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Earthquake mechanism and stress transfer induces salt diapir deformation: Results from hybrid inversion of d-InSAR and aftershock data of the Nov 27 2005 Qeshm Island earthquake, Iran

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On November 27, 2005 a thrust earthquake magnitude Mw 5.9 occurred in Qeshm Island in the Zagros Fold Belt (ZFB) in southern Iran, in a region that is subjected to intense tectonic and salt diapir activity. The earthquake mainshock was followed by numerous aftershocks, the largest being a strike-slip event magnitude Mw 5.4. In this work we evaluate source parameters of these earthquakes using an integration of InSAR and aftershock data, and then develop models to explain these events by static stress transfer. The InSAR data set includes 10 interferograms obtained by Envisat acquisitions in ascending (I2 and I6 mode) and descending (I2 mode) orbits. The aftershocks data is based on 15 stations of local network recording from one week until three months after the main shock. While the InSAR data suggest a locally concentrated deformation field which might be due to shallow source, the aftershocks locate at a much deeper region. To resolve this discrepancy we propose a complex structure, including two major parts interacting by stress transfer: the first one is located in the deep seismogenic zone responsible for the main earthquake events; the later one is located in the upper most crustal part where salt diapir plasticity is believed to have amplified the surface deformation. Regarding this idea using stress transfer model calculations we show that the mainshock event has may have triggered the largest aftershocks, even with completely different mechanism and that the system of

mainshock-asftershocks reactivated the upper plastic part (i.e. the salt diapir), which amplifyingied the surface deformation field. In this work for the hybrid inversion of InSAR and aftershock data we use the Constrained Genetic Algorithm. The outcome of our joint inversion is a multi-segment model which is on the one hand consistent with aftershock pattern and other hand determines the border of reactivated plastic upper material and also can well retrieve observed surface deformation mapped by InSAR. Therefore, the combination of geodetic and seismic data into stress models suggests that an earthquake triggered both, deep aftershocks and deformation within a shallow salt diaper. Supporting our idea of complex structure, the coulomb stress transferring shows how the sequence of resolved events in the inversion has been triggered by each other.