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Monitoring of Crust Deformation of 2003 BAM Erathquake and Fault Modelling with DInSAR Technique and Using Genetic Algorithm

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Active faulting in Iran is result of the convergence between the Arabian & Eurasian plates, which occurs at about 40 mm yr -1 at longitude 60 ćŁE and is mostly accommodated by distributed shortening within the political borders of Iran. InSAR applications provides ideal situation for active tectonic studying & seismic hazard assessment in Iran. With the advent of space borne radar systems, SAR interferometry is becoming a new tool for active tectonics by providing both surface change maps spanning periods of days to years, for measuring co- and inter-seismic deformations, and accurate high resolution topographic maps for measuring crustal strain accumulated over longer periods of time. In this paper, we analyze synthetic aperture radar (SAR) interferograms derived from Envisat radar data. Use of interferograms from both ascending and descending satellite passes enables us to indicate regions of surface and near-surface slip which is used to modeling procedure. Also we used azimuth offset (AZO) data as additional data. This is horizontal displacement information for earthquake that is obtained with sub pixel matching of SAR amplitude images. Combining the interferometry with subpixel matching of the SAR amplitude images allows us to obtain the full three-dimensional displacement field for the earthquake, distinguishing vertical from horizontal motions.

The purpose of modeling procedure used here is to determine a set of source parameters explaining both the tectonic observations and the InSAR data. We performed DInSAR process onto SAR images to retrieve only displacement fringes. in this regards, we used three-pass interferometry approach , which in it 3 radar images of the

same area is combined to form two interferograms and then the interferometric phase field due to topography is removed from the observed phase. After this step, for increasing the signal to noise ratio we removed trend from phase and AZO data. For this mean we select 4 points in the far field, away from earthquake, and with considering residual phase(or offset) in these points fit a plane to them, consequently subtract this plane from the data.

The paper followed by a brief discussion of dislocation theory, in this study we used a finite rectangular dislocation embedded in the elastic half space. The InSAR geodetic data are inverted to gain insight into the fault geometry. We used the standard Okada model as a model that defines the relation between the source parameters and geodetic measurements of surface displacement. A set of 7 fault parameters used in our model are: 1) fault length, 2) coordinates of the fault, 3) upper and lower depth, 4) strike, 5) dip, 6) slip and 7) rake. , the goal is to find the values of parameters which best fit the data. There are two approaches in this regards: forward and inverse problem. Estimation of fault parameters with first method is a trial-and-error approach. We used second method; in this method estimation of parameters is done directly from observed data. Fitting the modeled fringe to observed data in this approach is better than forward approach. We intended to solve inverse problem with InSAR data only, without need to any geologic data. In this regards we found Genetic algorithm (GA) as a powerful tool. GA is a search technique used in computing to find exact or approximate solutions to optimization and search problem, this algorithm can estimate unknown parameters without need to know initial value. We could innovate a new method in GA and named it by Adaptive GA. With this new method we could gain better results than previous.