TWO DIMENSIONAL VELOCITY FIELD OF THE IRANIAN PLATEAU

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ABSTRACT

Long-term crustal flow of the Iranian Plateau is computed using a kinematic model. Three independent data sets (geometry of the seismically active faults mapped in prior geological studies, geodetic benchmark velocities, and principal stress directions) are combined using a finite-element model to better understand regional geodynamics of the Iranian Plateau. We are successful to find the best kinematic model, in which all the data sets are fitted at a RMS level of 1.0 datum standard deviation. The best fitted model, for the first time, provides the velocity field over the Iranian Plateau from all available kinematic data. Spatial distribution of displacement rates within the plateau shows a mixed pattern, in which semi-rigid blocks (e.g. Lut Desert Block and South Caspian Block) are embedded in a deformation zone (e.g. the Zagros and Alborz Mountain Belt). Our estimated rates are consistent with the past earthquakes, and are in the range of previous published rates, in which geodetic benchmark velocities are merely analyzed using different modeling techniques. Sharp changes of displacement rates in some region (e.g. northeastern Iran) show high strain rates, and hence using elastic block modeling seems not to be suitable for fault slip rate estimation. Moreover, the obtained results are useful to calculate the strain rate field, which could be considered as an indicator for undiscovered or/and unmapped faults.

INTRODUCTION

The Iranian Plateau is located within the convergence zone of two rigid plates, the Arabian and Eurasian plates (Hempton, 1987). Neotectonics in the Iranian plateau is complicated by a mix of the various tectonic processes, including seismically active intra-continental collision (Zagros, Alborz, Kopet-Dag, Talesh) and subduction of the oceanic crust (Makran). Despite being highly seismic regions in the Iranian Plateau, seismotectonics and contribution of distributed seismic sources have remained largely unknown. In the recent studies (Djamour et al., 2010; Djamour et al., 2011; Mousavi et al., 2013; Walpersdorf et al., 2014), some parts of the Iranian Plateau are modeled using purely elastic micro-plates separated by only few plate boundary faults. The weakness of these modeling is that only major fault can be studied and distributed deformations resulted from minor faults are ignored. However, lots of minor faults exist in Iranian plateau and should be considered in any proper strain modeling.