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Mid-Crustal thrusting and vertical deformation partitioning : 2017 Mw 7.3 Sarpol Zahab Earthquake in Zagros Mountain belt

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The Zagros fold-and-thrust belt is the product of oblique collision between Arabian and Eurasian plate which is an important orogenic belt for studying crustal deformation and seismogenic faults. Previous studies suggest that the M > 7 big earthquake occurred in the deep basement related to mid-crust thrusting with a deep décollement fault located at 20-25 km depth resulted from a ductile shear zone. However, the moderate earthquakes (~Mw 5.5-6.5) often occur in sedimentary cover with a thickness of about 10 km. The interface of basement and sedimentary cover is Hormuz Salt layer which is the major décollement fault of the Zagros fold-and-thrust belt. The crustal deformation is decoupling between the basement and sedimentary cover, thus the coseismic rupture could not propagate upwards to the shallow fold-and-thrust belt due to the viscous Hormuz salt layer. Hormuz salt layer switch its brittle behavior to plastic deformation in low P-T condition in term of rheology, thus this salt layer acts as a barrier against rupture propagation. The Mw 7.3 Sarpol Zahab earthquake occurred in NW portion of the Zagros fold-and-thrust belt on November 12, 2017, which is locate between the Kirkuk Recess and Lurestan Salient. This big event provides an opportunity to check the hypothesis the decouple of crustal deformation as well as the vertical partitioning in the Zagros orogenic belt. In this study, we plan to use SAR interferometry technique with ALOS-2 and Sentinel-1 radar images to characterize coseismic and deformation pattern induced by Sarpol Zahab earthquake and to inverse the distribution of slip on the fault patches. The maximum coseismic surface along the LOS is 98 cm and 48 cm for ascending and descending orbits of ALOS-2 satellite respectively. The geometry of the fault planes is composed of the ramp-flat structures with dipping angles of 7.2, 11.8 and 45.2 from shallow to deep portion respectively. It can be found that the main slip is located at the southwest of the hypocenter, which suggest the fault rupture propagates from the northeast to the southwest. More than 95% of the seismic moment is released at the depth of 11-15 km. Two slip asperities marked by “S-1” and “S-2” can be recognized. The “S-1” is located at the middle segment with peak slip of 5.2 m at depth of 13-15 km. The “S-2” occurred on the upper segment with peak slip of 4.8 m at depth of 11-13 km. Both the two slip asperities dominantly control the surface deformation. A slight slip concentration with a slip average of ~0.7 m is found at the lower segment, and it partly contribute for the surface motion of the northeast lob of the InSAR deformation field. None of fault slip is been found above the depth of 10 km, which suggests the coseismic rupture hasn’t transferred through the intervening Hormuz Salt section with depth of 8-11 km. In addition, we also calculate the Coulomb stress transfer for assessing the stress increasing and shadow on the major fault systems.