Comparison of Strong-Motion Networks along North-Anatolian (NAF-Turkey) and San Andreas (SAF-California) Faults – Need to Enhance

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On-scale recordings of ground shaking during earthquakes are important for understanding the physics of fault rupture and causes of earthquake damage, and for improving design codes. Two major right-lateral strike-slip fault systems, the North Anatolian Fault (NAF) in Turkey and the San Andreas Fault (SAF) in California, each approximately 1500 km long, have generated earthquakes that caused loss of life and property. The two most recent NAF earthquakes [August 17, 1999 Izmit (M_w=7.4) and November 12, 1999 Duzce (M_w=7.1)] resulted in more than 17,000 fatalities and damaged more than 250,000 residential and business units (U.S. Geological Survey Circular 1193). Strong-motion data recorded during and after this earthquake provided additional insight into long-duration pulses with significant engineering implications (Çelebi, 2001, Çelebi and others, 2001). One of the significant California earthquakes on the SAF [1989 Loma Prieta (M_w=6.9)] caused extensive loss of property (~$10B) and 62 fatalities (Page and others, 1999).

Table 1 provides a numerical comparison of the operating strong motion instruments in Turkey and California. Figure 1 shows equiscaled maps depicting the distribution of strong-motion stations in Turkey and California. The strong-motion network along the NAF when compared to the network along SAF is very sparse – particularly when compared with the networks in Japan where the distance between stations is generally about 20-25 km (about 2 km in some urban areas [Kashima, 2000]). With the recent addition of ANSS (USGS Circular 1188) strong-motion stations, California is far ahead in numbers (Table 1) compared to Turkey, particularly when comparison is made along SAF and NAF. Still, the density desired by seismologists and engineers have not yet been accomplished in either California or Turkey.

Table 1. Comparison of Strong-Motion Networks in Turkey and California (Note 1: N100 means number of stations within 100 km offset on both sides of surface fault – SAF in California and NAF in Turkey, Note 2: IRREW – KOERI-Istanbul Rapid Response and Early Warning Network)

	Ground Stations		Structures (total)	Sources/Comments
	Total	N100		
California (424,001 sq. km.)	~1600	~1200	708	http://www.cisn.org (includes CGS and USGS, CalTech)
Turkey (814,578 sq. km) 779,452 sq. km. land only	~158	~40 (~100 if IRREW included)	<20	http://angora.deprem.gov.tr/ http://www.koeri.boun.edu.tr/

Future disastrous events are forecast on both faults. Significant enhancements in strong-motion networks to record these events are needed to improve response capabilities and build more earthquake resistant societies in the future. There are many gaps in the strong-motion network along the NAF to be filled. Recent addition of BYT Network (between Bursa and Yalova) is a good example of regional denser arrays (Gulkan and others, 2004) that can be added to the network in Turkey to fill gaps, particularly in urban areas. An example of a guideline for urban areas is that a network should produce necessary data to facilitate construction of shake-maps (http://earthquake.usgs.gov/eqcenter/shakemap/).

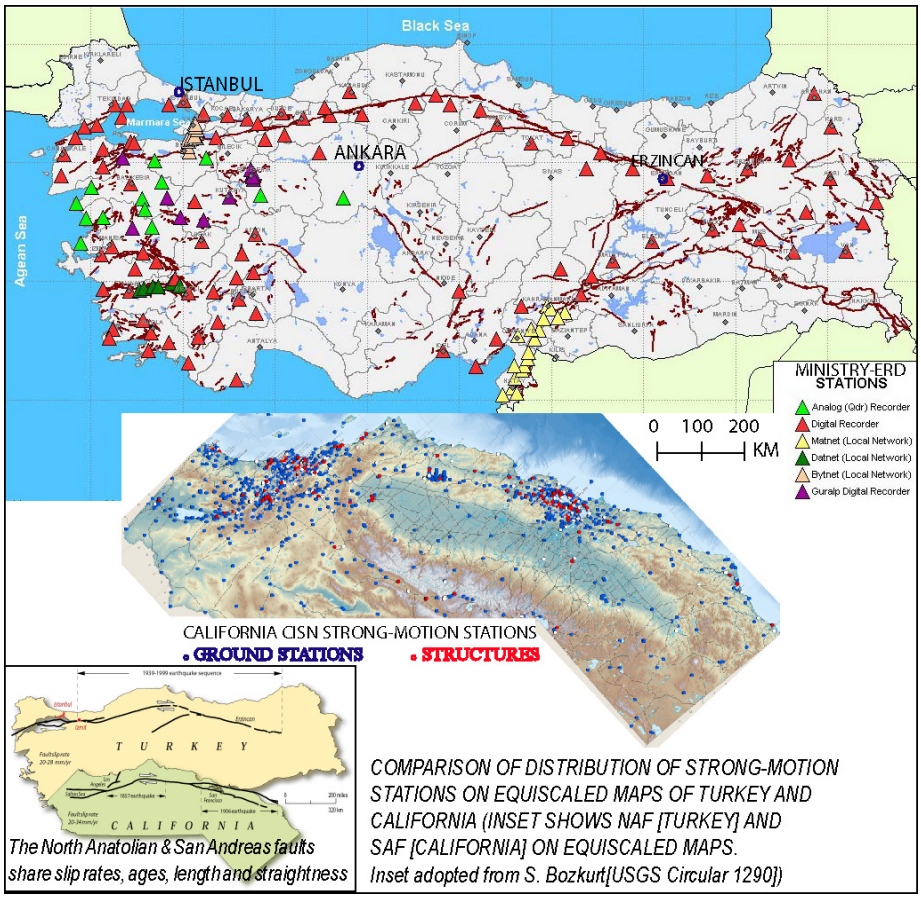

Figure 1. Equiscaled maps of Turkey and California. Maps depict general distribution of Strong-Motion Stations (Sources: Turkey Map- Mr. Akif Alkan, Earthquake Research Department, Ministry of Public Works, Ankara, Turkey, California Map: www.cisn.org, inset- courtesy S. Bozkurt, 2006)

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