Coulomb Stress Change in Ahar-Varzaghan (20121108) Earth Quakes

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Abstract

Understanding how the movement of faults and deformation affects such as motion-induced surface stress and strain, which is very important in seismic regions. The best way to learn about the effects of fault movement is modeled. For example, the modeling of surface displacement or deformation and the amount of damage earthquake can be estimated by the model. Coulomb stress changes can be modeled or predicted earthquake aftershocks or future Earthquakes. we employ assumptions on the orientations, rupture lengths and average slip associated with each earthquake to calculate stress changes. Using this model, we displacement, stress and strain at any depth in the Earth's surface acquired. In this study the modeling of earthquakes **M_w= 6.5, M_w=6.3** Ahar-Varzaghan. The earthquakes induced displacements, strains and stresses were calculated at the surface at an average depth and its aftershocks for 10-km Ahar and 4 km Varzaghan.
Keyword: Coulomb Stress Change, Ahar-Varzaghan, Earthquakes, Okada

INTRODUCTION

On the late afternoon of Saturday, August 11, 2012, the northwest of Iran was shaken by two of the strong earthquakes in Iranian history (Figure 1). First was hit by 6.5 Mw at 16:54 local time (12:23 GMT), and about 11 minutes later, a 6.3 Mw struck 10 km to the west.

COULOMB FAILURE

For the calculation, information of Ahar-Varzaghan earthquake used. This information was extracted from the Iran seismological center that is visible in Table 1 and Figure 1.

Tabel 1Information of 20120811 Ahar-Varzaghan Earthquake extracted from the Iran seismological center

Centroid Lat 38.394 Lon 46.856	Centroid Lat 38.423 Lon 46.825
Centroid Depth : 9.0	Centroid Depth : 9.0
Strike Dip Rake	**Strike Dip Rake**
173 61 -4	7 57 21
Strike Dip Rake	**Strike Dip Rake**
265 87 -151	265 72 146
Origin Time 20120811 12:23:15	Origin Time 20120811 12:34:33

Figure 1 The Study area

To calculate the length and width of the rupture zone of the earthquake were used empirical relationships (Table 2).

Table 2 Geometrical characteristics of earthquake faulting obtained from empirical relationships

Earthquake	RW(rupture width(km))	RLD(subsurface rupture length(km))	AD(average displacement(m))	Rake (degree)
Ahar	9.885	28.840	0.407	-4
varzaghan	8.729	21.667	0.286	21

Results

Ahar vertical and horizontal displacement after M_w= 6.5 mainshock showed in Figures 2 and 3. Varzaghan vertical and horizontal displacement after M_w= 6.3 mainshock showed on Figures 4 and 5.

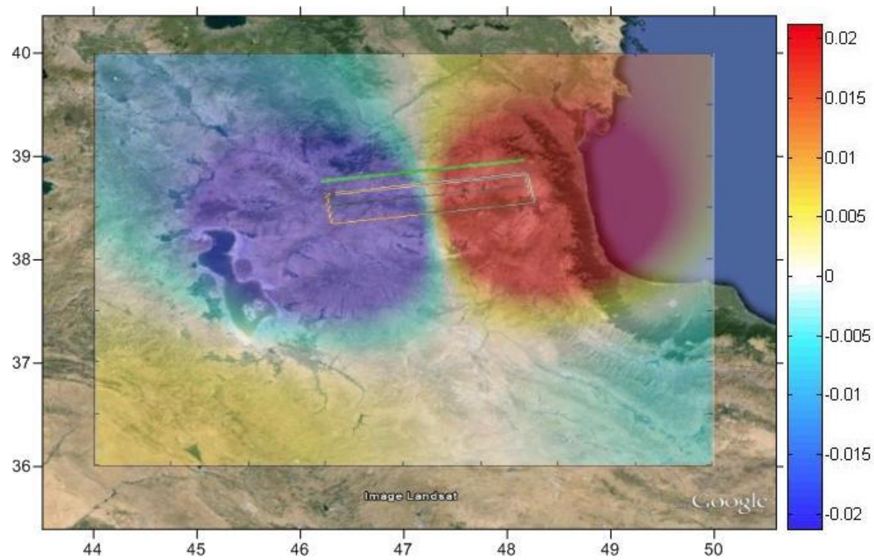

Figure 2 Ahar vertical displacement by meter after M_w= 6.5 Earthquake

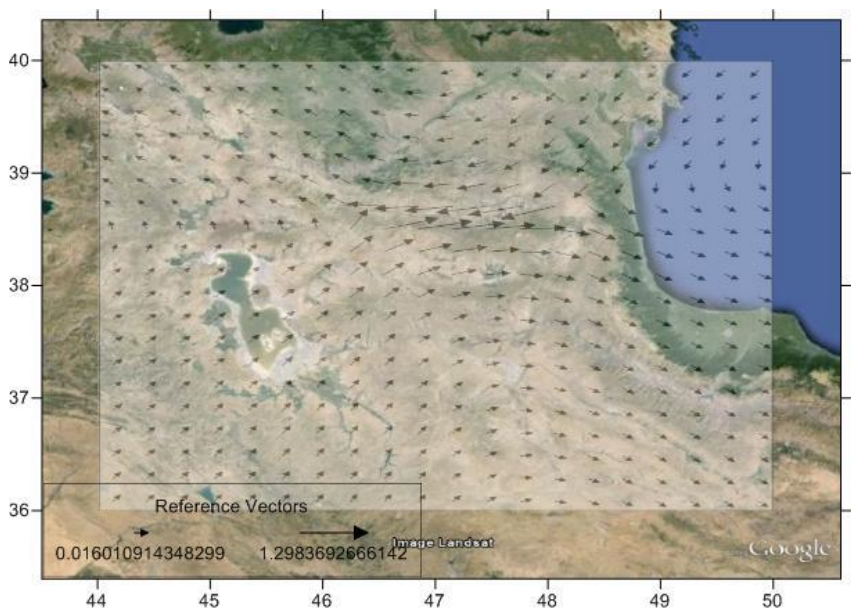

Figure 3 Ahar horizontal displacement by meter after M_w= 6.5 Earthquake

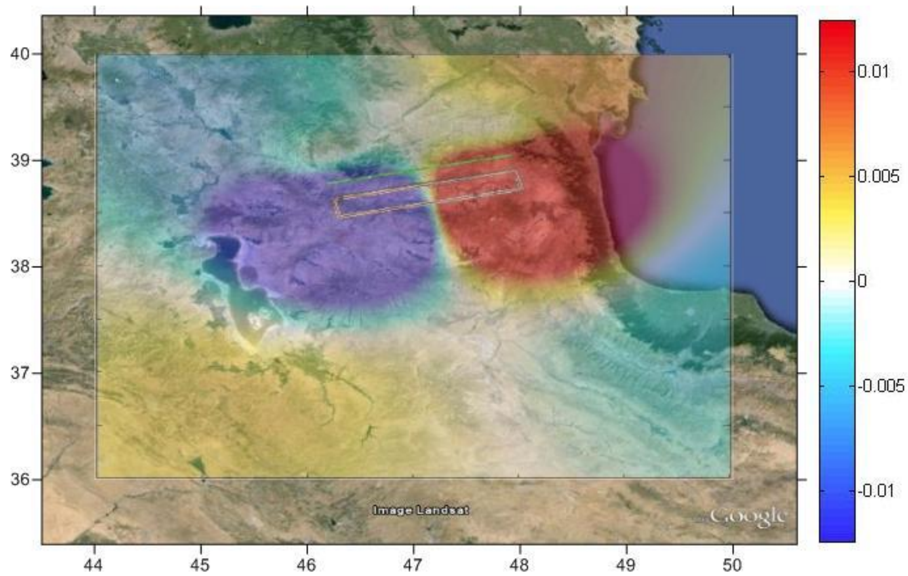

Figure 4 Varzaghan vertical displacement by meter after M_w= 6.5 Earthquake

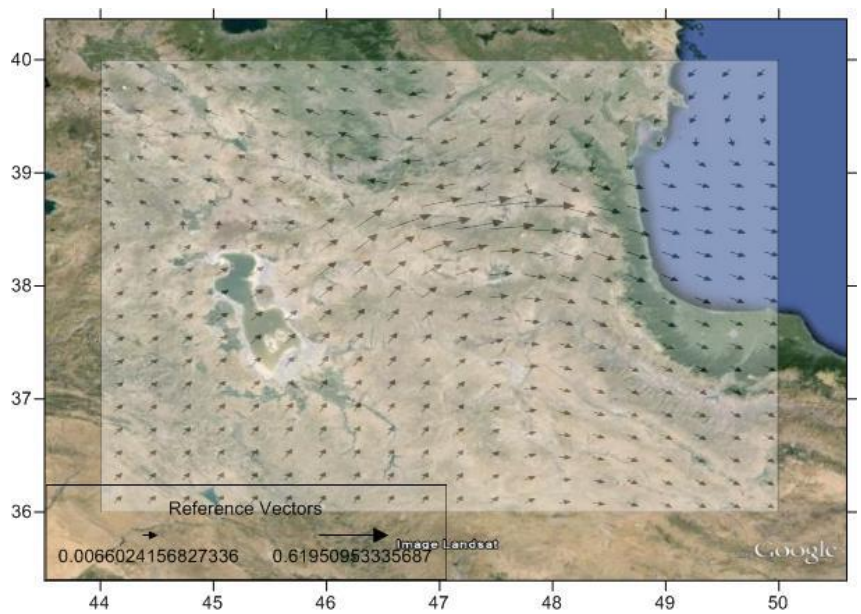

Figure 5 Varzaghan horizontal displacement after M_w= 6.5 Earthquake

The Coulomb stress changes after Ahar- Varzaghan Earthquakes are shown in Figure 6 and 7. We computed the Coulomb stress change in an elastic halfspace [1] by assuming a shear modulus of 3x10^10 Pa, Poisson's ratio 0.25 and an effective coefficient of friction, μ'=0.4 at depth of 10 km and 4 km [2]. Although preliminary, these results highlight the need to consider static stress interactions when estimating the seismic hazard in Azerbaijan. Past earthquakes have occurred within sufficient proximity of mainshocks for static stress interactions to affect their timing.

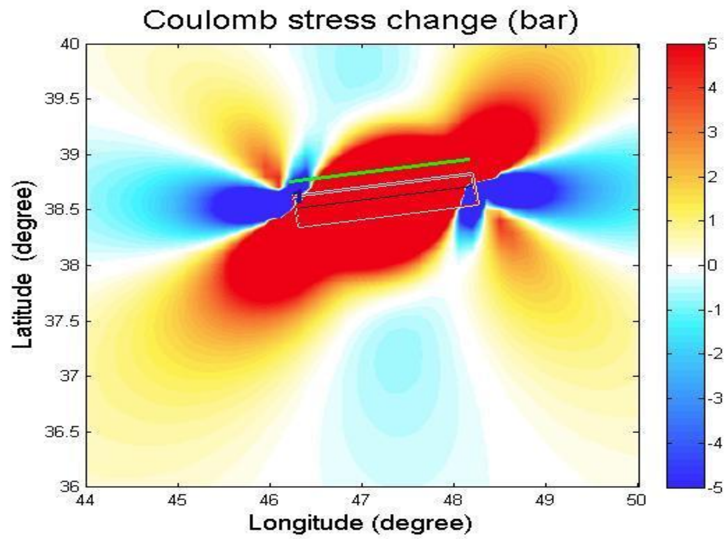

Figure 6 Coulomb stress change After Ahar Earthquake

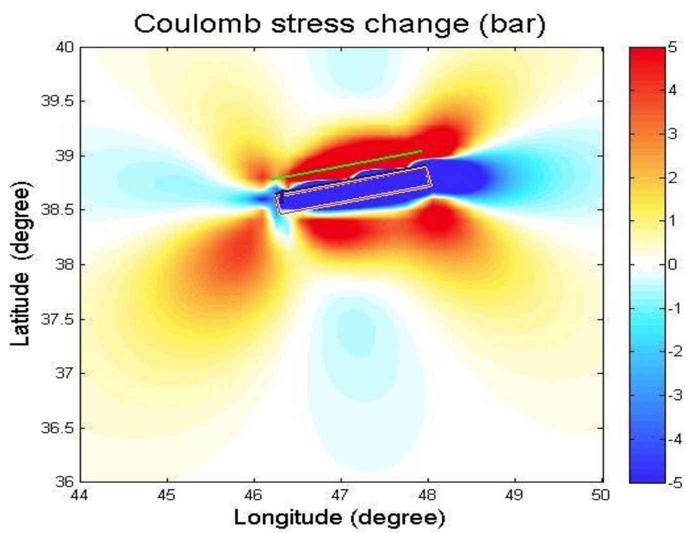

Figure 7 Coulomb stress change After Varzaghan Earthquake

Conclusion

Coulomb stress changes can be modeled or predicted earthquake aftershocks or future Earthquakes. we employ assumptions on the orientations, rupture lengths and average slip associated with each earthquake to calculate stress changes. Using this model, we displacement, stress and strain at any depth in the Earth's surface acquired. In this study the modeling of earthquakes **M_w= 6.5, M_w=6.3** Ahar-Varzaghan. The earthquakes induced displacements, strains and stresses were calculated at the surface at an average depth and its aftershocks for 10-km Ahar and 4 km Varzaghan. Geodesy with wavelet tools and deep learning can be helpful in this area [3-11].

Competing interests:

The authors declare no competing interests.

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