, we discuss some examples showing the forecasting performances of the ensemble model with respect to each single model.

Motivation: To take advantage of the Time-Dependent models we update the models after each target event

Point 1: 13 Time-Independent models submitted the 5-year CSEP experiment for Italy (Marzocchi, Schorlemmer and Wiemer, 2010)

Point 2: 2 Time-Dependent models for which we are able to reevaluate the probability of occurrence. The target events for these models are Mw 5.5+ from R.O.C.M. in the forecasting time under interest

Point 3: 14 M 5.0+ from ISIDe in the time domain 2010-01-01 2014-12-31

Strategy: Inclusion of correlation weights to condition the inverse log-likelihood derived from the 5 years forecasting testing experiment

Score Model Averaging (SMA) based on correlation weights divided by the cumulative log-likelihood (Marzocchi et al., 2012). We arbitrary choose to give half of the weight to the time-dependent models since we decide to update them after each target events to emphasize the role of time dependency in this experiment

NEXT STEPS
- include the 3-months models implemented in CSEP (RI_S, RI_L, Triples) and other short-term clustering models of shorter forecasting time windows (6 months, 1 year)
- test different way to weight the models
- include the GMPEs or the IPEs to calculate hazard maps in ground motion or intensity (see poster of Roselli et al.)
- Build a web page with the help of experts in communication to spread information to different stakeholder and have their feedback

REFERENCES:
ISIDe http://iside.mi.ingv.it/it/dati/standard/index.jsp
R.C.M. http://www.ingv.it/RCM/1/
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