TURKEY'S SEISMICITY AND AN OVERVIEW OF EARTHQUAKE STUDIES

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Abstract -
Turkey is between three major tectonic plates, and compressed towards the north by Arabian and African plates. This region is the most active area of the Mediterranean region in terms of earthquake activity. Although a number of plates having different sizes on the region based on the spatial distribution of the seismicity, mainly three plate boundariesplayimportantroles [1].
These are the African, Arab and Eurasian plates. The Turkish/Anatolian plate is surrounded by African and Arabian plates in the south, the Eurasian plate in the north and the Aegean plate in the west. Relative motions between the African, Arabian and Eurasian plates account for most of the tectonic activity in theregion (Figure 1, [2]).

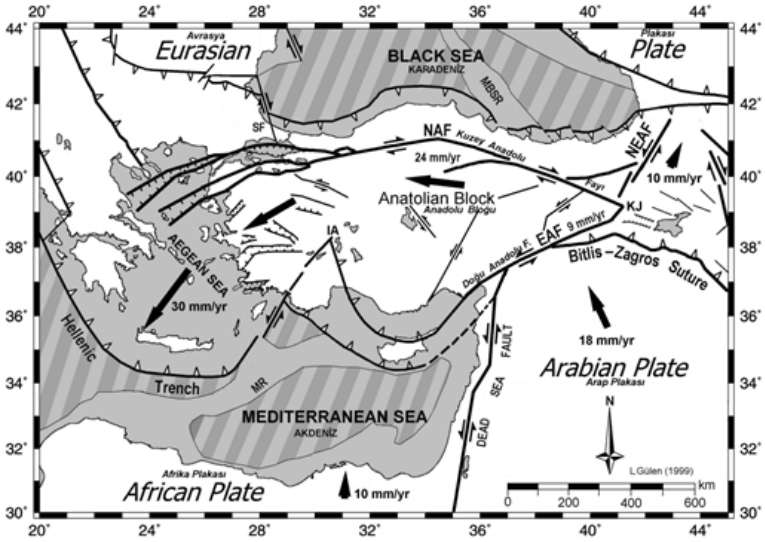


Figure 1. Major tectonic plates and active fault zones around Turkey [2]

As a result, the Anatolian plate has a high danger for seismicity. This consists of the North Anatolian Fault Zone (NAFZ), East Anatolian Fault Zone (EAFZ) and SE Anatolian Thrust Zone which form the borders of the Anatolian Plate and important active fault segmentsthroughout Western Anatolia [3]. All these active faults cause a short time intervals intensive damages in Turkey earthquakes, which in turn is a significant risk of earthquake in Turkey (Figure 2, [3]).

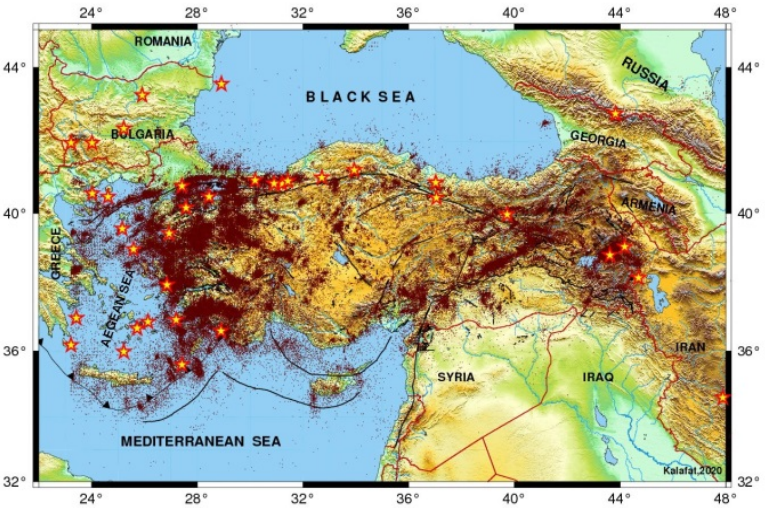


Figure 2.Seismicity of Turkey (1900-2020; Stars indicate Ms>7.0 earthquakes,[3])

For instance,Seismological studies reveal that the NAFZ is divided into 2 main branches in the Marmara Sea and that there are unbreakable segments in these branches. Therefore, the presence of seismic gaps in the region that can produce large earthquakes in the future has been revealed by seismological studies (Figure3-4).

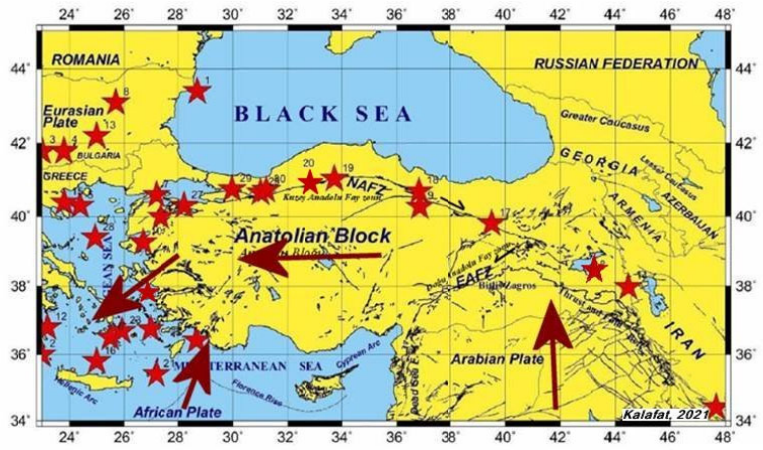


Figure 3.The destructive earthquakes that have occurred in the last century along the North Anatolian Fault Zone (NAFZ) and the boundaries of the tectonicplates(Ms>7.0; 1900-2020, [4])

Keywords - Turkey, Seismicity, Seismic Network,Anatolian Plate, KOERI

I. INTRODUCTION

The beginning of seismological studies of Kandilli Observatory and Earthquake Research Institute dates back to 1895. The Ottoman Empire started seismic observations by purchasing 2 seismographs after the 1894 Istanbul earthquake. And KOERI has been conducting uninterrupted seismic observations for nearly 127 years. Today, real-time seismic monitoring is carried out with more than 260 earthquake stations spread across the country. Modern technological equipment and communication systems are used in allstations [5].

In order to investigate and to real-time monitor the seismic activity and seismotectonic of Turkey and its vicinity, The Kandilli Observatory and Earthquake Research Institute (KOERI) of Bogaziçi University operates seismic stations countrywide.Besides in 2016, KOERI Regional Earthquake and Tsunami Monitoring Center (RETMC) was accredited by the United Nations as a Tsunami Service Provider in the Northeast Atlantic, Mediterranean and connected seas (in the region covering the Eastern Mediterranean, Aegean, Marmara and Black Sea). KOERI is also a 24/7 NationalTsunamiWarning Center [6].

Therefore, earth science studies have an important contribution to the emergence of earthquake hazard. The evaluation of the data receiving from KOERI seismic stations also contributes to the determination of earthquake hazard in detail, and to contribute to the minimization of the risks of the earthquake. We distribute all of the earthquake parameters after the earthquake, automatically. Also, We publish estimated life losses, shaking maps and damage maps immediately after the earthquake. After an important earthquake, KOERI is quickly sent information from the smartphones to the society and the decision-making institutions carrying out disaster studies.KOERI also operates the Istanbul Early Warning and Rapid Response System. Istanbul city has a large population, majority of the industrial facilities, a historical city and very close to active faults.As it is known, the city of Istanbul and the Marmara region expect an earthquake with a magnitude of Mw> 7.0 in the next 50 years with a probability of 70% [7].

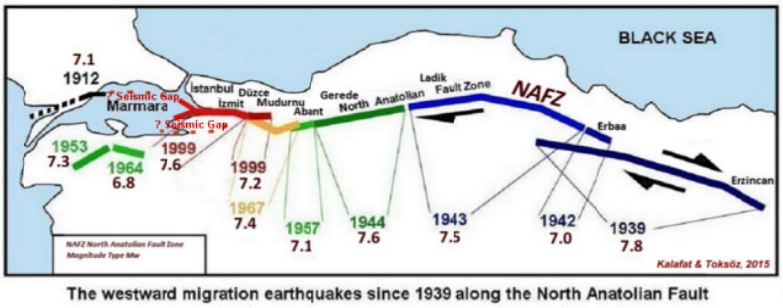


Figure 4.The destructive earthquakes that have occurred in the last century along the North AnatolianFaultZone (NAFZ), [7]

KOERI is providing seismic data and information about earthquakes for EMSC (European Mediterranean Seismological Center-FRANCE; USGS United State Geological center-US; ISC International Seismological Center-UK)and neighbour countries.

At the same time, KOERI Disaster Prepared Education Unit (DPEU) established after the 1999 earthquakes, provides regular trainings to thousands of students and citizens every year in order to increase disaster awareness. These studies have made a significant contribution to increasing the resistance of the society against disasters.

II. METHODS

The Kandilli Observatory and Earthquake Research Institute (KOERI), being the oldest institution on seismological studies, have observation networks having seismological and engineering purposes. Since 1926, The Kandilli Seismological Division, an integral arm of KOERI, continues to provide seismological observation services with its continuously expanding network distributed throughout Turkey. Today all seismic stations are broadband and they have new technological equipment. Real time data are recorded digital forms at the Regional Earthquake-Tsunami Monitoring Center (RETMC). Today, KOERI Seismic Network has more than 260 stations in the whole of Turkey (Figure 5).

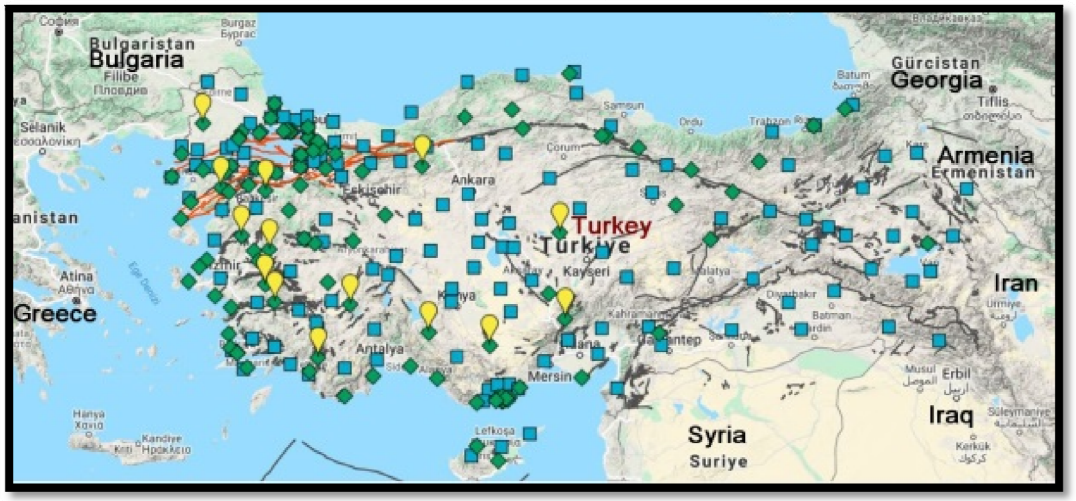


Figure 5.Distribution of SeismicStations in Turkey [8]

Events are recorded real time at the monitoring center digital form obtained from broad-band stations. These are processed using HYPO71 for the hypocenter determination. The seismological division of KOERI determines, as rapidly and accurate as possible, location and size of all earthquakes of magnitude commonly larger than 2.0 that occur in the country.It provides twenty-four hour information service to government agencies, to government public information centers and to news media. This information is also disseminated immediately to the relevant international seismological centers by e-mail, wireless, fax and by internet channels. Observatory has been supplying mainly 3 kind of seismological data: phase readings, waveform and catalogue to the earth scientists in Turkey and all over the world through internet facilities. As of May 2005, KOERI has started to publish waveform data by internet and KOERI also continued to publish continuous data and event base data. Today KOERI has about 40 terabyte data storage unit for backup purposes and made available from there to users by the normal archive date request tools. KOERI has published many catalogs at differenttimes [9].

III. EXPECTED RESULTS/ CONCLUSION/ CONTRIBUTION

To mitigate the seismic risk and prevent seismic panic, the KOERI has for improving the seismic monitoring system by establishment the broadband digital seismic network in Turkey. Such monitoring system permit rapid acquisition of seismic wave form data, automatic detection of earthquake event and hypocenter determination. The system also provides high quality data appropriate to study on seismology and tectonic as well as earthquake prediction.
KOERI provides regular trainings for students and citizens every year in order to increase disaster awareness. These studies have made a significant contribution to increasing the resistance of the society against disasters [10].

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