Geophysical Research Abstracts
Vol. 20, EGU2018-10448-1, 2018
EGU General Assembly 2018

3D big data modeling and visualization of underground faults through information fusion of 2D underground faults' mapping and seismic data mining

Antonios Konstantaras (1), Theofanis Frantzeskakis (1), and Emmanuel Maravelakis (2)

(1) Laboratory of Computer Technology, Informatics & Electronic Devices, TEI Crete, Chania, Greece, (2) Design & Manufacturing Laboratory, TEI Crete, Chania, Greece, (Corresponding Author: akonstantaras@chania.teicrete.gr)

This paper aims to fuse three dimensional information to known two dimensional mappings of underground faults by mining their depth extent information from earthquake hypocenters associated to particular underground faults. Self developed spatio-temporal clustering algorithms [1,2,3] are being deployed to cluster earthquakes into distinct seismic regions [4,5,6] and proximity algorithms [7] in space and in time are used to allocate groups of seismic events to particular underground faults. As these algorithms can be assimilated as single instruction processes with multiple data to process, the authors have resolved to parallel processing operations using heterogeneous parallel programming encompassing both central processing units and several hundreds of graphic processing compute units [8]. For every distinct underground fault, the spatial extent is retrieved from known two dimensional maps, whilst its in-depth location across its spatial extent is being depicted by the hypocentres' depth measurements of earthquakes associated with each particular underground fault. Equal number of matrices to the overall number of known underground faults are being produced containing the three dimensional location of every individual underground fault. Three dimensional big data visualization using extremely powerful graphic processing units is being performed to visualize and navigate amongst wide areas containing multiple underground faults and in some cases [9] interacting underground fault networks.

References

[1] Konstantaras, A., Katsifarakis, E., Maravelakis, E., Skounakis, E., Kokkinos, E., Karapidakis, E. (2012). Intelligent Spatial-Clustering of Seismicity in the Vicinity of the Hellenic Seismic Arc, Earth Science Research, 1(2), 1-10.
[2] Konstantaras, A., Varley, M. R., Vallianatos, F., Collins, G., Holifield, P. (2002). Recognition of Electric Earthquake Precursors using Neuro-Fuzzy models: Methodology and Simulation Results, Signal Processing Pattern Recognition and Analysis, IASTED, Crete, Greece.
[3] Georgoulas, G., Konstantaras, A., Katsifarakis, E., Stylios, C. D., Maravelakis, E., Vachtsevanos, G. J. (2013). "Seismic-mass" density-based algorithm for spatio-temporal clustering. Expert Systems with Applications, 40(10), 4183-4189.
[4] Konstantaras, A. J. (2013). Classification of distinct seismic regions and regional temporal modelling of seismicity in the vicinity of the hellenic seismic arc. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 6(4), 1857-1863.
[5] Konstantaras, A. J. (2016). Expert knowledge-based algorithm for the dynamic discrimination of interactive natural clusters. Earth Science Informatics, 9(1), 95-100.
[6] Konstantaras, A., Varley, M. R., Vallianatos, F., Makris, J. P., Collins, G., Holifield, P. (2007). Detection of weak seismo-electric signals upon the recordings of the electrotelluric field by means of neuro-fuzzy technology. IEEE Geoscience and Remote Sensing Letters, 4(1), 161-165.
[7] Eldred, A., Veeramani, P. (2006). Existence and convergence of best proximity points. Journal of Mathematical Analysis and Applications, 323(2), 1001-1006.
[8] Owens, J., Luebke, D., Govindaraju, N., Harris, M., Krüger, J., Lefohn, A., Purcell, T. (2007). A survey of general-purpose computation on graphics hardware. Computer Graphics Forum, 26(1), 80-113.
[9] Konstantaras, A., Vallianatos, F., Varley, M. R., Makris, J. P. (2008). Soft-computing modelling of seismicity in the southern hellenic arc. IEEE Geoscience and Remote Sensing Letters, 5(3), 323-327.