

Contribution of the SIGMA research programme to quantify the uncertainties in seismic hazard assessment

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SIGMA research & development program took place between 2011 and mid-2016. The main objectives were to improve the knowledge of data, methodologies and tools to better quantify and reduce the epistemic uncertainties of the seismic hazard models. The SIGMA researches were undertaken within an academic and industrial framework. The research program was organised in five Work Packages (WP):

-WP1: Improve the knowledge of seismic sources: the main goals are to produce a homogeneous catalogue of earthquakes for the French territory that covers both the historical and instrumental periods, and to improve the knowledge of faults and geological structures that are potentially active in south-eastern quarter France and Po Plain Italy.

-WP2: Improve seismic ground motion models: the objective is to develop methods of ground motion prediction that are adapted to the French, Northern Italy and neighboring countries context, with a realistic characterization of aleatory and epistemic uncertainties.

-WP3: Improve local site conditions representation: the goal is to develop methods and tools to evaluate sites potentially subjected to local site effects, and that are appropriate to be used in the seismic hazard calculation methods. The final objective is to build guidelines to account for site effects.

-WP4: Improve seismic hazard models: the goal is to better quantify and possible reduce uncertainties of seismic hazard models estimations. This WP integrates all the results coming from the other WPs and compares the results between standard practices and SIGMA improvements. The objective is to evaluate the benefits produced by SIGMA project on the seismic hazard assessment.

-WP5: Improve the characterization and exploitation of seismic ground motions: the objective is to ensure that results of the overall project fulfil the engineers and designers needs for the structure design and operations. The goal is to produce methods and tools for the development of the needed engineering parameter(s) of the seismic ground motion adapted to the facilities.

SIGMA achieved significant scientific progress presented in numerous scientific articles published in peer reviewed journals. SIGMA produced operational results useful within an industrial framework: a seismicity catalogue for the French territory; a database of seismic ground motions for Europe; new ground motion prediction equations for Europe with specificities for France and Italy; a guide of good practices for site characterization; a guide on site effects quantification; a summary of the SIGMA lessons learned and recommendations for the development of seismic hazard models. SIGMA has developed an international network of academic and industrial experts.