Geophysical Research Abstracts
Vol. 13, EGU2011-10776, 2011
EGU General Assembly 2011

Modelling real earthquake activity with reverse engineering based on evolutionary computation methods

Marina Kechaidou (1), Georgios Ch. Sirakoulis (1), Emmanouil M. Scordilis (2), and Ioannis Karafyllidis (1)

(1) Democritus University of Thrace, School of Engineering, Electrical and Computer Engineering, Xanthi, Greece (gsirak@ee.duth.gr, +30 25410 79540), (2) Department of Geophysics, School of Geology, Aristotle University, Thessaloniki, Greece

Hazard assessment of dangerous natural phenomena is very important because these phenomena result in loss of human life and property, especially in dense populated areas. Earthquakes are probably the most devastating phenomena since their immediate and long-term consequences are severe. Earthquake activity modelling, especially in areas known to experience frequent large earthquakes, could lead to improvements in building regulations and infrastructure development that will prevent as much as possible loss of lives, injuries and property damage. Greece is considered to be one of the top active lands in the world as well as the most active seismically region of Europe. Earthquakes in Greece are monitored continuously and instrumental earthquake data are available since the beginning of the 20th century, when seismological networks were firstly deployed. In this study we concentrate on the earthquake data analysis in different regions of Greece, characterized by different seismicity level. More specifically, a novel model is proposed based on evolutionary computation methods, such as symbolic regression by genetic programming and genetic algorithms in order to elucidate hidden mathematical relations and patterns found in the under study seismological data signals. Automated techniques for collecting and storing earthquake data have become increasingly precise and powerful leading to a very large amount of gathered data increasing with time and difficult to handle. To distil such amounts of gathered data into knowledge and into practical regulations, the data should be organized and the relationships between the measured parameters must be described using analytical mathematical models which will lead to automated processes of data handling. In many scientific research fields, the increasing measurement infrastructure supported by increasing networking and increasing computer power has led to collections of staggering amounts of data, but automated processes for distilling these data into knowledge in the form of analytical mathematical relationships have not kept pace. The proposed model can reveal hidden relations between parameters measured on an earthquake occurrence, such as displacements, velocities and accelerations. Furthermore, it is calibrated with the usage of reverse engineering in an attempt to close the loop from data collection to initial hypothesis model formation and revision. The presented simulation results qualitatively and quantitatively reveal some of the fundamental characteristics for each studied geographical region located in Greece that stem from its geodynamic properties. Consequently, the proposed model could serve as a computer-assisted basis for hazard evaluation and mapping of regional earthquake phenomena.