
Far field post-seismic deformation of the Kahramanmaraş and Çardak earthquakes

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Résumé

On February 6th, 2023, two large earthquakes ruptured the East Anatolian Fault (EAF) and the Çardak fault with respective moment magnitudes of $M_w=7.8$ and $M_w=7.6$. The EAF, located east of the central Anatolian plateau, accommodates ~ 1 cm/year of sinistral motion between Anatolia and Arabia. The occurrence of these large earthquakes associated with the density of observation is a unique opportunity to get insights on physical processes related to the seismic cycle including understanding the spatial variations of rheological properties of the fault zones and of the surrounding medium in a context of active tectonic deformation. The wide zone affected by co-seismic deformation and, consequently, stress variations, allows probing regions with contrasting crustal and lithospheric structure and rheology. Continuous GNSS time series months after the earthquakes show that pre-earthquake interseismic velocities are modified over hundreds of kilometers, extending northward well across the North Anatolian Fault into the Black Sea coast and westward over the Central Anatolian plateau. Seismicity rates have also been modified at far locations. We will present results of GAMIT/GLOBK reprocessing of GNSS time series from permanent stations of the Turkish National Fundamental GPS Network (TNFGN) acquired from the earthquake date to July 2025. Independent Component Analysis of these data isolate several seasonal patterns, and noise components, and only one large scale component attributable to post-seismic deformation. On-going work include (1) interpolating the post-seismic strain field from the displacement field using the VDoHS (vertical derivatives of horizontal stress rates) method and examining its correlation with seismic activity, and (2) comparison of GNSS data with forward viscoelastic modeling based on available solutions for co-seismic displacement

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