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Co-seismic Crustal Deformation of the 12 November 2017 Mw 7.4 Sar-Pol-Zahab (Iran) Earthquake: integration of analysis based on DInSAR and seismological observations

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The November 12, 2017 *Mw 7.4* earthquake that trembled near the border region between Halabjah (Iraq) and Sarpol-e Zahab (Iran) is the largest ever-recorded earthquake in the Zagros Mountains since 1900. The epicenter location of the event suggests that the NNW trending Mountain Front Fault (MFF) has been responsible for the earthquake though it was not associated with surface faulting. Analysis of teleseismic P- and SH- body-waveforms data indicate a well-constrained rupture propagated along the dip direction of the fault plane with an effective rupture area of 80km long, 70km wide and focal depth of 19$\pm$2 km ENE dipping low-angle thrust faulting with a small strike-slip component that produced little uplift in the region (Strike: 358^o; Dip: 16^o, Rake: 149^o and Seismic Moment (Mo): 1.828x10^{20} N.m. with maximum displacement (D$_{max}$) of 6.9m at hypocenter, and rupture velocity (Vr) of 3.2 km/s). The source rupture duration is about 45s, but the main moment release is observed in the first 10s. Focal mechanism solution of the event indicates a NNW trending plane dipping 16 degrees ENE. This is in agreement with the dip direction of the MFF and the distribution of aftershocks covering an area some 50-70 km wide. We explore its details in astonishment, if it is proved, that the Zagros Mountain Front fault (MFF) was responsible then it might have become curved at depth (?)

To measure the co-seismic crustal deformation around the epicenter, we processed the ascending and descending Sentinel-1 SAR images, collected before and after the earthquake, by SNAP software and generated the interferograms of surface deformation. The Differential InSAR (DInSAR) results show an upward and downward displacements of $\sim$90 cm and $\sim$30 cm around the epicenter respectively. Furthermore, we investigate the difference between strike derived from seismological and that inferred from DInSAR satellite observations, and its possible causes.

We do not have “best” or “right” rupture model yet, but just models satisfying for specific data sets. The aftermath of earthquakes like the 2017 Halabjah (Irak)-Sarpol-e Zahab (İran) provides excellent opportunity to evaluate our understanding of earthquakes and their hazards in the earthquake prone regions.