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Strain Partitioning and Stress Rotation at the North Anatolian Fault Zone after the 1999 Izmit Mw=7.4 Earthquake

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We investigate aftershock focal mechanisms of the M_w=7.4 Izmit earthquake of Aug 17^{th}, 1999 on the western North Anatolian Fault Zone (NAFZ). Spatial clustering and orientation of 446 fault plane solutions are analyzed. The Izmit mainshock results from right-lateral slip on an EW-trending near vertical fault plane. Aftershock clusters define 4 individual fault segments. Focal mechanisms surrounding epicentres of the Izmit and subsequent Düzce mainshock (M_w=7.1, 12.11.99) indicate dominantly strike-slip but also normal faulting. Aftershocks in the area between Izmit and Düzce segments are mainly related to EW-extensional normal faulting indicating a small pull-apart structure. West of the Izmit mainshock, trains of aftershocks suggest branching of the North Anatolian Fault into three or more active segments differing significantly in dominant focal mechanisms. Fault segmentation of the NAFZ in the Izmit-Düzce region obtained from coseismic slip corresponds to spatiotemporal evolution of aftershock focal mechanisms. Areas with high coseismic slip show aftershocks that are dominantly strike-slip, but low-slip barriers show mostly normal faulting aftershocks.

Stress tensor inversions of the focal mechanisms show systematic rotations of the local stresses following the Izmit mainshock. In the Izmit region maximum compressive stress is rotated counterclockwise with respect to mainshock and regional stress field. Towards the eastern end of the rupture, stresses are rotated clockwise. We suggest that tectonic loading and increase of shear stress on individual NAFZ segments results in rotation of the local stress field that is partially reset corresponding to earthquake stress drop and orientation of the fault segment.