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Interseismic strain accumulation on the Western Doruneh fault, Northern Iran, by multitemporal SBAS – DInSAR technique

Giuseppe Pezzo (1), Cristiano Tolomei (1), Simone Atzori (1), Yassaman Farbod (2), Esmaeil Shabanian (2), Stefano Salvi (1), Olivier Bellier (2), and Claudio Faccenna (3)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy (contact: giuseppe.pezzo@ingv.it), (2) CEREGE, CNRS & Université Paul Cezanne, Aix Marseille, France, (3) Roma TRE University, Rome, Italy

The Doruneh fault is one of the longest and most prominent faults in Iran. This ∼600 km long fault plays an important role in the regional tectonics, by accommodating up to 15 mm/yr of north–south right-lateral shear between central Iran and Afghanistan. Despite its length and prominence, relatively sparse seismicity has been recorded on this fault and no large earthquakes, even in the historical record. From scaling relationships, this type of fault has the potential to produce earthquakes with magnitudes M>7.5.
In order to better understanding the kinematic and the deformation stile of this potentially dangerous fault, we have investigated the surface deformation by InSAR methodology, in particular we applied the SBAS (Small BAseline Subset)-DInSAR technique to retrieve the mean velocity and the temporal evolution of the ground displacement for the western tip of Doruneh fault. In the SBAS approach, the entire image dataset is split into different subsets, characterized by small temporal and spatial baselines. We used an ENVISAT image dataset, composed of 51 images from the descending orbit (21 for the track 206, frame 2902 and 30 for the track 435, frame 2902) and 26 from the ascending orbit (track 156 frame 692). They both span 8 years, from 2002 to 2010.
We obtained the radar line-of-sight (LOS) components of ground deformation with an estimated accuracy of about 5 mm and 1 mm/yr for the displacement and for the mean velocity, respectively. Within the SBAS processing, we set a maximum temporal baseline of 1200 days, with a maximum spatial baseline of 300 m; the SRTM digital elevation model was used to remove the topographic contribution from the interferograms.
The geocoded velocity maps have an output resolution of 80m, that we further reduce to 400 m in order to increase the signal-to-noise ratio. By combining the ascending and descending orbits, we were able to retrieve the horizontal (East-West) and vertical components of the displacement. In this case we assumed a north-south component of the velocity interpolating the values provided by the GPS stations in the area.
We interpret the velocity fields retrieved by SBAS technique in term of interseismic strain accumulation and propose some preliminary model of the fault slip-rate.