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DOUBLE DIFFERRENCE RELOCATION OF EARTHQUAKES IN KERMANSHAH REGION, WESTERN IRAN

Yousef NOURIAN KOJABADI
M.Sc. Graduate, Institute of Geophysics, University of Tehran, Iran
ynourian@ut.ac.ir

Esmaeil BAYRAM NEJAD
Assistant Professor, Institute of Geophysics, University of Tehran, Iran
ebayram@ut.ac.ir

Mohammad REZA GHEITANCHI
Professor, Institute of Geophysics, University of Tehran, Iran
mrghchee@ut.ac.ir

Hosein FAHIMI
M.Sc. Graduate, Institute of Geophysics, University of Tehran, Iran
hfahimi@ut.ac.ir

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The study region in this paper is located in the western Iran (Kermanshah province) along the seismically active thrust zones in Zagros fold-and-thrust belt that extends from western Iran to northern Iraq. This region was recently affected by the major earthquake with magnitude Mw7.3, on November 12, 2017, causing extensive damage and casualties. The IRSC (Iranian Seismological Centre) has reported more than 9000 events in the region extended from 33° N to 35° N and from 44°E to 46°E between 2006 and 2019. In this study, we use phase data (including arrival times of Pg, Pn, Sg), recorded by IRSC seismic stations (local seismic network of Kermanshah and other nearby local networks) with the combination of records from regional stations in Iraq and Turkey. In addition to IRSC optimum velocity crustal model that is used for most of the regions in Iran, Javaheri et al. (2013) and Haddad et al. (2015), introduced two other structures for this region by employing data from Kermanshah local seismic network. First, we relocate all events using the absolute location algorithm hypo71 (Lee and Lahr, 1975) using two velocity models and compare residual RMS and corresponding horizontal (ERH) and vertical (ERZ) errors to select an appropriate velocity model (Figure 1). Controlling the effect of network geometry on events location, we applied selection criteria: azimuthal gap <180 degree, recording station >5, initial event uncertainty in epicentre and depth <6 Km and arrival time residuals < 1 s. Therefore, 1755 events were selected for relocation by using hypo71, as our initial locations. Then we employed double-difference earthquake location method, hypoDD with the events that were selected based on our selection criteria. The results and comparisons between initial hypocentre locations and relative double difference methods with crustal velocity structures (Javaheri et al. preferred), indicates reduction in locations scattering and residual RMS value, significantly (Figure 2). Altogether, the relative relocations show increased agreement with major active faults in this region.

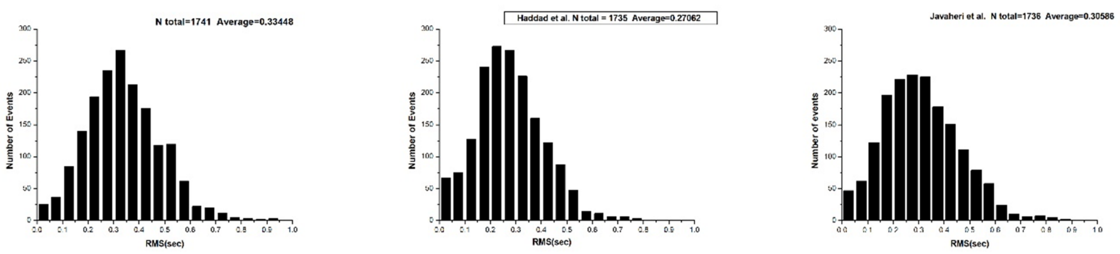

Figure 1. RMS residual for selected crustal velocity models.

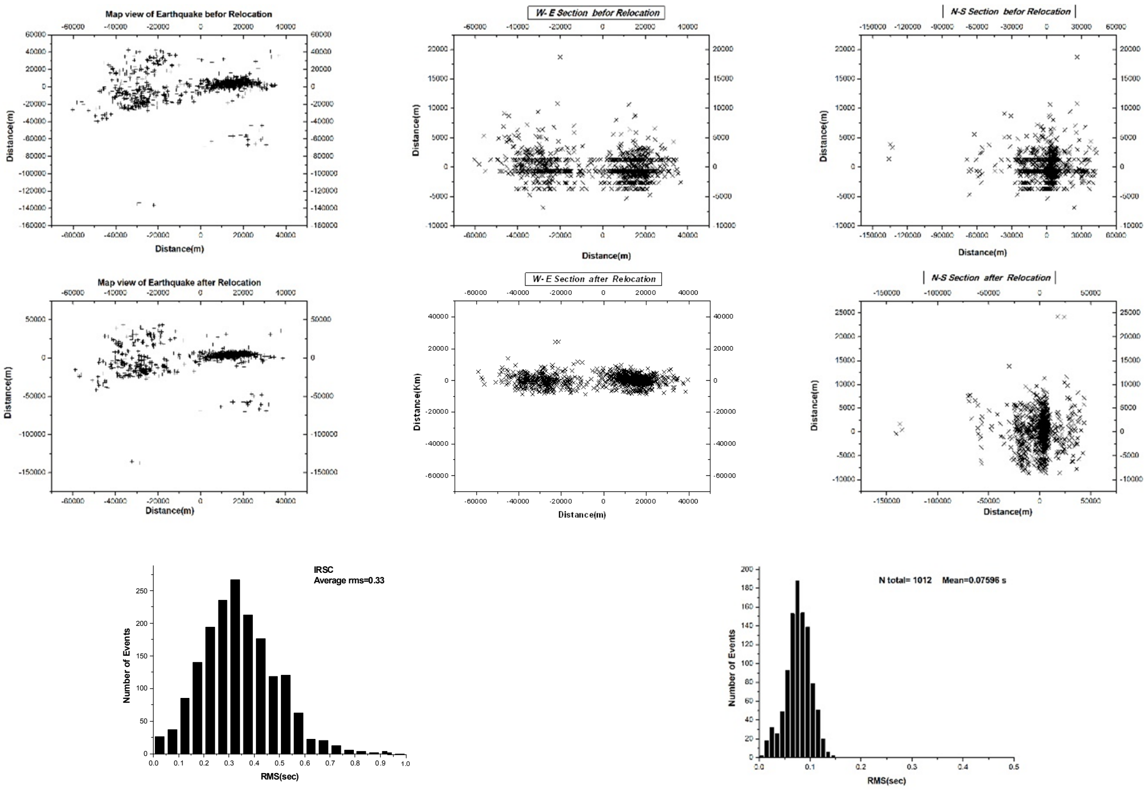

Figure 2. First row indicates the map view, W-E section and N-S section of 1012 events selected by HypoDD methods before relocation, the second row is the results after relative relocation (all events are plotted related to the center of cluster), and finally the Rms residual histograms of data before and after relocation.

REFERENCES

Haddad Momeni, M., Bayram Nejad, E., and Gheitanchi, M.R., (2015). Determination of the crustal velocity model by one-dimensional inverse method in Kermanshah region using local earthquakes. *Journal of New Research in Earthquake*, Islamic Azad University, Iran, *10*(4), 27-34.

Javaheri Mofrad, M., Gheitanchi, M. R., and Bayram Nejad, E., (2013). Investigation crustal velocity structure in the Kermanshah region using local earthquakes Simultaneous Inversion modeling. *Journal of Earth*, Islamic Azad University, Iran, *8*(29), 115-127.

Lee, W.H.K. and Lahr, J.C. (1975). Hypo71 (revised): *A Computer Program for Determining Hypocentre, Magnitude and First Motion Pattern of Local Earthquakes*. U.S. Geol. Survey. Open-File Rept., 75 –311.

Mottaghi, A.A., Rezapour, M., and Yaminifard, F. (2010). Double-difference relocation of earthquake hypocenters along the southern flank of the Central Alborz, Iran. *Bulletin of the Seismological Society of America*, *100*(5A), 2014-2023.

Nourian Kojabadi, Y., Bayram Nejad, E., and Gheitanchi, M.R., (2014). 3-D Relocation of earthquakes in Varzaghan – Ahar area using Double-Difference method. *The 32nd National and 1St International Geosciences Congress*, Geological Survey of Iran.

Waldhauser, F. and Ellsworth, W.L. (2000). A double-difference earthquake location algorithm: Method and application to the northern Hayward fault, California. *Bulletin of the Seismological Society of America*, *90*(6), 1353-1368.

Waldhauser, F. (2012). HypoDD--A Program to Compute Double-Difference Hypocentre Locations (hypoDD Version 2.1b - 06/2012). US Geology Survey. Open File Rep., 01 113.