SD13/TH/O4 - INSIGHTS INTO THE USE OF GENETIC CLUSTERING TO DELINEATE SEISMOGENIC SOURCE ZONES FOR INPUT INTO PROBABILISTIC SEISMIC HAZARD ANALYSIS

G. Weatherill, P. Burton2

¹European Centre for Training & Research in Earthquake Engineering, Pavia, Italy; ²Seismic Risk Group, School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom

The delineation of seismic sources for input into probabilistic seismic hazard analysis (PSHA) is a process that unfortunately can be applied inconsistently from region to region. In many areas of high seismic risk, seismogenic sources, be they areal zones, geometric fault segments or distributed point sources, may often be delineated via the best judgement, or even a compromise judgement, of a team of experts. Whilst much expertise may be applied in this process, the zone models themselves may often better represent a compromise of judgement rather than "natural" phenomena, and in doing so they may also lack objective means of validation and reproduction. Traditional methods of cluster analysis have previously been applied to this task, which, whilst more objective, are limited in the extent to which they can utilise other forms of geological and seismotectonic information. A genetic clustering approach, in the form of a modified genetic K-medoids algorithm, can provide a framework by which seismogenic sources are spatially partitioned according to objective judgements regarding the role of different sources of information. Evolutionary-based clustering allows the algorithm identify "better" partitions from a population of seismogenic source models, guiding the generation of new partitions on the basis of the fitness criteria. The fitness function provides a tool for integrating different forms of seismotectonic (e.g. focal mechanism) and geological data (e.g. rupture plane), and can attempt to optimise the cluster analysis in such a manner as to best reconcile the observed seismicity with the additional data. An additional clustering heuristic is also used to achieve this objective. Example applications illustrate how this approach can maximise the information used in the development of seismogenic sources models, which often depends heavily on the region in question, as well as the role that expert judgement can play within the objective framework. The algorithm is applied to idealised earthquake data, in addition to real earthquake data from different areas of the globe. Issues in the development of this prototype framework for source delineation are addressed, including the translation of seismicity partitions into source zones and means of validation.