SPACE GEODETIC CONSTRAINTS ON THE EARTHQUAKE DEFORMATION CYCLE ALONG THE NORTH ANATOLIAN FAULT

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Global Positioning System observations for geodynamic studies were initiated in Turkey in 1988 with the establishment of a very broad and sparse network of GPS survey points. Densification and repeat observations of this initial network have progressed at a rapid rate since that time. A focused survey network in the Marmara region of the NAF was installed by ETH-Zurich and Istanbul Technical University in the early 1990s (e.g., Straub and Kahle, 1995) and a network of continuous GPS (CGPS) stations (MAGNET) was installed by TUBITAK MRC along the Marmara NAF segment in the late 1990s (Yalcin et al., 1999). In addition, the Turkish General Command of Mapping has developed a major GPS program to maintain geodetic control and monitor crustal deformation in Turkey and is cooperating with the Turkish Earth Science research community (e.g., Ayhan et al., 2002). These data, which we continue to develop, are providing estimates of the rate and spatial distribution of strain accumulation along the entire 1000 km length of the NAF. These new constraints are in turn providing information on variations in fault properties along the fault and with the stage in the earthquake cycle, particularly around the Marmara segment believed to still be a seismic gap with the potential for a significant future earthquake. For the 1999 Izmit earthquake segment, the well constrained pre-earthquake velocity field and the location of a number of MAGNET stations within the co-seismic deformation zone at the time of the earthquake provide a wealth of information about co- and post-seismic processes and hence fault mechanics and crustal/upper mantle rheology. In this presentation, we review the current status of GPS control along the NAF and our present understanding of earthquake processes and crustal rheology revealed by these data.

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Yalcin, N., et al., Seismic Hazard Assessment in the Marmara Sea Region, International Union of Geodesy and Geophysics (IUGG99), 18-30 July, Birmingham, United Kingdom, 1999.

Ayhan, M.E., et al., Interseismic strain accumulation in the Marmara region, Bull. Seism. Soc. Am., 92, 216-219, 2002.