The slip deficit along the North Anatolian Fault (Turkey) in the Marmara Sea: Insights from paleoseismicity, seismicity and geodetic data

Ersen Aksoy\textsuperscript{1}, Mustapha Meghraoui\textsuperscript{2}, and Renaud Toussaint\textsuperscript{2}

\textsuperscript{1}Dept. of Engineering Geology, University of Mugla, Turkey
\textsuperscript{2}CNRS - UMR7516, Institut de Physique du Globe, Strasbourg, France (m.meghraoui@unistra.fr)

The North Anatolian Fault experienced large earthquakes with 250 to 400 years recurrence time. In the Marmara Sea region the 1999 (Mw = 7.4) and the 1912 (Mw = 7.4) earthquake ruptures bound the Central Marmara Sea fault segment. Using historical-instrumental catalogue and paleoseismic results (\textasciitilde 2000-year database), the mapped fault segments, fault kinematic and GPS data, we compute the paleoseismic-seismic moment rate and geodetic moment rate. The geodetic moment rate is obtained by projecting the measured surface displacements to estimate the strain rate, and evaluating the associated elastic stress rate over a regular spatial grid. The paleoseismic-seismic moment rate is obtained by summing the moment tensors over regions of the spatial grid and periods of time. A clear discrepancy appears between the moment rates and implies a significant delay in the seismic slip along the fault. The rich database allows us to identify the size of the seismic gap and related fault segment and estimate the moment rate deficit. Our modeling suggest that the locked Central Marmara Sea fault segment even including a creeping section bears a moment rate deficit \( = 6.4 \times 10^{17} \) N.m./yr. that corresponds to Mw \( \geq 7.4 \) for a future earthquake with an average \( \geq 3.25 \) m coseismic slip. Taking into account the uncertainty in the strain accumulation along the 130-km-long Central fault segment, our estimate of the seismic slip deficit being \( \geq 10 \) mm/yr implies the size of the future earthquake ranges between Mw = 7.4 and 7.5.