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Strong Motion Networks – Rapid Response and Early Warning Applications in Istanbul

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In recent years several strong motion networks have been established in Istanbul with a preparation purpose for future probable earthquake. This study addresses the introduction of current seismic networks and presentation of some recent results recorded in these networks.

Istanbul Earthquake Early Warning System
Istanbul Earthquake Early Warning System has ten strong motion stations which were installed as close as possible to Marmara Sea main fault zone. Continuous on-line data from these stations via digital radio modem provide early warning for potentially disastrous earthquakes. Considering the complexity of fault rupture and the short fault distances involved, a simple and robust Early Warning algorithm, based on the exceedance of specified threshold time domain amplitude levels is implemented. The current algorithm compares the band-pass filtered accelerations and the cumulative absolute velocity (CAV) with specified threshold levels.

Istanbul Earthquake Rapid Response System
Istanbul Earthquake Rapid Response System has one hundred 18 bit-resolution strong motion accelerometers which were placed in quasi-free field locations (basement of small buildings) in the populated areas of the city, within an area of approximately 50x30km, to constitute a network that will enable early damage assessment and rapid response information after a damaging earthquake. Early response information is achieved through fast acquisition and analysis of processed data obtained from the network. The stations are routinely interrogated on regular basis by the main data center. After triggered by an earthquake, each station processes the streaming strong motion data to yield the spectral accelerations at specific periods and sends these parameters in the form of SMS messages at every 20s directly to the main data center through a designated GSM network and through a microwave system. A shake map and damage distribution map (using aggregate building inventories and fragility curves) will then be automatically generated using the algorithm developed for this purpose. Loss assessment studies are complemented by a large citywide digital database on the topography, geology, soil conditions, building, infrastructure and lifeline inventory. The shake and damage maps will be conveyed to the governor's and mayor's offices, fire, police and army headquarters within 3 minutes using radio modem and GPRS communication.

Self Organizing Seismic Early Warning Information Network (SOSEWIN) in Atakoy District
SOSEWIN sensors were developed by GFZ and Humbold University as part of SAFER project and EDIM project, and with cooperation of KOERI, the sensors were installed in Atakoy district of Istanbul city with Early Warning purpose. The main features of the SOSEWIN system are each sensing unit is comprised of low-cost components, undertakes its own seismological data processing, analysis and archiving, and its self-organizing capability with wireless mesh network communication.

Seismic Network in Important Structures
Some of the critical structures located in Istanbul city such as Fatih Sultan Mehmet Suspension Bridge which is connecting Asian and European sides of the city, Hagia Sophia Museum and Suleymaniye Mosque which are historical structures with an age of over 1000 years and 450 years respectively, and Isbank Tower which is one of the tallest structures in the city with a height of 181.2m are monitorized to observe their seismic behavior.