Geophysical Research Abstracts
Vol. 17, EGU2015-9103, 2015
EGU General Assembly 2015

Fault strength in Marmara region inferred from the geometry of the principle stress axes and fault orientations: A case study for the Prince's Islands fault segment

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The general consensus based on historical earthquake data point out that the last major moment release on the Prince's islands fault was in 1766 which in turn signals an increased seismic risk for Istanbul Metropolitan area considering the fact that most of the 20 mm/yr GPS derived slip rate for the region is accommodated mostly by that fault segment.

The orientation of the Prince's islands fault segment overlaps with the NW-SE direction of the maximum principle stress axis derived from the focal mechanism solutions of the large and moderate sized earthquakes occurred in the Marmara region. As such, the NW-SE trending fault segment translates the motion between the two E-W trending branches of the North Anatolian fault zone; one extending from the Gulf of Izmit towards Çınarcık basin and the other extending between offshore Bakırköy and Silivri.

The basic relation between the orientation of the maximum and minimum principal stress axes, the shear and normal stresses, and the orientation of a fault provides clue on the strength of a fault, i.e. its frictional coefficient. Here, the angle between the fault normal and maximum compressive stress axis is a key parameter where fault normal and fault parallel maximum compressive stress might be a necessary and sufficient condition for a creeping event. That relation also implies that when the trend of the sigma-1 axis is close to the strike of the fault the shear stress acting on the fault plane approaches zero. On the other hand, the ratio between the shear and normal stresses acting on a fault plane is proportional to the coefficient of frictional coefficient of the fault. Accordingly, the geometry between the Prince's islands fault segment and a maximum principal stress axis matches a weak fault model.

In the frame of the presentation we analyze seismological data acquired in Marmara region and interpret the results in conjuction with the above mentioned weak fault model.