



1 Routine application of simulation techniques for earthquake hazard studies

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Simulating future earthquake activity by the production of synthetic earthquake catalogues provides a powerful and adaptable means of investigating problems related to earthquake hazard and risk. It provides an alternative to standard analytical techniques for probabilistic seismic hazard analysis (PSHA), and is compatible to the extent that the same input provides the same output. This can be reassuring to end-users who may be conservative with regard to the methodology adopted for engineering applications. However, a simulation-based approach to PSHA provides a number of benefits to the analyst when adopted for routine practice. Firstly, the method is extremely easy to adapt in the light of developing methodology; an example is the accurate mixing of ground motion models that employ different distance metrics. Conventional PSHA hazard software can only manage this with the aid of conversion formulae that entail additional inexactness in the results. Secondly, the fact that simulation methods are essentially an observational-based approach, rather than dealing in mathematical abstractions, focuses the analysis on real physical outcomes, reducing the scope for errors of interpretation. Thirdly, the comparison of the simulations with the historical input data used to construct the model provides a powerful means of validating the model by “closing the loop”. This provides security against faults in the model arising from misguided interpretation or even simple typing errors in a complex, hard to decode, input file. In routine application of PSHA for engineering design, such security features are an important safeguard.