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Aseismic slip and seismogenic coupling in the Marmara Sea: What can we learn from onland Geodesy?

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Ever since the Mw7.4 Izmit earthquake in 1999, which ended an eastward migrating seismic sequence of Mw > 7 earthquakes, evaluation of seismic hazard associated with the last unbroken segments of the North Anatolian fault is capital. However, a strong controversy remains over whether the main Marmara fault segments are locked and are likely to experience a major earthquake or are releasing strain aseismically. Using a Bayesian approach, we propose a preliminary probabilistic inter-seismic model constrained by published GPS datasets. The posterior mean model shows that Ganos and Cinarcik segments are locked while creep is detected in the central portion of Marmara fault. Our analysis, however, reveals that creeping segments are associated with large model uncertainties, which mainly results from the sparsity of current geodetic observations. We then discuss how the GPS network can be improved to attain more reliable assessment of inter-seismic slip rates. With this purpose, we implement a network optimization procedure to identify the most favorable distribution of stations measuring strain accumulation in the Marmara Sea. Using the results of this network design analysis, additional GPS sites have been installed last summer to fill the gaps remaining after a first densification of the network in 2015 and measurements have started on the whole upgraded network. While new projects are emerging to monitor seafloor deformation, we also evaluate how sea bottom geodetic measurements can improve inter-seismic slip estimates.