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

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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