Geophysical Research Abstracts
Vol. 17, EGU2015-15247, 2015
EGU General Assembly 2015

Continued fault locking near Istanbul: Evidence of high earthquake potential from InSAR observation

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A sequence of large earthquakes occurred along the North Anatolia fault in the last century. These earthquakes, including the recent 1999 İzmit/Düzce earthquake, generally propagated westward toward the Marmara Sea, defining the Main Marmara fault (MMF) as a seismic gap. An assessment of the seismic hazards along the MMF is important because Istanbul, one of the largest cities in the world, lies approximately 10 km north of the eastern MMF. A study of fault locking status allows for a better evaluation of the seismic hazard around Istanbul. In this paper, we use combined ascending and descending Interferometric Synthetic Aperture Radar (InSAR) and Global Positioning System (GPS) observations to investigate the crustal deformation associated with the Princes Island fault (PIF), eastern segment of the MMF. After decomposing the displacement signals and minimizing the post-seismic deformations, a clear deformation pattern relating to fault locking at the PIF was identified. The strain accumulation rate of the PIF is estimated to be about 20 mm/y. Our results show direct geodetic evidence that the eastern MMF is highly locked. Moreover, even under stress loading of adjacent strong earthquakes this locking was found to be sustained, indicating a continuous build-up of a slip deficit and therefor a high potential of earthquake hazards.