GPS-aided Crustal Deformation Studies in Turkey

Semih Ergintav and Rahsan Cakmak

TUBITAK Marmara Research Center, Earth and Marine Sciences Institute (EMSI), Gebze, TURKEY
E-mail : semih.ergintav@mam.gov.tr

Abstract

Global Positioning System (GPS) 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 developed with 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 EMSI 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). Later, the universities, with the supports of EMSI, have focused to local geological problems with repeated observations and increased the densification of the GPS data set. After the 2006, EMSI has extent its CGPS network to different tectonic regimes of Turkey. These data, which we continue to develop with the contribution of newly established Turkish Continuously Operating Reference Station Network (CORS-TR), are providing estimates of the rate and spatial distribution of strain accumulation along the major fault zones of Turkey. These new constraints are in turn providing information on variations in fault properties along the faults in the earthquake cycles, 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.

Straub, C., and H. Kahle, Active crustal deformation in the Marmara Sea region, NW Anatolia, inferred from GPS measurements, Geophys. Res. Lett., 22, 2533-2536, 1995.

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.