## Fault interactions in the Sea of Marmara pull-apart (North Anatolian Fault): earthquake clustering and propagating earthquake sequences

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Knowledge on large earthquakes (M  $\geq$  7.0), geology and fault kinematics is used to analyse conditions that favour isolated seismicity, clustered earthquakes or propagating sequences along the North Anatolian Fault (NAF) and the Sea of Marmara pull-apart. The overall NAF- Marmara fault system is one of the most appropriate on Earth to document fault interactions because reliable information covers almost completely two seismic cycles (the past  $\sim$ 500 yr). Coulomb stress analysis is used to characterize loading evolution in well-identified fault segments, including secular loading from below and lateral mading imposed by the occurrence of previous earthquakes. Earthquakes along the NAF tend to occur where previous events have increased the stress, but significant isolated events in the Sea of Marmara region (1894, 1912) have occurred, suggesting the secular loading has been the determining factor. Present-day loading appears to be particularly high along the 70-km-long segment located in the central Marmara Sea, southwest of Istanbul. For the 18th Century  $M \ge 7.0$  earthquake clusters, we construct scenarios consistent with the tectoric and instorical data. We find that scenarios consistent with slip deficit and secular loading distributions (from below) clearly involve a sequence that propagates westward through the Sea of Marmara, despite the structural complexity. However, the inference of a propagating sequence implies that each event has occurred in a segment previously successed by lateral Coulomb stress interactions. Propagating earthquake sequences do not occur every seismic cycle along the NAF. The loading has to be in a particular state of stress close to failure and uniform all along the fault segments to experience propagating earthquake sequences. Non-uniform stress relief during the 18th century sequence explains the occurrence of isolated events in Marmara in 1894 and 1912. As a consequence, the well-known 20th century sequence along the NAF has not propagated as a sequence across the Sea of Marmara. The most linear part of the NAF across northern Turkey behaves as a single fault segment, accumulating stress during hundreds of years and rupturing entirely during very short periods. The Marmara pull-apart fault system behaves as a major geometric complexity, stopping or delaying the progression of earthquake clustering and propagating sequences. Fault zones interact with each other at a very large scale.