UNIVERSITY OF NAPLES FEDERICO II

DEPARTMENT OF STRUCTURES FOR ENGINEERING AND ARCHITECTURE
PHD PROGRAM IN
STRUCTURAL, GEOTECHNICAL ENGINEERING AND SEISMIC RISK

CYCLE XXXVII

The undersigned prof. Warner Marzocchi (Full Professor) at the Department of of Earth, Environmental, and Resources Sciences, S.S.D. GEO/10 Geofisica della Terra solida

ASKS

to be included in the list of tutors for cycle XXXVII.

1. Curriculum vitae (max 500 words)

Warner Marzocchi is professor of Geophysics and of Natural Hazard Forecasting at the University of Naples Federico II and at the Scuola Superiore Meridionale. His current research is focused on seismic and volcanic hazard analysis, earthquake and eruption forecasting, statistical seismology, and testing natural hazard models. He is author of more than 150 publications on journals listed in the Web of Science (H-index 39 in WoS, and 40 in SCOPUS). He is a member of the Academia Europaea and was included between the first and second percentile of top scientists in all scientific fields (JPA Ioannidis, J. Baas, R. Klavans, KW Boyack "A standardized citation metrics author database annotated for scientific field ", Plos Biology https://doi.org/10.1371/journal.pbio.3000384).

He has coordinated, at different levels, many national, European and international projects focused on earthquake and eruption forecasting and hazard analysis. Among other commitments, he has served as: co-chair of the Seismic Hazard Center at INGV; member of the advisory board for NERC-ESRC UK programs and projects; member of the science advisory group (SAG) of the "International Continental Scientific Drilling Program", ICDP; member of the Southern California Earthquake Center (SCEC) advisory council; member of the Global Volcano Model (GVM) scientific steering committee; member of the Scientific Review Panel for the Uniform California Earthquake Rupture Forecast (UCERF3); member of the Commission for Seismic Risk mitigation ("Art.11 Legge 77/2009"), appointed by the Italian Government; member of the International Commission on Earthquake Forecasting (ICEF) appointed by the Italian Government; co-chairman of World Organization of Volcano Observatories (WOVO); chairman of the International Association of Volcanology

and Chemistry of the Earth Interior's Commission on Statistics in Volcanology (IAVCEI-COSIV).

He has been invited to give lectures and talks at Risk Management Solutions' symposium "Advances in earthquake forecasting" (New York, Jan. 2008), at meetings of the American Geophysical Union, European Geosciences Union, Japan Geoscience Union, and at many Universities and International Research Institutes.

He graduated in Earth Sciences cum laude (1987) and received his PhD degree in Physics (1992) at the Alma Mater Studiorum University of Bologna. He became associate professor in Physics of Volcanism (1998) at the Osservatorio Vesuviano, he has been chief scientist at INGV, visiting professor at the Institute of Statistical Mathematics in Tokyo, and visiting scientist at the University of Southern California. Since 1998 he taught Statistics and data analysis applied to geosciences, Geophysics, and Natural hazard forecasting at graduate and PhD students of the University of Bologna, Roma Tre, Geneva, and Naples Federico II.

2. PhD students of whom the undersigned has been a tutor in the last three years

n. 3	Two on University funds, and one on an EU H2020 project

3. Title of the proposed research

Towards non-Poisson PSHA modeling for building code purposes

4. Field of study

Geotechnical Engineering □

Structural Engineering □

Seismic Risk □ X

5. Summary of the research project (max 500 words. State of the art, short program planned for the activities, etc.)

Since the beginning, PSHA estimates for building code purpose are rooted in modeling earthquake rates assuming a time-homogeneous Poisson distribution for the occurrence of the largest events (mainshocks). However, as clearly demonstrated by the recent last earthquake sequence on Central Italy, earthquakes tend to cluster in space and time. Hence, to fulfill the "Poisson-assumption", earthquake rates are estimated from seismic catalogs which are declustered (i.e., removing earthquake clusters leaving the major earthquakes, i.e., the mainshocks) by suitable procedures. However, since the subdivision between independent and triggered earthquakes, or between mainshocks and foreshocks / aftershocks, has no consolidated scientific roots, today there are different declustering models that produce different declustered catalogs and, consequently, different earthquake rates. Overall, this has an important effect on PSHA estimates. Furthermore, it is well established that, regardless of the procedure used, declustering removes earthquakes that may have given strong ground shaking.

Despite these shortcomings, the procedures for estimating PSHA at national level for building code purposes are still rooted in the "Poisson-assumption". The few attempts to overcome this assumption have clearly shown that declustering lowers significantly the overall seismic hazard. These studies are still in a pioneering phase and several issues remain unsolved.

In this project, we aim at exploring innovative strategies to address PSHA overcoming the "Poisson-assumption", through the development of time-dependent earthquake occurrence models which may produce realistic synthetic 50-years long earthquake catalog. These synthetic catalogs can be eventually used to derive nonparametrically the probability of exceedances of different kind of ground shaking. Besides to overcome the "Poisson-assumption" accounting for the effect of earthquake clustering on seismic hazard, these models may provide realistic PSHA estimates over different time windows and fill the

temporal gap between operational earthquake forecasting (short-term seismic hazard) and classical PSHA.

The outcomes of these models will be carefully compared with classical PSHA outcomes based on the Poisson assumption and with the recent attempts to take into account earthquake clustering to evaluate the impact in terms of building code.

6. Research publications

C. Meletti, **W. Marzocchi**, V. D'Amico, G. Lanzano, L. Luzi, F. Martinelli, B. Pace, A. Rovida, M. Taroni, F. Visini (2020). The new Italian seismic hazard model (MPS19). Ann. Geophys., 64 (1), SE112

A. N. Papadopoulos, P. Bazzurro, **W. Marzocchi** (2021). Exploring Probabilistic Seismic Risk Assessment Accounting for Seismicity Clustering and Damage Accumulation: Part I. Hazard Analysis. Earthq. Spectra., 37(2), 803-826, DOI:10.1177/8755293020957338

G. Lanzano, L. Luzi, V. D'Amico, F. Pacor, C. Meletti, **W. Marzocchi**, R. Rotondi, E. Varini (2020). Ground Motion Models for the New Seismic Hazard Model of Italy (MPS19): Selection for Active Shallow Crustal Regions and Subduction Zones. Bull. Earthq. Eng. 18, 3487-3516.

M. C. Gerstenberger, **W. Marzocchi**, T. Allen, M. Pagani, J. Adams, L. Danciu, E. Field, H. Fujiwara, N. Luco, K-F Ma, C. Meletti, M. Petersen (2020). Probabilistic Seismic Hazard Analysis at Regional and National Scale: State of the Art and Future Challenges. Rev. Geophys. 58, e2019RG000653.

W. Marzocchi, T.H. Jordan (2017). A unified probabilistic framework for seismic hazard analysis. Bull. Seismol. Soc. Am., 107(6), 2738-2744.

W. Marzocchi, M. Taroni, G. Falcone (2017). Earthquake forecasting during the complex Amatrice-Norcia seismic sequence. Science Adv., 3, e1701239.

W. Marzocchi, M. Taroni, J. Selva (2015). Accounting for epistemic uncertainty in PSHA: logic tree and ensemble modeling. Bull. Seismol. Soc. Am., 105(4), 2151-2159.

W. Marzocchi, M. Taroni (2014). Some thoughts on declustering in probabilistic seismic hazard analysis. Bull. Seismol. Soc. Am., 104(4), 1838-1845.

7. Funded research projects in which the proposed research fits

European project H2020 - RISE

8. Funds available for research grants, equipment, missions, etc.
European project H2020 - RISE

9. Information related to the research period abroad (min. 3 months) provided for the PhD student (please indicate University/research institution and professor/researcher of reference) (max 300 words)
The research will be carried out in collaboration/synergy with foreigner colleagues. Below I show some of the institutions and names of the most likely candidates: University of Edinburgh, prof. Ian Main University of Southern California, prof. Thomas H. Jordan University of Bristol, prof. Maximilian Werner United States Geological Survey, Dr. Edward Field

10. Collaborations with companies on the research topic (if available) (max 300 words)

Naples, April 30, 2021 SIGNATURE

This form must be filled and sent to the e-mail address phd.dist@unina.it no later than Friday 30/04/2021.