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EDITORIAL

Editorial to the Special Issue on SIGMA

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In recent years, attempts have been made to identify and quantify uncertainties in seismic hazard estimations for regions with moderate seismicity. These studies have highlighted the lack of representative data, thereby resulting in predictions of seismic ground motion with large uncertainties. These uncertainties, for which no estimation standards exist, create major difficulties and can lead to different interpretations and divergent opinions among experts. There is a wide consensus among the scientific and technical community for the need to improve knowledge so as to better characterize and, ideally, reduce the uncertainties entering in the calculation of seismic ground motion hazard.

To address this situation, in January 2011, an industrial consortium composed of the French electric power utility (EDF), the French company AREVA, the Italian electricity company Ente Nazionale per l'Energia eLettrica (ENEL), and the French Atomic Energy Commission (CEA) launched an international research and development program. This program, named SeIsmic Ground Motion Assessment (SIGMA), lasted for 5 years and involved a large number of international institutions.

The main objective of the research program was to establish a framework to be used in the future to produce stable and robust hazard estimates. Better characterization and more stable uncertainty estimation could provide input for the updating of regulations. It was expected that total uncertainties will be reduced by significantly lowering epistemic uncertainty, and subsequently, this research program would significantly contribute to the following efforts:

- Validate, homogenize and stabilize input databases for seismic hazard calculations;
- Produce accepted and validated methods and calculation tools;
- Reduce total uncertainties;
- Improve confidence in seismic hazard assessments; and
- Foster technical and scientific exchanges among French and other European organizations.

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The total cost of the program amounted to 7.5 million Euro over a period of 5 years and a large number (30) of worldwide academic, research and professional institutions contributed to the project and their contributions resulted in the publication of 75 technical reports reviewed by the Scientific Committee, 40 publications in peer-reviewed journals and numerous communications in international conferences, workshops and symposia.

Although a book presenting the main outcomes of the SIGMA project, "An Overview of the SIGMA Research Project: A European Approach to Seismic Hazard Analysis", has been published by Springer in the series Geotechnical, Geological and Earthquake Engineering (http://www.springer.com/fr/book/9783319581538), it appeared essential to gather in one volume the most important, and recent, contributions to the project presented in detail by their authors. Papers related to the five different work packages of the project are included in this volume and are presented in this sequence

- Knowledge of seismic sources;
- Seismic ground motion prediction;
- Local site conditions representation;
- Seismic hazard models;
- Characterization and utilization of seismic ground motions.

During 5 years SIGMA has not only achieved significant steps forward in the methods for evaluating seismic hazard at a site, but it also contributed to establishing a strong network of academic institutions, researchers and engineering companies that will survive after the project ends. The overall organization of the project fostered very lively and fruitful discussions between all participants. Despite the amount of effort devoted to SIGMA, significant endeavors remain to be made to increase the reliability of seismic hazard predictions and to better understand and constrain the associated uncertainties. In fact, not all topics related to SHA have been covered during the course of the project, either because they were discarded after its start or because new topics emerged during the 5-year program. SIGMA clearly stressed the importance of collecting data to feed and constrain the models, the necessity of high quality site characterization through field instrumentation, the need for evaluation of site response and implementation of the single-station sigma approach. All these improvements in empirical knowledge contribute to a better estimation of the hazard and characterization of the epistemic uncertainties.

This special issue of BEE is a tribute to Professor Marco Mucciarelli who was a very active member of the Scientific Committee of SIGMA and who passed away at the end of the project.

Alain Pecker
Guest Editor
Chairman of the Scientific Committee of SIGMA