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of  
GEODESY and GEOPHYSICS**

**NATIONAL REPORTS OF**

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GEOMAGNETISM AND AERONOMY COMMISSION  
HYDROLOGICAL SCIENCES COMMISSION  
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SEISMOLOGY AND PHYSICS OF THE EARTH'S INTERIOR COMMISSION  
VOLCANOLOGY AND CHEMISTRY OF THE EARTH'S INTERIOR COMMISSION

**OF TURKEY  
FOR 2011 - 2015**

to be presented at the  
XXVI. GENERAL ASSEMBLY  
of the  
INTERNATIONAL UNION of GEODESY and GEOPHYSICS  
22 JUNE - 02 JULY, 2015

**ADHERING ORGANIZATION**  
MINISTRY OF NATIONAL DEFENCE  
GENERAL COMMAND OF MAPPING  
ANKARA-2015 ([www.hgk.msb.gov.tr](http://www.hgk.msb.gov.tr))



# TURKISH NATIONAL UNION OF GEODESY AND GEOPHYSICS (TNUGG)



ADHERING ORGANIZATION  
MINISTRY OF NATIONAL DEFENCE  
GENERAL COMMAND OF MAPPING  
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**TURKISH NATIONAL UNION  
OF GEODESY AND  
GEOPHYSICS**



**2011 – 2015 TERM REPORT  
OF  
TURKISH NATIONAL GEODESY COMMISSION**

**GENERAL COMMAND OF MAPPING  
ANKARA  
2015**



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General Command of Mapping

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## 1. Introduction

Directing and promoting the scientific studies in the field of Geodesy, ensuring cooperation and communication among its members, organizing scientific meetings and following international developments and consequently representing Turkey; could be listed among the activities of Turkish National Geodesy Commission (TNGC).

Geodesy has not taken its place which it deserved in earth sciences yet and it is left in the area of interest of geology and geophysics. Science aims discovering nature and explaining natural events. Scientific information and products are adapted and promoted as long as they are about explaining natural events and facilitating the social life. For this reason; it is considered that the Turkish scientists of geodesy; along with their solely scientific aims, ought to take place in the studies which will support the social life and also do their best to avail geodesy take its respectful position among geological sciences.

Along with the social requirements came into place after the destructive earthquakes of Düzce and Gölcük, happened in 1999 in Turkey and the recorded scientific and technological developments, the regulation of Turkish National Geodesy and Geophysics Association was changed. One of the major changes in the regulation is, creating opportunities to sponsor the projects which will be focused on earth sciences.

It has become inevitable to make fundamental changes in the structure and function of TNGC parallel with national requirements and international developments. In the studies which were resulted as re-establishing TNGC the following criteria were initiated;

- a. Ensuring a participating managerial structure for TNGC,
- b. Make it active in national and international levels,
- c. To participate in studies for determining the institutions sponsoring research projects (TNGGU, TUBITAK, DPT, MINISTRIES etc.) in our country to sponsor geodetic projects,
- d. To develop geodetic joint projects and programs,
- e. Helping, obtaining data from national and international centres to be used in the projects.
- f. To encourage its members to publish qualified works in the international scientific journals.
- g. To encourage Turkish scientists of geodesy to be organized in national levels, to take place in activities and producing joint projects.
- h. To ensure the communication among the members of TNGC.
- i. To ensure the information change among the members of TNGC by organizing scientific meetings.

In TNGC's structure; an executive committee, authorized and functioned to implement all sort of organising about the activities of TNGC, a centre office which will be responsible for application of decisions of the executive committee, a candidate determining commission for determining the candidates to take place in the examination for the personnel who will be employed in the organs of TNGC, were established. Additionally; TNGC working groups (WG) are compatible with those of IAG as reference coordinate systems (WG1), Gravity Field (WG2), Earth Rotation and Geodynamics (WG3) and Positioning and Applications (WG4). TNGC has also been organizing annual scientific meetings since 2002.

It is necessary for TNGC to take the appropriate steps and to produce applicable projects along with the National Earthquake Program, which was introduced in the scope of the

changes made in the structure of TNGGU. The earthquakes and the geodynamic events are the most destructive and deforming events for geodetic networks along with their important social consequences. As our country is a natural laboratory for the studies on the crust of earth movements; after the earthquakes whose magnitudes are  $M_w \geq 6$ , the basic Geodetic networks should be upgraded and the geodetic methods should be used for modelling and interpreting the movements of the crust of the earthquake along with determining the area of velocity. The three methods that are used in geodynamic researches are; Geodesy, Geology and Seismology and in particular taking into account that the geodetic methods are one of the indispensable and essential methods for verification of the researches, the joint earth science projects should be used constructed.

The public institutions and foundations, private sector and the universities are the three major elements of mapping so of Geodesy. Producing everything that the country requires, the geodetic contributions for solving the problems of earth sciences, education, contribution to the development of the universal science and technology, competitive and profitable production, application and development of new competences, study for taking place among the worlds scientists of geodesy and ensuring the resources of the country to be used effectively are representing the major aims and their subdivisions of those three major elements of Geodesy. Expanding the cooperation and cooperation opportunities among the private sector, public institutions and the universities; should be one of the major aims of TNGC. For attaining this goal; producing and applying original projects including country requirements should be seen as the basic solution.

## **2. Turkish National Geodesy Programme**

The long-running studies for forming a national geodesy programme have come to an end in 2015. Turkish National Geodesy Programme has been constituted, and will come into operation after the approval of Executive Committee of Turkish National Geodesy Commission in the annual scientific meeting in 2015.

The purposes of the programme are; to evaluate the situation of the geodetic studies performed in our country so far, to associate them with the global studies and hereby to carry out a requirement analysis, and to suggest studies to meet these requirements. Since the programme introduces the national priorities and needs, it is anticipated that it can be used as a reference document in project applications to funding organizations. Contents of the programme are given below:

- 1. PURPOSE**
- 2. INTRODUCTION**
  - 2.1. General**
  - 2.2. International Union of Geodesy and Geophysics (IUGG) and Turkish National Union of Geodesy and Geophysics (TNUGG)**
  - 2.3. International Association of Geodesy-IAG**
- 3. NATIONAL GEODETIC OBSERVATION SYSTEMS AND EVALUATION STUDIES**
  - 3.1. Existing Situation**
  - 3.2. Turkish National Reference Frame**
  - 3.3. Datum Transformation Studies**
  - 3.4. Monitoring the Deformation in Geodetic Networks**
  - 3.5. National Geoid Determination Studies**
  - 3.6. Current Studies and Projection of Future Studies**
    - 3.6.1. Deformation of Geodetic Networks**
    - 3.6.2. Turkish National Fundamental GPS Network**
    - 3.6.3. Turkish National Permanent Stations Network**
    - 3.6.4. Marmara Permanent GPS Network**
    - 3.6.5. Turkish National Permanent Stations Network-Active (TNPGN-Active)**
    - 3.6.6. Turkish National Sea Level Monitoring System**
    - 3.6.7. Modernization of Turkish National Height System**
    - 3.6.8. Monitoring the Gravity Changes**
- 4. NATIONAL GEODESY AND EXPECTATIONS**
  - 4.1. GPS/GNSS Analysis Centre**
  - 4.2. Development of a web-based GPS/GNSS Analysis Software**
  - 4.3. Development of a GPS/GNSS Analysis Software**
  - 4.4. Densification of TNPGN-Active**
- 5. IMPORTANCE AND PRIORITIES OF FUTURE GEODETICAL STUDIES**
- 6. RESULTS**
- 7. REFERENCES**

### **3. Administrative Structure**

Turkish National Geodesy Commission (TNGC) acts as one of the sub commissions of Turkish National Union of Geodesy and Geophysics (TNUGG). TNGC activities are carried with respect to TNUGG statutes and TNGC By-Laws.

#### ***TNGC Central Bureau***

TNGC President

TNGC University Representative

TNGC Secretary

#### ***TNGC Executive Committee***

TNGC President

TNGC University Representative

TNGC Secretary

TNGC President (past)

TNGC University Representative (past)

Study Group (I) President

Study Group (II) President

Study Group (III) President

Study Group (IV) President

ASCE Representative

TÜBİTAK (The Scientific and Technical Research Council of Turkey) Representative

#### ***Working Groups***

With the new TNGC By-laws, four Working Groups were constituted according to the present commissions in IAG and national requirements. Also it is possible to constitute Sub Study Groups under the Working Groups.

#### ***TNGC Working Groups***

Working Group I : Reference Coordinate Systems

Working Group II : Earth Rotation and Geodynamics

Working Group III : Gravity Field

Working Group IV : Point Positioning and Applications

#### ***Nominating Committee***

Three members of Nominating Committee are selected by TNGC Executive Committee, determined the President and Secretary candidates of Working Groups. On the other hand, Nominating Committee executes its duty for the other subjects determined by TNGC Executive Committee.

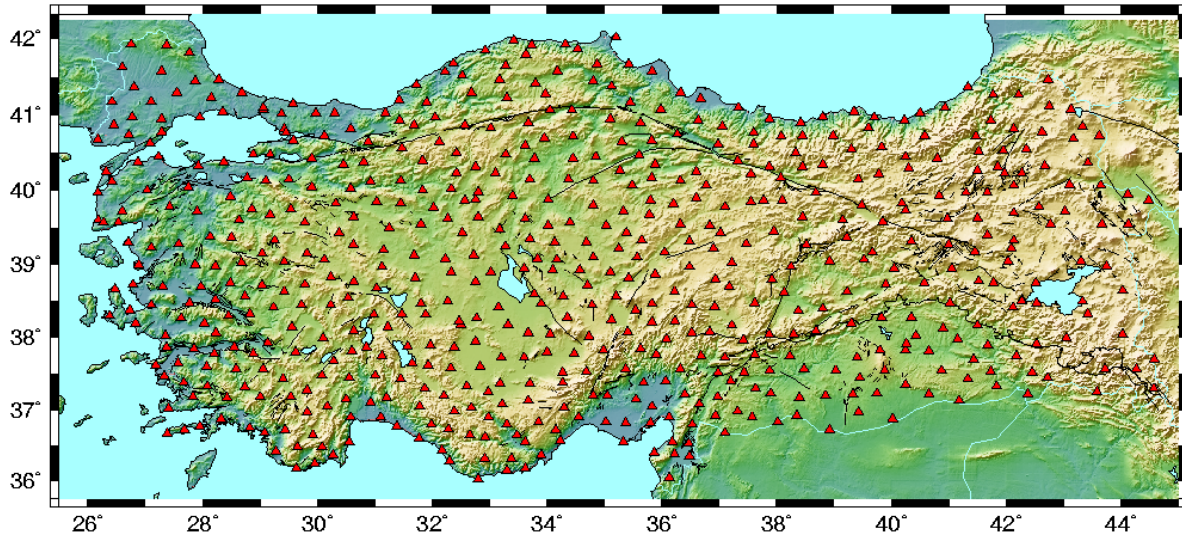
#### 4. Working Group Activities of The Commission

There are four working groups that are voluntarily working under Turkish National Geodesy Commission. In this section of the report the reader might obtain information about their activities.

##### a. Reference Coordinate Systems Working Group

###### (1) Turkish National Fundamental GPS Network (TNFGN)

TNFGN is the first fundamental geodetic network based on GPS technology in the country. The network consists of about 600 sites (see Fig. 4.1) established through campaign type GPS surveys between 1997 and 1999. Some of the stations were re-surveyed due to the destructive earthquakes after mid-1999. For each station, 3D geocentric coordinates and their associated errors and velocities have been computed in ITRF2008 and transformed into ITRF-96, which is the initial reference frame adopted for TNFGN. Positional accuracies of the stations are about 1-3 cm and the relative accuracies are within the range of 0.1 - 0.01 ppm. The network has been connected to the former horizontal reference network through overlapping sites in order to estimate the transformation parameters between ED-50 and WGS84 systems. Time-dependent coordinates of all stations have been computed in the context of the maintenance of the network with repeated GPS observations.



**Figure 4.1** Distribution of TNFGN stations

###### (2) Turkish National Permanent GPS Network and Turkish National Permanent RTK Network (TNPGN and TNPGN-Active)

TNPGN is the permanent GNSS network consisting of 20 stations (see Fig. 4.2) established particularly to serve as a realization of ITRF-96 in Turkey which is adopted as the Turkish reference frame. In this network, ANKR (Ankara) GNSS station continues to send its hourly and daily data to IGS and EPN while no real-time data streaming at the moment. Also ISTA GPS (Istanbul Technical University) and TUBI GPS (TUBITAK Marmara Research Center) are operational as well. TNPGN-Active, contrary to TNPGN, is a web based RTK network consisting of 146 sites (see Fig. 4.2) to serve real-time positioning information for the variety of applications such as mapping, GIS and cadastral applications. System operations and



computations of coordinate correction parameters are being held in control centers located in General Command of Mapping and General Directorate of Land Registry and Cadastre in Ankara. GNSS data collected at all stations are transferred to the control center via ADSL, GPRS/EDGE and correction parameters are transferred to the users in the field after computation in the center. RTK correction parameters which are in current RTCM and CMR+ formats are transferred to the rovers via GPRS and NTRIP (For VRS; CMR+ and RTCM3.1, for SAPOS FKP; RTCM 2.3, for MAC; RTCM 3.1Net and for DGPS; RTCM 2.1).



**Figure 4.2** Distribution of stations. Red triangles: TUSAGA, blue triangles: TUSAGA-Active.

Data collected at continuous stations are processed via GAMIT/GLOBK V10.5 software on a daily basis and coordinate time series are created. Since its installation in late 2008, more than 6 years of static data have been collected in TUSAGA-Active network up to now. Permanent stations are also contributing to regional ionosphere modeling, GNSS meteorology, and tectonic studies.

In terms of ionosphere modeling, a group of researchers of various disciplines from General Command of Mapping, Hacettepe University and Bilkent University Department of Electrical and Electronics Engineering got together and constituted IONOLAB ([www.ionolab.org](http://www.ionolab.org)). IONOLAB group estimates Total Electron Content (TEC), interpolate (mapping) TEC regionally, makes statistical analysis of TEC and investigates lithosphere-ionosphere relation through seismic activity by using TUSAGA-Active stations. Thus, monitoring of ionosphere with a dense, homogeneous GNSS network provides important possibilities in characterization and modeling of electron density and TEC.

### **(3) Turkish National Vertical Control Network (TNVCN)**

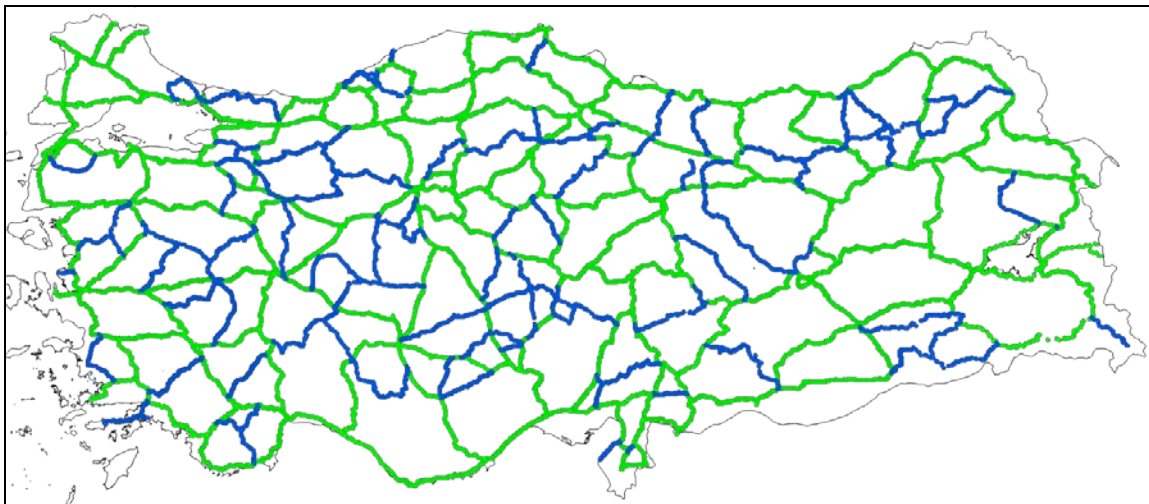
Levelling studies in Turkey started with the establishment of Antalya tide gauge station in June 1935. Following a long time interruption after 1936, the works resumed in 1944 and the vertical control network was physically established based on the first phase spirit levelling



measurements till 1970 carried out along the main and collateral roads and even along the railroads throughout the country. Since the studies on the gravity network begun in 1956, no gravity measurement was made at vertical control benchmarks until 1970.

The second phase measurements of the network including gravity were commenced in 1973 in order to renew the existing lines destructed due to infrastructure works and to establish new lines in necessary places. After the re-adjustment of most recent levelling observations of the first and second period campaigns in 1999, Turkish National Vertical Control Network-1999 (TNVCN-99) has been devised, consisting of 243 lines and 25680 benchmarks with 29316 km long (see Fig. 4.3). The datum of the network is based on the sea level records of Antalya tide gauge averaged between 1936 and 1971.

The benchmarks of the network are inevitably exposed to destruction due to the road enlargement and urban construction activities. While the ratio of destruction is about 49% between 2000 and 2006, it is now estimated to reach up to 63% based on the results of the reconnaissance surveys at 9000 benchmarks in 2011.



**Figure 4.3** Turkish Vertical Control Network. Green lines: first order, blue lines: second order network.

#### **(4) Turkish Sea Level Monitoring System (TSLMS)**

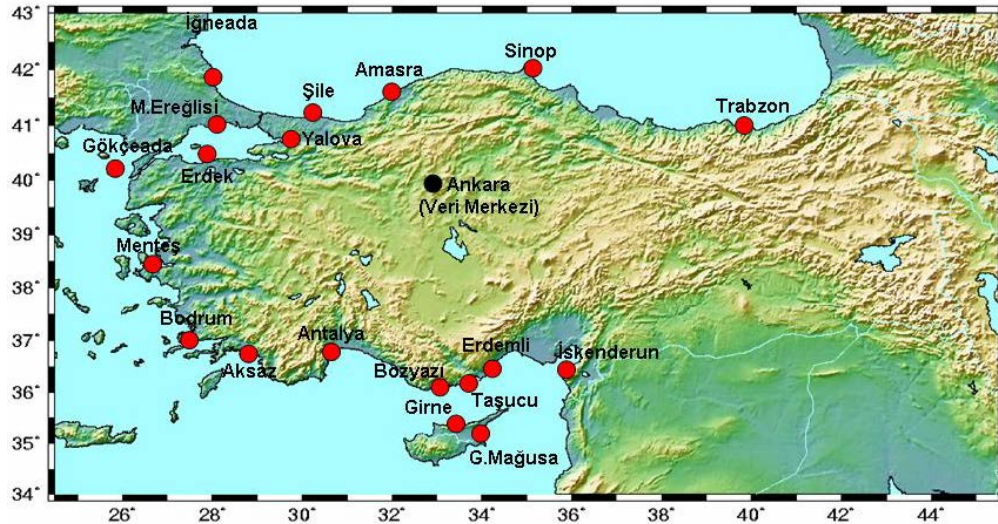
Many coastal countries deploy and operate tide gauges along their coasts to meet sea level related practical and scientific needs. Tide gauges in Turkey are established and operated by General Command of Mapping in order to determine the tidal datums including mean sea level and meet the sea level data needs of scientific and engineering communities. Sea level observations have been carried out by float operated gauges till 1998, since then the gauges have been upgraded and changed with acoustic ones with sounding tubes and Turkish National Sea Level Monitoring Network has been established. At present TSLMS consists of one data center and 20 tide gauge stations shown in Figure 4.4.

Sea level and other ancillary meteorological parameters are collected at stations and stored in data loggers every 15 minutes and then transmitted to data center via GPRS. Quality control and the data analysis operations are performed at the data center in Ankara.

Since the tide gauges measure sea level relative to land upon which they are located, observed sea level contains true sea level along with any vertical land movement signal. Periodic

geodetic measurements such as GPS, continuous GPS, and precise levelling are carried out at all TSLMS tide gauges at 1-2 years interval to separate vertical land movements from true sea level and to monitor absolute sea level relative to earth center.

Besides geodetic objectives, these stations are also contributing to regional oceanography, meteorology and tsunami early warning center.



**Figure 4.4.** Locations of the existing tide gauge stations of TSLMS.

#### **(5) Papers, Presentations, Posters, Master and PhD Thesis, Projects and Technical Reports, Other Activities**

##### **Papers in International/National Journals**

##### **Papers in International Journals**

Altuntas C., Karabork H., Tusat E. (2014) “**Georeferencing of ground-based LIDAR data using continuously operating reference stations**”. Optical Engineering 53(11), 114110.

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**adjustment: preliminary results**". 143 of the IAG Symposia Series, Editor Chris Rizos, Assistant Editor-in-Chief Pascal Willis, 2015 (paper accepted for publication).

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Madzak M., Böhm J., Böhm S., Krasna H., Nilsson T., Plank L., Tierno Ros C., Schuh H., Soja B., Sun J., Teke K. (5-8 March 2013) **"Vienna VLBI Software – Current release and plans for the future"**. Proceedings of the 21st Meeting of the European VLBI Group for Geodesy and Astrometry (EVGA), Reports of the Finnish Geodetic Institute, edited by N. Zubko and M. Poutanen, Helsinki, Finland, 73-76.

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## **National Papers**

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Ulukavak M., Yalçinkaya M. (2014) “**Toplam Elektron İçeriği (TEC) Değerleri ve Deprem İlişkisinin İncelenmesi**”. Gümüşhane Üniversitesi Fen Bilimleri Enstitüsü Dergisi, Cilt 4 Sayı 1, 107-116.

Yıldırım F., Kaya A., Kaplan Y. (2011) “**Jeodezik Dik ve Coğrafi Koordinat Dönüşüm Yöntemlerinin Karşılaştırılması**”. Harita Dergisi, Sayı:146, s. 1–7.

## **Presentation in International/National Symposium**

### **Presentations/Poster in International Symposiums**

Ulukavak M., Yalçinkaya M., Zengin Kazancı S., Tanır Kayıkçı E. (2015) “**Investigation of Total Electron Content Variations Before the Aegean Sea Earthquake (24.05.2014 Mw 6.9)**”. 26th General Assembly of the International Union of Geodesy and Geophysics (IUGG), June 22- July 2, 2015, Prague, Czech Republic.

Tanır Kayıkçı E., Douša J., Teke K., Tornatore V., Zengin Kazancı S., Ulukavak M. (2015) “**Comparisons of Tropospheric Delay Estimates Between GNSS and VLBI Techniques Conducted by the Analysis Centers at Karadeniz Technical University**”. 26th General Assembly of the International Union of Geodesy and Geophysics (IUGG), June 22- July 2, 2015, Prague, Czech Republic.

Zengin Kazancı S., Tanır Kayıkçı E., Ulukavak M., Yalçinkaya M. (2015) “**Investigation For Spatial and Temporal Variations of Daily Mean Temperatures of Black Sea Region, Turkey**”. 26th General Assembly of the International Union of Geodesy and Geophysics (IUGG), June 22- July 2, 2015, Prague, Czech Republic.

Karaaslan Ö., Tanır Kayıkçı E. (2015) “**Determining The GPS/Levelling Geoid Undulations By Interpolation Methods And Artificial Neural Networks Method For Region of Trabzon, Turkey**”. 26th General Assembly of the International Union of Geodesy and Geophysics (IUGG), June 22- July 2, 2015, Prague, Czech Republic.

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Zengin Kazancı, S. (2014) "**A Study on Application of Spatial Interpolation Methods: Case Study on Daily Mean Temperature Data at Black Sea Region (Konumsal Enterpolasyon Yöntemlerinin Uygulanması: Karadeniz Bölgesi Günlük Ortalama Sıcaklık Verileri Örneği)**". Master Thesis (Yüksek Lisans Tezi), Karadeniz Teknik Üniversitesi, Fen bilimleri Enstitüsü, Mayıs 2014, Trabzon

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### **Scientific Projects and Technical Reports**

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Tanır Kayıkçı, E., Teke, K. (2012) "**KTU-GEOD IVS Analysis Center Annual Report 2011**", International VLBI Service for Geodesy and Astrometry 2011 Annual Report, edited by K. D. Baver and D. Behrend, NASA/TP-2012-217505, 2012. <http://ivsc.gsfc.nasa.gov/publications/ar2011/acktu/>

### **Other Activities on International Level**

**KTU-GEOD IVS Analysis Center** (*Reponsible Persons: Emine Tanır Kayıkçı-KTU, Kamil Teke-Hacettepe Uni.*)

The proposal of Karadeniz Technical University (KTU) to become an International VLBI Service for Geodesy and Astrometry Analysis Center (IVS AC) was accepted on March 23,



2009 in a Directing Board meeting during the 19<sup>th</sup> European VLBI for Geodesy and Astrometry Working Meeting held in Bordeaux, France. Following the approval of being an IVS AC. KTU-GEOD IVS AC has used VieVS (Vienna VLBI Software), which is distributed with its open source code based on MATLAB. We are anticipating the release of a geodetic parameter combination module of VieVS. Main tasks of KTU GEOD AC tasks are to analyze VLBI sessions with different parameterizations, focusing on the European VLBI Network (EVN), to study different stochastic models by means of comparing geodetic estimates derived from the analysis of VLBI sessions and from other space geodetic techniques (see papers at *Scientific Technical Reports*)

**Analysis Center For Near Real-Time GNSS Troposphere Monitoring In Turkey within COST Action ES1206,** (*Reponsible Person: Emine Tanır Kayıkçı-KTU*)

One of the main goals of the WG1 “Advanced GNSS processing techniques” of the GNSS4SWEC Project (COST Action ES1206) is the transfer of knowledge, tools, and data exchange in support of new analysis centers and new networks. Dr. E. Tanır Kayıkçı suggested to set up a new processing center for all available national stations in Turkey and asked for support within the COST Action during 1st ES1206 GNSS4SWEC Workshop, February 26 - 28, 2014, Munich, Germany. Therefore, new analysis center was set up in Karadeniz Technical University for near real-time GNSS troposphere monitoring in support of numerical weather forecasting within a short-term scientific mission by Dr. Jan Douša at Geodetic Observatory Pečňý (GOP) of the Research Institute of Geodesy, Topography and Cartography (RIGTC) in September 2014. New network with Turkish national permanent GNSS stations will significantly improve the coverage of near real-time tropospheric products in Europe and national processing center is an optimal way for access to all such data.

**TRAB Permanent GNSS Station at KTU** (*Reponsible Person: Emine Tanır Kayıkçı-KTU*)

As a Geodesy division of KTU Geomatics Engineering department, TRAB permanent GNSS station (was operated in both EUREF Permanent Network (EPN) and IGS network between 1999-2007 and in-active since 2007) support the operation of TRAB permanent station with our university budget to contribute increasing IGS and so EUREF station densities in Turkey. So, TRAB station has operated actively with new receiver at site since February 2015. In near future, we are wishing to be included in EPN and join also IGS network

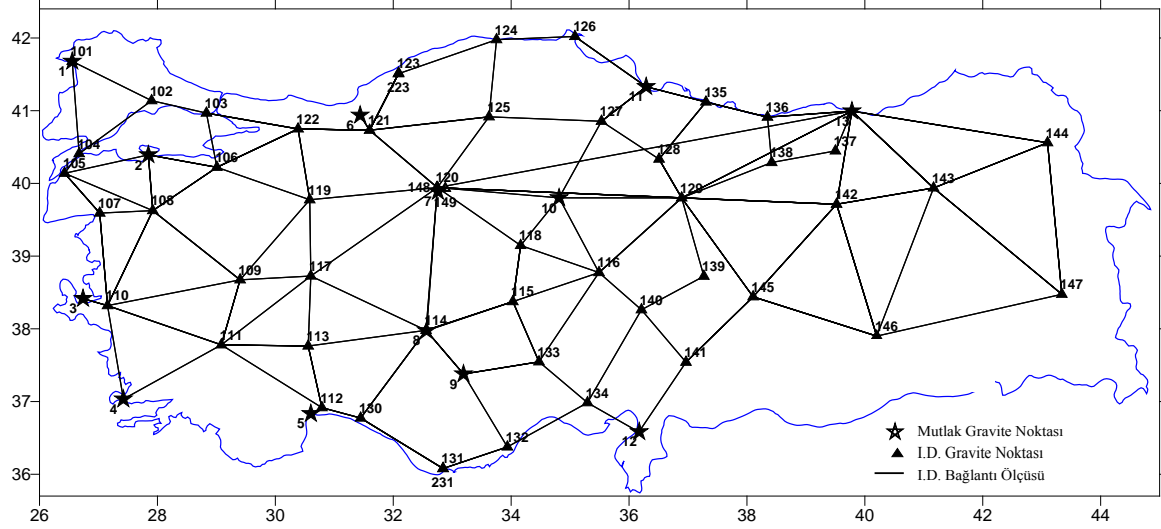
**b. Gravity Field Working Group**

**(1) Gravity Network (TNGN-99)**

The fundamental gravity network (TNGN-99), consisting of 68 stations together with a calibration baseline with more than 200 mgal gravity range, has been established between 1993 and 1999 (see Fig. 4.5). 13 of these stations were observed with FG5 (101) absolute gravimeter of German Federal Agency for Cartography and Geodesy (BKG). 132 gravity connections between stations were measured, in so called go-back way, by two LaCoste & Romberg gravimeters (G-347, G-379). Gravimeter readings were converted to gravity values using manufacturer calibration values, and then tidal corrections were applied.



The daily measurements of each gravimeter were adjusted individually and corrected for instrumental drift. All reduced measurements were then adjusted by least squares taking into account the absolute gravity values. The adjustment resulted in standard deviations of gravity points between  $\pm 4\text{-}9 \mu\text{Gal}$ .

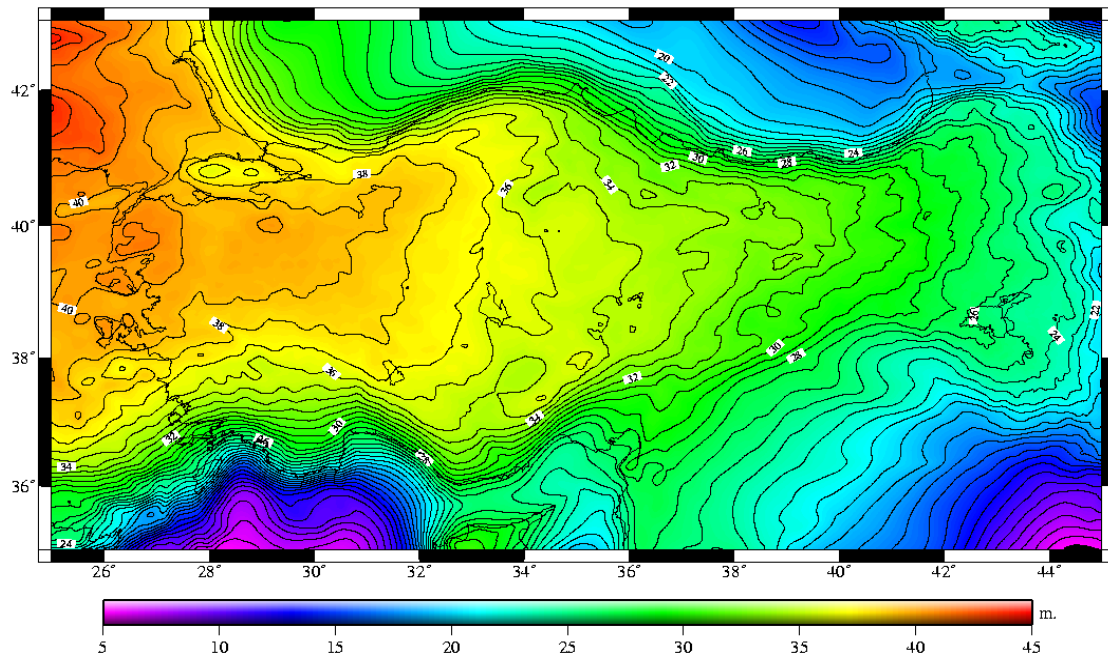


**Figure 4.5** Fundamental Gravity Network-1999. Stars: Absolute stations, triangles: network sites.

## (2) Turkish Geoid-2009 (TG-09)

Recently released geoid model Turkish Hybrid Geoid-2009 (THG-09) is a gravimetric model based on Remove-Compute-Restore technique (see Fig. 4.6). EGM08 geopotential model to degree and order 2160, DNSC08 satellite altimetry derived gravity anomalies on the sea surface, 3''x3'' digital terrain model including bathymetry, ~2700 GPS/levelling points and ~262400 surface gravity anomalies compiled from the national database are used in the computations.

We used remove-restore procedure based on EGM08 and applied RTM reduction of the surface gravity data. FFT technique was then used to obtain the residual quasi-geoid from the reduced gravity. We restored the individual contributions of EGM08 and RTM to the whole quasi-geoid height. Since the Helmert orthometric height system is adopted in Turkey, the quasi-geoid model was then converted to the geoid model by making use of Bouguer gravity anomalies and digital terrain model. After all we combined gravimetric geoid model with GPS/levelling geoid heights in order to obtain a hybrid geoid model or a transformation surface to be used in GPS positioning applications. Finally, we tested the hybrid geoid model with GPS/leveling data which were not used in the combination to assess the external accuracy. Results show that the external accuracy of the THG-09 is  $\pm 8.4 \text{ cm}$ .



**Figure 4.6** Geoid Model of Turkey (THG-09).

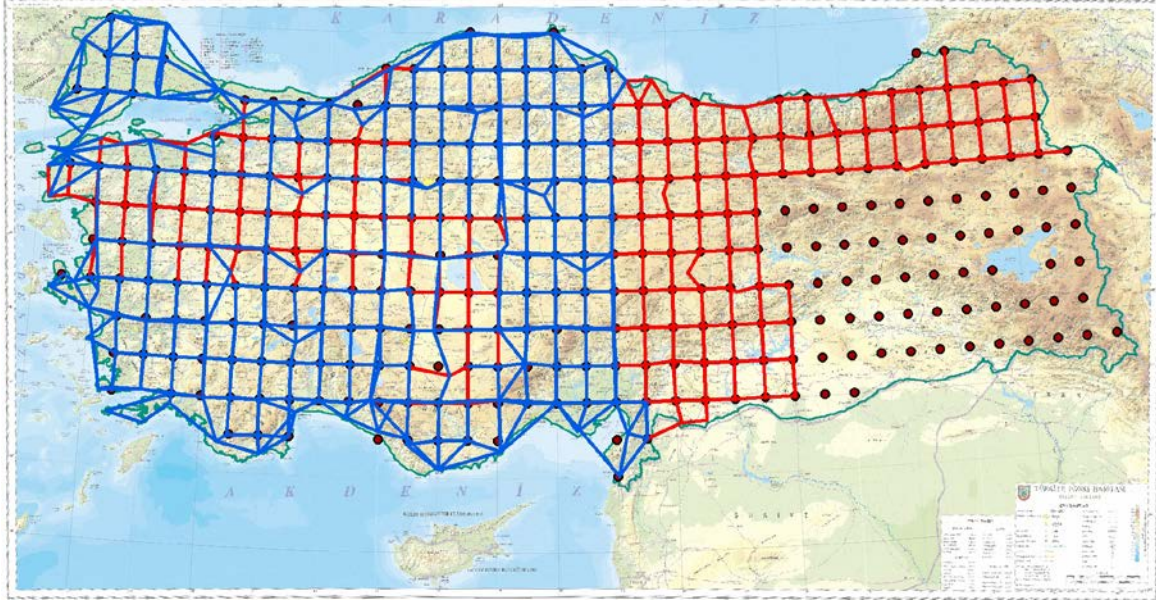
### **(3) Height Modernization Studies in Turkey**

A height system adopting the mean sea level of Antalya tide-gauge as the zero-height level and realized with first and second order leveling networks is currently in use within Turkey. With the widespread use of GNSS technology in mapping society, the gravimetric geoid models have been computed and related with national height system. But those models could not reach the accuracy to be used directly in GNSS positioning. Besides, rapid destruction of numerous leveling benchmarks due to the recent reconstruction of roads led to problems in the precise height determination in the country. The mean accuracy of the recently released geoid model THG-09 is about 9 cm and does not operate well enough along the borders, along the coasts, over the water bodies and the inland regions where the large gravity data gaps exist especially on the mountainous areas. Based on the results of the reconnaissance survey at 9000 benchmarks in 2011, it is now estimated that the number of the destructed benchmarks have reached up to 63% of the leveling network.

To overcome these shortcomings, General Command of Mapping initiated a height modernization project. The intention is to improve the geoid model that will provide a direct determination of physical heights from GNSS observations and no more leveling at the user level.

Terrestrial gravity data in Turkey have been collected by different organizations over many decades. Although the density of these data is sufficient in most part of the country, the poor quality, mainly due to the inconsistent coordinate and gravity reference frames, prevented us to compute a gravimetric geoid model of a few cm accuracy. Therefore, we are now working on the elimination of discrepancies between these historical datasets, developing a national gravity database and preparing guidelines for measuring, reducing, processing and exchanging terrestrial gravity data. In the meantime, new field campaigns were started in 2011 to extend the national gravity standardization network and to increase the amount of control points to be used for the quality check of the historical data.

The extended gravity network will consist of terrestrial points with 30 minutes spacing including the existing network points (see Fig. 4.7).



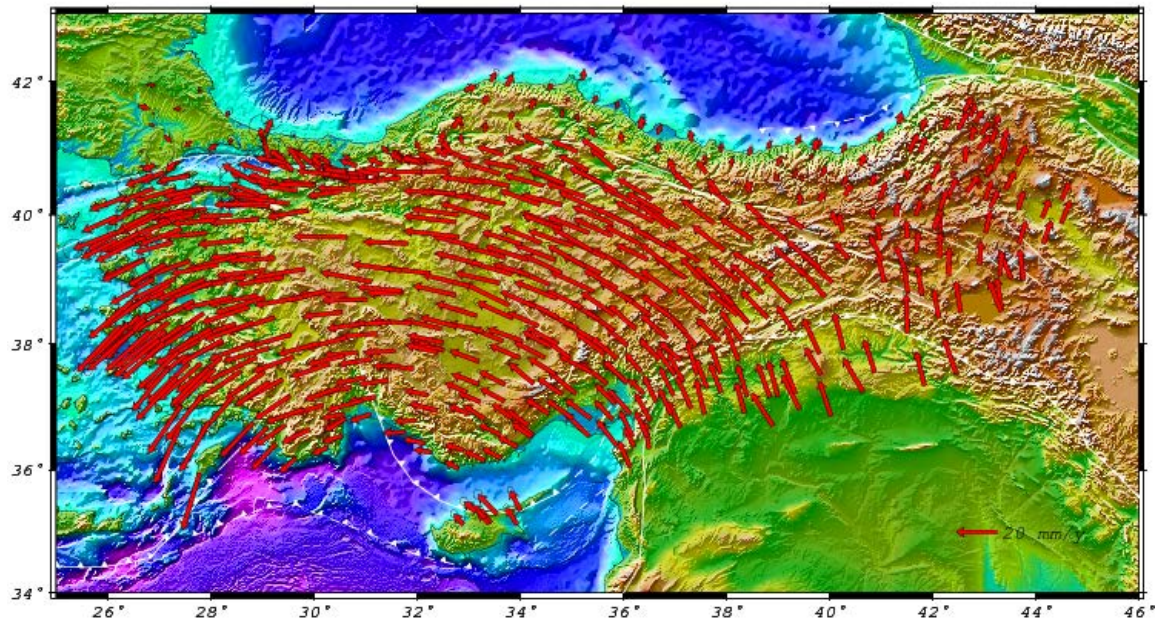
**Figure 4.7** Extension of the gravity network. Red and blue lines: gravity ties.

Besides, a protocol for a densifying the gravity network between GCM and 4 other national institutes namely, General Directorate of Mineral Research and Exploration, Turkish Petroleum Corporation and TÜBİTAK Marmara Research Center and TÜBİTAK National Metrology Institute has been signed. The main purpose of this national collaboration is to make relative gravity measurements at 5 minute spatial resolution.

### c. Geodynamic Working Group

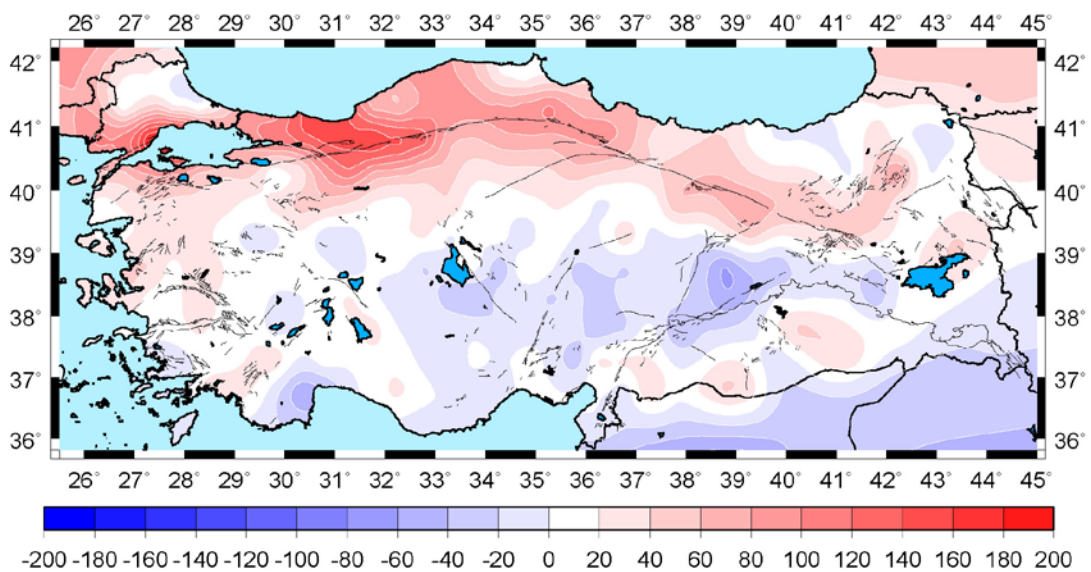
Anatolia, which takes place among major plates Africa, Arabia and Eurasia, is an ideal place to study both inter-plate tectonic and the deformation. GPS studies in Turkey which date back to late 1980's, have revealed the current northward motion of Arabia with respect to Eurasia and eastward escape of Anatolian Plate due to compression along East Anatolian Fault where the two plates collide. This rigid body rotation gives an upper bound of 24 mm/yr along North Anatolian Fault with an Euler pole near Sina, Egypt as well as compression in Marmara region which was implication of the catastrophic earthquake sequence (17 Aug 1999  $M_w=7.5$  İzmit and 12 Nov 1999  $M_w=7.5$  Düzce Earthquakes) in 1999. Figure 4.8 shows a recent velocity field of Anatolia in a Eurasia-fixed frame. Survey-type GPS observation campaigns initiated just after the earthquakes enabled the precise determination of co-seismic displacements reaching up to a few meters. While the post-seismic phenomena is still under investigation by survey-type campaigns and a continuous network, current results have not proved any significant change in the inter-seismic velocity field after the earthquakes possibly due to the on-going post-seismic signals.



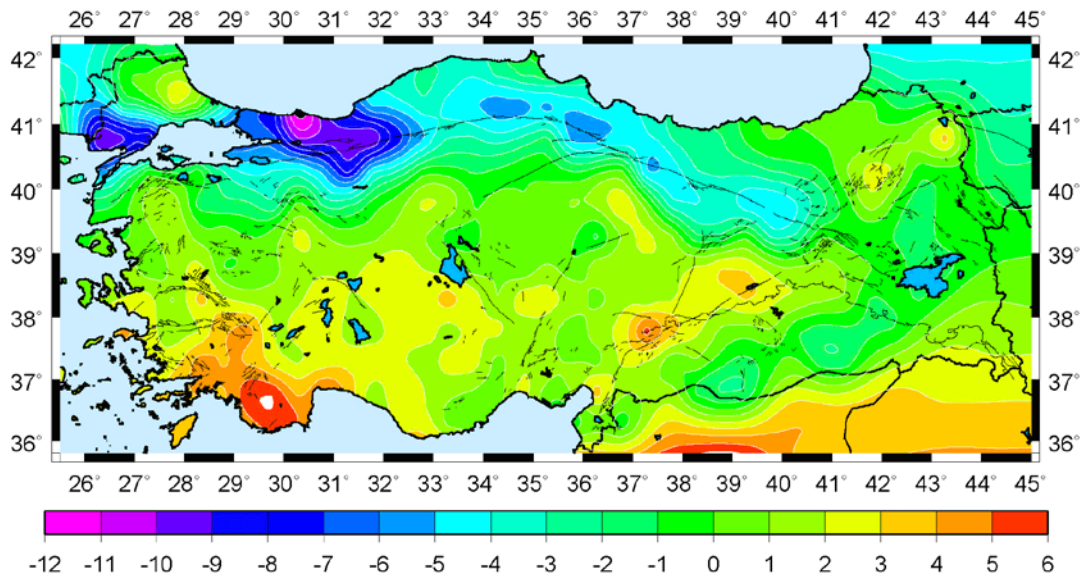


**Figure 4.8** Horizontal Velocity Map of Turkey acquired from inter-seismic data before the earthquakes (Eurasia Fixed)

Interseismic deformation is monitored by periodic GPS and leveling measurements across Turkey while specific densified networks are established for local and regional secular deformation in certain regions. Analyses of velocity field have been carried out to expose areas of secular deformation and seismic hazard. Strain analyses utilizing secular movements shed light on rigid block rotations, local compression and faulting areas that well conform to the geological and geophysical evidence of Anatolia. Shear strain rates and rigid-body rotation rates are given in Figure 4.9 and Figure 4.10, respectively. Due to high seismic activity, co-seismic and post-seismic deformation is also monitored by independent GPS campaigns. Earthquakes with magnitude equal and higher than Mw 6.0 cause surface displacements that should be taken into account in high-precision geodetic studies.



**Figure 4.9** Shear strains in nanostrain per year



**Figure 4.10** Rigid-body rotations in  $^{\circ}/\text{Myr}$

Co-seismic surface displacements obtained from survey-type pre-earthquake and post-earthquake GPS observations are analyzed and modelled in an elastic isotropic medium. Depending on the time interval, computed inter-seismic deformation is dispersed from observed co-seismic deformations and published to civilian users surveying in the regions under earthquake influence. TNFGN as well as other existing stations comprises a set of precise coordinates along with their velocities and possible co-seismic corrections for the earthquake prone areas. Specifically, certain parts of Anatolia are still investigated through permanent measurements.

#### **d. Positioning and Applications Working Group**

Positioning and Application Working Group is mainly concentrating on collecting information from the institutions and private sectors to identify their technical problems and needs to create a specific project that will compensate their needs and solve for their problems. In order to realise this, the group has determined some subjects and list their titles to get some contribution to turn them back with a real project benefiting to the institutions and professionals. The main titles that are exploited are as follows,

- Providing Geodetic Infrastructure knowledge to the GIS users
- Following contributions are going to be made by the group member for understanding of professionals who are directly practicing Large Scale Map and Map Information Production Regulation.
  - Educational support
  - More explanations and comments will be made to clarify some of the articles (especially on new technologies related ones) of the regulation
  - Alternative solutions will be advised on statistical test
  - Determining local geoid models
  - Way of improving existing local geoid models and also Turkish Geoid-2009
  - Monitoring problems of the regulation in practice and recommending solutions
- Supporting groups who develops standard on engineering surveying and engineering geodesy.

Currently Large Scale Map Making Regulation is used in Turkey. However this does not fit the needs of surveying authorities. It was approved in 1988 and therefore it mostly covers conventional surveying standards rather than modern standards. Therefore new and updated one has been prepared. It is called Large Scale Map and Map Information Production Regulation. It is going to bring new and extended technical standards to surveying profession.

Firstly it has been design to cover all current needs of surveying authorities. Moreover its design is suitable to cover coming technologies and technical developments in the profession. Moreover two additional national standards have been developed and integrated as its appendix to the regulation. One of them is XML based “*National Data Exchange Format*” for Digital Maps and the other one is “*Detail and Attribute Catalogue*”. Both are prepared to fully compensate the national needs; but compatible with international standards.

The advantage of this regulation against the previous one is its approval authority. It is going to be approved by the Cabinet. The meaning of this is: It is going to be a regulation for all kind of large scale map making and map information collection. Therefore all will be in a single standard.

## 5. Annual Scientific Meetings

Commission agreed to organise annual scientific workshops. Therefore since 2002, workshops have been organized under the directive of TNGC. National scientists from geodesy, geology and geophysics disciplines, graduate and undergraduate students and professionals are participated in these workshops. Invited and selected submitted papers are presented, discussed and knowledge is shared by different professional disciplines. The scientific meeting between 2011 and 2015 are as follows:

- Permanent GNSS Stations Network and Analysis – Istanbul 2011
- Height System Modernization of Turkey – Zonguldak 2012
- Determination of Local Geoids – Afyonkarahisar 2012
- Natural Disasters and Geodesy – Sivas 2013

A scientific meeting on geodesy education in Turkey will be held in Ankara in autumn this year.

One of the main philosophies of Turkish National Geodesy Commission is to contribute and organise educational activities for professional surveyors and students in Geodesy and Photogrammetry departments. Therefore it organises annual scientific workshops and encourages institutions and private firms to provide quality training periods for undergraduate students who might have found a chance to observe both practical and theory combination on real professional applications. More on to that, encourage working groups to concentrate on some educational based projects that are generally drawn as follows

- Supporting researchers such as providing data, information and etc.
- Contributing course programs for updating and/or extending their coverage
- Supporting national and international accreditation works at the universities
- Encouraging researchers and surveying engineers to publish or present their works on quality national and international journals and symposiums
- Organising activities that professionals can discuss and criticise technical problems

- Contributing to develop common terminology for surveying profession
- Establishing data base to distribute and share commissions' paper works such as minutes, publications, technical reports and etc.

## 6. List of Articles Published in the Surveying Journal

In this section only title of the publications are given. Full copy of the articles can be obtained via General Command of Mapping web site, <http://www.hgk.msb.gov.tr>. This journal is an official journal of General Command of Mapping and published twice a year. Full text of these articles is in Turkish. However English Abstracts exist for all of them.

2011 Issue: 145

- Computation of The Actual Coordinates And Velocities of Turkish National Fundamental GPS Network  
Bahadır AKTUĞ, Serdar SEZER, Soner ÖZDEMİR, Onur LENK, Ali KILIÇOĞLU
- Data Quality Control & Management System of Turkish Sea Level Monitoring Network  
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Taşkın KAVZOĞLU, Emrehan Kutluğ ŞAHİN, İsmail ÇÖLKESEN
- A New Proposal on the Definition, Naming and the Limits of the Oceans on Turkish Maps  
Erdem BEKAROĞLU, Murat ATAOL, Hakan YİĞİTBAŞIOĞLU
- Military Applications On The Virtual Globe  
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- Monitoring the Mass Variations within the Earth System from GRACE Satellite Data  
Mehmet SİMAV, Hasan YILDIZ, Ersoy ARSLAN
- Investigation Of The Effects Of Different GPS Solutions And Different Base Distances To The Orientation Accuracy in Kinematic GPS Supported Aerial Triangulation  
Ahmet ÇAM, Murat UYSAL
- Mathematical Models Of Catadioptric Systems In Panoramic Imaging  
Cumhur ŞAHİN, S. Özgür UYGUR, Bahadır ERGÜN
- Serving Database of Populated Places' Names Over The Internet  
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- Investigating the Accuracy of RASAT Satellite Imagery Geometric Correction According to the Number and Distribution of Ground Control Points Mustafa ERDOĞAN, Altan YILMAZ, Oktay EKER
- A Comparison of Resolution Merge Techniques According To Preservation of Spectral Value and Image Excellence: Worldview-2 Application  
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- Technical Investigation of Range Imaging Camera and Evaluation of Measurements from SR4000 and CamBoard nano Camera  
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Mustafa CANIBERK, Abdullah OKUL, Abdullah SAYGILI, Bekir YÜKSEL
- An Investigation of the INSPIRE Metadata Model for Geospatial Web Service:Proposals for TNGIS  
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- The Use of Worldview-2 Imagery and Auxiliary Data for Land Cover and Land Use Mapping  
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- Updating in Multiple Representation Databases. Model Generalization and Object Matching Stage  
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- Internet Based GNSS Processing Services  
Berkay BAHADUR, Aydın ÜSTÜN

2015 Issue: 153

- Determining the Endangered Fields of Turkish Coasts with Coastal Vulnerability Index  
Özlem SİMAV, Dursun Zafer ŞEKER, Ayşegül TANIK, Cem GAZİOĞLU
- Examination of the Relationship Between Urban of Forest and Agricultural Areas with  
Historical Orthophotos  
Mustafa CANIBERK, Erdem Emin MARAŞ, Temel DURĞUT
- GOKTURK-2 Satellite Imagery Tests  
Veysel Okan ATAĞ, Mustafa ERDOĞAN, Altan YILMAZ
- Fuzzy Classification for Land Cover Detection: a Case Study in Ankara  
Dijle BOYACI, Mustafa ERDOĞAN, Ferruh YILDIZ
- Results of LIDAR Test Performed by OPTECH HA-500 and RIEGL LMS-Q1560  
Abdullah KAYI, Mustafa ERDOĞAN, Oktay EKER

## 7. List of Articles Published in Journal of Geodesy and Geoinformation

Journal of Geodesy and Geoinformation is a peer-reviewed, semiannual, open access and widely distributed periodical, published by UCTEA Chamber of Surveying and Cadastre Engineers, Turkey. The Journal was published under the name of "HKM Jeodezi, Jeoinformasyon ve Arazi Yönetimi Dergisi" between 2003 and 2011, and "Harita ve Kadastro Mühendisliği" during the period 1965 - 2002. Detailed information can be found in <http://www.hkmodergi.org/jgg/index.php/JGG>.

2012 Issue : 105

- Regional spatio - temporal modeling of the ionospheric Vertical Total Electron Content (VTEC) using Multivariate Adaptive Regression B-Splines (BMARS)  
Mahmut Onur KARSLIOĞLU, Murat DURMAZ
- Modelling Very Long Baseline Interferometry (VLBI) observations  
Kamil TEKE, Emine Tanır KAYIKÇI, Johannes BÖHM, Harald SCHUH
- A novel image fusion method using IKONOS satellite images  
Deniz YILDIRIM, Oğuz GÜNGÖR
- Destriping of GRACE solutions by fitting high-degree polynomials  
Emine SİMAY ATAYER, Cüneyt AYDIN
- Comparison between simple and complete Bouguer approaches in interpolation of mean gravity anomalies  
Ramazan Alpay ABBAK, Aydın ÜSTÜN, Artu ELLMANN

2012 Issue : 106

- Seasonal and intraseasonal polar motion variability as deduced from atmospheric torques  
Michael SCHINDELEGGGER, Johannes BÖHM, David SALSTEIN
- Accuracy improvement and evaluation measures for registration of multisensor remote sensing imagery  
Deniz GERÇEK, Davut ÇEŞMECİ, Mehmet Kemal GÜLLÜ, Alp ERTÜRK, Sarp ERTÜRK

- Classification of multispectral images using Random Forest algorithm  
Özlem AKAR, Oğuz GÜNGÖR
- Digital zenith camera system for Astro-Geodetic applications in Turkey  
Kerem HALICIOĞLU, Rasim DENİZ, Haluk ÖZENER

2013 Issue : 107

- Photogrammetric features for the registration of terrestrial laser scans with minimum overlap  
Sibel CANAZ, Ayman HABİB
- An automatic region growing based approach to extract facade textures from single ground-level building images  
Emre SÜMER, Mustafa TÜRKER
- Analysis of surface textures of physiographic features extracted from multiscale digital elevation models via grey level co-occurrence matrix  
Dinesh SATHYAMOORTHY
- Thematic mapping of urban areas from WorldView-2 satellite imagery using machine learning algorithms  
Dilek KOÇ-SAN

2013 Issue : 108

- Automated Detection of Buildings and Roads in Urban Areas 1 from VHR Satellite Images  
Ali Özgün OK
- Observed TEC Anomalies by The GNSS Sites Preceding The Aegean Sea Earthquake of 2014  
Mustafa ULUKAVAK, Mualla YALÇINKAYA



**TURKISH NATIONAL UNION  
of  
GEODESY and GEOPHYSICS**

**NATIONAL REPORT  
GEOMAGNETISM AND AERONOMY COMMISSION OF  
TURKEY FOR 2011 - 2015**

**to be presented at the  
XXVI. GENERAL ASSEMBLY  
of the  
INTERNATIONAL UNION of GEODESY and GEOPHYSICS  
22 JUNE - 02 JULY, 2015**

**GEOMAGNETISM AND AERONOMY COMMISSION OF TURKEY  
([www.mta.gov.tr](http://www.mta.gov.tr))**

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***June 22 –July 2, 2015  
Prague / CZECH REPUBLIC***

***GEOMAGNETISM AND AERONOMY COMMISSION OF TURKEY  
(TUJAK)  
ANKARA 2015***

***GEOMAGNETISM AND AERONOMY COMMISSION OF TURKEY***

***(TUJAK)***

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## **INTRODUCTION**

National Geomagnetism and Aeronomy Commission of Turkey (TUJAK) works and encourages studies on the subjects such as geomagnetism, paleomagnetism, magnetotelluric, magnetic induction and aeronomy. This National Report has prepared for the XXVI General Assembly of IUGG to present newly and/or developed scientific researches of Turkish geoscientists. The National Report represents homage to our scientists and their colleagues.

## **WORKS**

### **Prospecting By Magnetic Methods**

General Directorate of Mineral Research and Exploration has carried out studies on magnetic prospection for the purposes of geothermal energy and mining. The Turkish Petroleum Corporation works in some regions in Turkey for petroleum exploration.

### **Geomagnetic Researches**

Iznik (IZN) and Kandilli (ISK) Geomagnetic Observatories of Bogazici University, Kandilli Observatory and Earthquake Research Institute, observes and records regional magnetic variations in Turkey. Components of the magnetic field H, D, Z, and total magnetic field (F) are recorded in every minute. The recorded datasets are sent to INTERMAGNET (International Real-Time Magnetic Observatory Network) and World Data Centre (Kyoto, Japan) regularly. On the other hand, in order to determine the tectono-magnetic effect in the Western Part of the North Anatolian Fault Zone, around Iznik-Mekece Fault, total magnetic field measurements have been recording every minute at 9 stations since 1986.

Magnetotelluric and magneto-variational methods have been applied in the Western part of the North Anatolian Fault Zone in a North-South alignment in order to reveal shallow and deep electrical resistivity structure and to get valuable information about the Earthquake mechanism since 1999. Studies are continuing with the methods to image the resistivity structure beneath Marmara Sea and its surroundings.

### **Studies of Kandilli Geomagnetism Laboratory of Bogazici University, Kandilli Observatory and Earthquake Research Institute**

#### **1. Internal (main) geomagnetic field studies**

A major part of geomagnetic secular variation can be represented by a rotation of the main geomagnetic field about the geographical pole. This phenomenon is called the westward drift and is related to the non-dipole part of the Earth's main geomagnetic field. The International Geomagnetic Reference Field (IGRF) is a series of mathematical models of the Earth's main geomagnetic field and its secular variation. In this study, we attempted to compare IGRF models of different epochs by rotating them about an optimum pole which does not necessarily coincide with the geographical pole because such a rotation provides a closer approximation to the non-dipole secular variation than simple westward drift. Our purpose was to find the optimum pole positions and rotation rates and compare them with different epoch's results. The continuity of the path of the optimum poles suggested that it is a real phenomenon rather than a mathematical artifact.

## **2. External geomagnetic field studies**

Regular geomagnetic daily variations,  $S_R$ , result from electric currents flowing mainly in the E-region of the ionosphere. The currents result from dynamo action due to the movement of conducting ionosphere across the Earth's main geomagnetic field. The ionosphere conducts because it is ionized by electromagnetic radiation from the Sun. In the absence of this, the ions rapidly recombine and the E-Region conductivity drops to zero. During a solar eclipse the part of the ionosphere in the umbra is shielded from Sun's ionizing radiation.

## **3. Electromagnetic induction studies in the crust and upper mantle.**

This subject can be further classified into the following two.

- Studies on electrical resistivity structure of seismogenic zones

Fluid is an important factor in the fault zone and many of the active faults are characterized by a great volume of groundwater. Physico-chemical behavior at the fault zones is mostly determined by fluid-rock interactions. Electrical resistivity is a physical parameter that heavily depends on the fluid content of one medium. Magnetotelluric (MT) is an efficient electromagnetic method used in geophysics to image the electrical resistivity structure within the crust.

- Studies on electrical resistivity structure of volcanoes

Hydrothermal systems develop mostly in the vicinity of sources of heat within the Earth's crust. Most volcanoes are associated with hydrothermal systems in which convection causes heat to transfer from depths to the surface. Magnetotelluric and audio-frequency magnetotelluric methods are sensitive to presence of fluids and are viable tools for mapping the conductivity (reciprocal of resistivity) anomalies near the hydrothermal systems.



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## PROJECTS

### International Projects

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## **Organizations Active in TUJAK Interests**

1 – General Directorate of Mineral Research and Exploration – Ankara

<http://www.mta.gov.tr>

2 – General Command of Mapping – Ankara

<http://www.hgk.mil.tr>

3 – Turkish Petroleum Corporation – Ankara

<http://www.tpao.gov.tr>

4 – University of Istanbul – İstanbul

<http://www.istanbul.edu.tr>

5 – Boğaziçi University Kandilli Observatory – Istanbul

<http://www.koeri.boun.edu.tr>

6 – Istanbul Technical University – Istanbul

<http://www.itu.edu.tr>

7 – Middle East Technical University – Ankara

<http://www.metu.edu.tr>

8 – University of Dokuz Eylül – İzmir

<http://www.deu.edu.tr>

9 – Turkish Scientific and Technical Research Association – Ankara

<http://www.tubitak.gov.tr>

## **International Activities in TUJAK Interests of The Chamber of Geophysical Engineers of Turkey**

11th International Petroleum and Natural Gas Congress and Exhibition of Turkey, TUROGE 21-22 March 2012 Ankara, Turkey.

International Geophysical Conference and Petroleum&Natural Gas Exhibition 17-19 September 2012, İstanbul, Turkey.

12th International Petroleum and Natural Gas Congress and Exhibition of Turkey, TUROGE 11 April 2013 Ankara, Turkey.

19th International Petroleum and Natural Gas Congress and Exhibition of Turkey, IPETGAS 15-17 May 2013 Ankara, Turkey.

7<sup>th</sup> Congress and Exhibition of Balkan Geophysical Society 07-10 October 2013 Tiran, Albania.

The 20<sup>th</sup> International Geophysical Congress and Exhibition of Turkey, 25-27 November 2013 Antalya, Turkey.

13<sup>th</sup> International Petroleum and Natural Gas Congress and Exhibition of Turkey, TUROGE 09-10 April 2014 Ankara, Turkey.

14<sup>th</sup> International Petroleum and Natural Gas Congress and Exhibition of Turkey, TUROGE 18-19 March 2015 Ankara, Turkey.

20<sup>th</sup> International Petroleum and Natural Gas Congress and Exhibition of Turkey, IPETGAS 27-29 May 2015 Ankara, Turkey.

The 21<sup>th</sup> International Geophysical Congress and Exhibition of Turkey, 2015 Turkey.



**TURKISH NATIONAL UNION  
of  
GEODESY and GEOPHYSICS**

**NATIONAL REPORT  
HYDROLOGICAL SCIENCES COMMISSION OF  
TURKEY FOR 2011 - 2015**

**to be presented at the  
XXVI. GENERAL ASSEMBLY  
of the  
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22 JUNE - 02 JULY, 2015**

**HYDROLOGICAL SCIENCES COMMISSION OF TURKEY  
([www.dsi.gov.tr](http://www.dsi.gov.tr))**

# **REPORT OF NATIONAL HYDROLOGY COMMISSION OF TURKEY**

**(2011 – 2014)**



**GENERAL DIRECTORATE OF STATE HYDRAULIC WORKS (DSİ)**

ANKARA

April, 2015



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National Hydrology Commission of Turkey (TUHK in Turkish acronym) is an organization that focuses on hydrologic researches and applications, involves academicians engaged with the training of hydrologic sciences, specialists from governmental and private institutions. TUHK is a part of International Associations of Hydrological Sciences (IAHS) at national level. The aim of TUHK is to promote hydrological researches and projects, engineering applications, and to enhance communication between members. Demonstration of hydrologic application capacity which has been developing in recent years enormously in Turkey may be possible with the constitution of a strong hydrological society. State Hydraulic Works (DSI) is the founder and the executive organization for TUHK.

## **A. Activities of TUHK**

### **A. 1. Structural Reorganization of TUHK**

TUHK was held a steering committee meeting in 20.02.2013 with the participation of the management board of TUHK and the chairs of the working groups (Figure 1). In this meeting, it was pointed out that a reorganization was essential to strengthen the working groups. In this manner, it was decided that every working group would have a deputy chair from State Hydraulic Works (DSI in Turkish acronym) and two secretaries from university and DSI stakeholders, separately. All working groups also strengthened by the new participations from universities and governmental institutions.



Figure 1. Steering committee meeting in 20.02.2013

As regards to this decision, the new structure of TUHK is given below in Table 1.

Working Group Title	Position	Name and Title	Organization
	Chairman	Bülent Selek, Ph.D.	State Hydraulic Works of Turkey
	University representative	Prof. Dr. Hafzullah Aksoy	Istanbul Technical University
	TUBİTAK representative	Selma AYZ, Ph.D.	Scientific and Technical Research Council of Turkey.
	TUHK secretariat	Hakan Aksu, Ph. D.	State Hydraulic Works of Turkey
Surface Water	Group chairman	Prof. Dr. Bihret Onoz	Istanbul Technical University
	Vice chairman	Bilal Bektasoglu	State Hydraulic Works of Turkey
	University secretariat		
	DSI secretariat	Filiz Malkoc, Ph.D.	State Hydraulic Works of Turkey
Snow and Ice Hydrology	Group chairman	Prof. Dr. Ibrahim Gurer	Gazi University
	Vice chairman	Ayhan Akgoz	State Hydraulic Works of Turkey
	University secretariat		
	DSI secretariat	Mehmet Soylu	State Hydraulic Works of Turkey
Water Quality	Group chairman	Prof. Dr. Nilgün Harmancıoglu	Dokuz Eylul University
	Vice chairman	Fikriye Baltacı	State Hydraulic Works of Turkey
	University secretariat		
	DSI secretariat	Pelin Cosar	State Hydraulic Works of Turkey
Atmosphere-Soil-Vegetation Relations	Group chairman	Prof. Dr. Mahmut Cetin	Cukurova University
	Vice chairman	M. Sait Tahmiscioglu	State Hydraulic Works of Turkey
	University secretariat		
	DSI secretariat	Nefise Gedikoglu, Ph.D.	State Hydraulic Works of Turkey
Remote Sensing	Group chairman	Prof. Dr. Zuhar Akyurek	Middle East Technical University
	Vice chairman	Kemal Seyrek	State Hydraulic Works of Turkey
	University secretariat		
	DSI Secretariat	Nesibe Gulsah Guresci	State Hydraulic Works of Turkey
Isotope-Tracers	Group chairman	Prof. Dr. Serdar Bayari	Hacettepe University
	Vice chairman	Alime Temel Dilaver	State Hydraulic Works of Turkey
	University secretariat	Huseyin Karakus Assistant Professor Dr.	Kütahya Kumlupınar University
	DSI Secretariat	Sebahat Ozcan Eyupoglu	State Hydraulic Works of Turkey
Groundwater	Group chairman	Ozan Deniz Ph. D.	Canakkale Onsekiz Mart University
	Vice chairman	Birol Ozer	State Hydraulic Works of Turkey
	University secretariat	Zahide Acar Deniz Ph. D.	Canakkale Onsekiz Mart University
	DSI Secretariat	Halide Senem Coskun	State Hydraulic Works of Turkey
Water Resources Systems	Group chairman	Ishak Yüce Associate Professor Dr.	University of Gaziantep
	Vice chairman	Murat Hatipoglu, Ph. D.	State Hydraulic Works of Turkey
	University secretariat	Abdullah Muratoglu Research Assistant	Batman University
	DSI secretariat	Betül Karaaslan	State Hydraulic Works of Turkey
Continental Erosion	Group chairman	Prof. Dr. Huseyin E. Celik	Istanbul University
	Vice chairman	Ibrahim Biroglu	State Hydraulic Works of Turkey
	University secretariat		
	DSI secretariat	Murat Cavusoglu	State Hydraulic Works of Turkey
Statistical Hydrology	Group chairman	Prof. Dr. Hafzullah Aksoy	Ege University
	Vice chairman	Miktat Yavuz	State Hydraulic Works of Turkey
	University secretariat	Ebru Eris Assistant Professor Dr.	Ege University
	DSI secretariat	Deniz Ozdemir	State Hydraulic Works of Turkey

Table 1. TUHK Management Board

## **A. 2. TUHK Website**

TUHK web site was prepared and made accessible to public through the DSI web portal in 2013. (<http://www.dsi.gov.tr/faaliyetler/turkiye-ulusal-hidroloji-komisyonu>)

The web page includes the following items:

- Information about TUHK.
- Organization Structure.
- Working Groups.
- Regulation of TUHK.
- Events (hydrology calendar).
- Monthly Hydrology Bulletin.
- Publications.
- Hydrology Links.
- Membership procedures.
- Contact information.

## **A. 3. TUHK Logo**

Three different logos were presented by DSI, one of them was selected via voting procedure. TUHK Logo which is shown below was voted by consensus of all working group management board members last year (2014).



Figure 2. TUHK Logo

## **A. 4. Steering Committee Meeting - 2014 and TUHK Workshop**

The next meeting and the TUHK workshop was held in the DSI premises in Ankara with the participation of 50 TUHK members between 10 and 11 February 2014 (Figure 3). During the workshop, all chairs of working groups presented the current activities in Turkey with respect to their working group themes. In addition to these presentations, a researcher from METU presented a new research about remote sensing of hydrology by GRACE satellites. Another presentation focused on the submission procedure of research projects to The Scientific and Technological Research Council of Turkey (TUBITAK). General overview of the Turkish National Union of Geodesy and Geophysics (TNUGG) was presented by the secretary of TNUGG.



Figure 3. TUHK Workshop in February, 2014, Ankara

#### A. 5. TUHK Scientific Activities

TUHK working groups proposed two hydrology projects to TNUGG in 2014. The titles of the projects are “Establishment of Hydrostatistical Flow Estimation Model for Ungauged Basins” and “Analysis of Low Flow and Drought”. The evaluation process of these two projects is on-going.

VIII. National Hydrology Congress is going to be organized by Harran University and TUHK is the partner institution for the Congress (Figure 4). For more information, one could reach the website of the congress which is given below.

<http://hidrolojikkongresi.harran.edu.tr/>



Figure 4. VIII. National Hydrology Congress Poster

TUHK is also partner institution for IV. National Symposium for Isotope Techniques on Hydrology” which will be held between 5th and 9th October 2015 in Istanbul. <http://www.dsi.gov.tr/docs/sempozyumlar/4-ulusal-hidrolojide-i-zotop-teknikleri.pdf?sfvrsn=4>

TUHK proposed a project to The Scientific and Technological Research Council of Turkey (TUBİTAK) entitled as “Watershed Baseflow Index Map” with Istanbul Technical, Gaziantep, Cukurova, Ege, Batman and Kırklareli Universities.

#### **A. 6. TUHK E-Bulletin**

TUHK e-bulletin is published monthly on TUHK web-site. TUHK e-list includes approximately 1400 members from different water communities of Turkey. The members are composed of water professionals, academicians, decision makers, hydrology experts, practitioners, and governmental staff.

The link of the bulletin is given below.

<http://www.dsi.gov.tr/faaliyetler/turkiye-ulusal-hidroloji-komisyonu/hidroloji-bulteni>

Since January 2014 TUHK e-bulletin has been published in the new format. It consists of the items listed below.

National and International Publications.

Hydrological research studies.

National and International Hydrological Events.

Announcements and News related with the national and international institutions;

TUHK (National Hydrology Commission of Turkey).

IAHS (International Association of Hydrological Sciences).

UNESCO / IHP (International Hydrological Programme).

EMWIS (Euro-Mediterranean Water Information System).

INBO (International Network of Basin Organizations).

WWC (World Water Council).

EU (European Union).

UN – Water.

WMO (World Meteorological Organization).

ICID (International Commission on Irrigation and Drainage).

Job Announcements.

Did you know?

Statement of the month.

Discussion topics from members.

The information is given with a short description and includes the link of the news.



**TÜRKİYE ULUSAL HİDROLOJİ TOPLULUĞU**  
**e-Bülteni**



Sayı : 01/2015 (OCAK)

DSİ GENEL MÜDÜRLÜĞÜ

ETÜT, PLANLAMA VE TAHSİSLER DAİRESİ BAŞKANLIĞI

ULUSLARARASI HİDROLOJİK FAALİYETLER (UHF) ŞUBE MÜDÜRLÜĞÜ

Tel: (312) 417 83 00 / 2477 Faks: (312) 417 13 78

Düzenleyen: TUHK Sekreteryası

<http://www.dsi.gov.tr/faaliyetler/turkiye-ulusal-hidroloji-komisyonu>

**Bültenin kapsamı:**

- Ulusal ve Uluslararası Yayınlar
- Hidroloji Araştırma Çalışmaları
- UHF Arşivine Ulaşan yayınlar
- Ulusal ve Uluslararası Hidroloji Etkinlikleri
- TUHK (Türkiye Ulusal Hidroloji Komisyonu)

- IAHS (Uluslararası Hidroloji Bilimleri Birliği)
- UNESCO/IHP (Uluslararası Hidroloji Programı)
- EMWIS (Avrupa-Akdeniz Su Bilgi Sistemleri )
- INBO (Uluslararası Havza Organizasyonları Ağı)
- WWC (Dünya Su Konseyi)
- AB (Avrupa Birliği) ile bağlantılı bilgiler
- UN (Birleşmiş Milletler) ile bağlantılı bilgiler
- WMO (Dünya Meteoroloji Teşkilatı)
- ICID (Uluslararası Sulama ve Drenaj Komisyonu)

Duyurular

İş duyuruları

Biliyor muydunuz?

Tartışma konuları

Üyelerden

Haftanın sözü

**Not: Bu sayıda değerlendirilen alt bölümler koyu renkle belirtilmiştir.**

Figure 5. Monthly TUHK E-Bulletin (January-2015)



## **B. Hydrological Activities In Turkey**

Major contributing members of Turkish hydrological community are the General Directorate of the State Hydraulic Works (DSI), General Directorate of Water Management (SYGM), Turkish Water Institute (SUEN), Turkish State Meteorological Service (MGM), Ministry of Food, Agriculture and Livestock Research Institutes, universities and private sector.

During the last four years, it can be generally stated that the educational and technological capacities of the hydrometeorological services, and organizational abilities at the national level have been improved. In order to achieve the function of coordination in a more efficient manner, DSI has the principle responsibility of the hydrometeorological organizations, as being the focal point of national committees, covering the provision of advice to the Government on all related research, training, educational and practical matters in hydrology and giving the increased responsibility to DSI having more power in shaping national water resources policies. During the last four years, many conferences and symposiums related to hydrology and its most prevalent subtopics has been held in order to enhance the knowledge sharing among the pivotal institutions in both national and international level.

With the establishment of the Ministry of Forestry and Water Affairs in 2011, the institutional structure of governmental water institutions was changed fundamentally.

SUEN was founded as a new institution as a think tank under the Ministry of Forestry and Water Affairs with the purpose of realizing the scientific experience and water vision. SUEN intends to develop a national water policy in cooperation with other water related institutions and to provide opportunities for broader participation in international events.

The second new institution is General Directorate of Water Management which is responsible for determining policies towards protecting, rehabilitating and utilizing water resources as well as preparing river basin management plans on a basin basis in order to protect and improve water resources.

Electrical Power Resources Survey and Development Administration (EIE) was abolished and the water related tasks, especially hydrologic monitoring activities, of this administration transferred to DSI.

Suleyman Demirel University Water Institute and Ankara University Water Management Institution was established in order to ensure optimum water resources management and planning projects by producing a multi-disciplinary, graduate-level education and training of qualified, transparent and aims to train researchers can renew itself.

Turkish hydrology experts participated to UNESCO-IHP strategic planning activities for 2014-2021 in 2012 and 2013 as observer. Since 2014, Turkey is a member of intergovernmental council of UNESCO-IHP.

The 3<sup>rd</sup> Istanbul International Water Forum was held on May 27-29, 2014 with the attendance of 2,500 registered participants as well as Minister of Water Supply and Drainage of Sri Lanka, President of the World Water Council, President of the

International Water Resources Association (IWRA), Chair of National Committee for the 7<sup>th</sup> World Water Forum, Founding Director of the Institute for Advanced Sustainability Studies (IASS), Permanent Technical Secretary of International Network of Basin Organizations (INBO) and senior representatives of the ministries of Iran, Iraq, Poland, Macedonia, Morocco, and Yemen.

This third Forum tackled two all-important subjects of “Water Security” and “Legal Aspects of Water” in eight thematic sessions. Moving from the UN Millennium Development Goals to Sustainable Development Goals, the 3<sup>rd</sup> Istanbul International Water Forum addressed responses to the issues of global water security and discussed the issues of climate change, water-food-energy-ecology nexus, water governance and integrated basin management. The Forum also dealt with the legal aspects of water such as right to water and sanitation, national water law, transboundary water cooperation and the legislation on protection of water resources. The sessions were 105 minutes long and consisted of a keynote address followed by a moderated panel discussion featuring internationally prominent water experts. After the panel discussions, the audience had the opportunity to join the debate through Q&A’s.

Next to the thematic sessions, there were a number of side events organised by various national/international institutions and organisations.

The Forum also hosted a Water Expo, where various water organisations and firms showcased their water-related activities, services and products.

The outcomes of the 3<sup>rd</sup> Istanbul International Water Forum are aimed to feed the 7<sup>th</sup> World Water Forum that will be held in 2015 in Korea.

The celebration of World Water Day, March 22nd, has been celebrated in Turkey with a series of activities carried out to increase public awareness of water in the country. For this purpose, painting, composition and photography competitions and exhibitions are held.

Stockholm Junior Water Prize (SJWP) contest is carried out by DSI every year.

The 1<sup>st</sup> World Irrigation Forum (WIF) of which main organizer is International Irrigation and Drainage Commission (ICID) and host institution is Turkish Irrigation and Drainage Commission (TUCID) was held in Mardin, Turkey from 29th September to 5th October, 2013. Water management and introducing the new policies and technologies applied in agricultural sector, together with enhancing the cross-sectoral cooperation were the main issues aimed to be discussed in the WIF.

### **C. Institutional Relations and Cooperations**

The members of the Turkish hydrologic community are cooperated with many other institutions listed as following;

- IAEA, International Atomic Energy Agency.
- JIIHP, Joint International Isotopes in Hydrology Program.
- IAH, International Association of Hydro-geologists.
- IAH, Karst Commission.

- IAHS, International Association of Hydrological Sciences.
- TUBITAK, Scientific and Technical Research Council of Turkey.
- U.S. National Committee for Scientific Hydrology.
- NIMH, Bulgarian National Hydrology and Meteorological Institute.
- UNESCO, Division of Water Sciences, International Hydrology Program.
- UNESCO, FRIEND.
- WMO, World Meteorological Organization.

Turkey has other activities at regional level. Institutional relations and cooperation are close with Ministry of Food, Agriculture and Livestock, Ministry of Environment, Ministry of Energy, Ministry of Development, Scientific and Technological Research Center of Turkey, Universities, and other water related institutions.

There is close collaboration with other national and international organizations and programmes such as WMO, IAHS, and MedPartnership.

Participation in international scientific meetings:

- Meetings hosted by the country European Group of Basin Organizations EUROPE-INBO, 17-19 October 2012, Istanbul, Turkey.

Participation hydrology meetings abroad:

- Hydrology Forum, 8-10 May 2012, WMO, Germany.
- Hydrology Forum , 24-26 September 2014, WMO, Poland.

#### **D. Ongoing Projects**

- Capacity Building on Water Quality Monitoring.
- Capacity building to Implement EU Flood Directive in Turkey.
- The impact of Climate Change on Water Resources of Turkey.
- Preparation of Flood Management Plan (Yeşilirmak and Antalya Basins).
- Preparation of the Drought Management Plan (Konya and Akarcay Basins).
- Identification of dangerous substances in coastal and transition waters of Turkey.
- Determination of water pollution causing by the use of Plant Protection Products.
- Development for determination of environmental objective methodologies for surface, coastal, transition waters (Buyuk Menderes Pilot Project).
- Determination of Sensitive Areas and Water Quality Objectives based basin scale in Turkey.
- Establishment of Country Specific Water Quality Ecological Assessment System Project.
- Atatürk Dam Conservation and Development Project.
- Development of Sectoral Water Allocation Planning Model (Ceyhan River Basin Pilot Project).
- Special Provisions Determination Project for Conservation of Water Environment.
- Reuse of Treated Wastewater for Agricultural Purposes.
- Water Footprint Project.

- Technical Assistance for Economic Analysis and Water Efficiency Studies in the Context of River Basin Management Plans (Implementation for three pilot basins).
- Calculation porous media water flow velocities using particle image velocimetry (PIV) method.
- Istanbul Grand Melen Water Supply Project (Melen System).
- Ankara Gerede Water Supply Project.
- Turkish Republic of Northern Cyprus (TRNC) Water Supply Project.
- Master Plans of 25 Major Turkish basins.
- "Every Drop Matters" Partnership on Filter Dam.
- Upper Catchment Flood Control Action Plan.
- <http://www.cem.gov.tr/erozyon/Files/yayinlarimiz/brosurler/SEL%20BROSUR%20ING%20MAIL.pdf>
- South Eastern Anatolia (GAP), East Anatolia DAP and Konya Plain Project( KOP) Action plans.
- Trakya Development Project (TRAGEP).
- Eastern Black Sea Project (DOKAP).
- Floods Strategy Action Plan 2013-2017.
- Thousand ponds in Thousand Days.

#### **E. Completed Projects**

- Watershed Protection Action Plans for 25 Great Basins in Turkey.
- Project on Pollution Control of Hazardous Substances.
- Capacity Building on Water Quality Monitoring.
- National Water Information System Project Feasibility Study.
- Project on Establishment of Automatic Water Measurement Stations.
- Development of statistical flow estimation models based on GIS in the Kızılırmak River Basin. TUJJB-TUMEHAP 01-11 project. ODTÜ Civil Engineering, 2014.

#### **F. TUBITAK-Supported Scientific Ongoing Projects**

- Turkish national manual and specifications & geoportal for flood hazard mapping studies.  
<http://person.zirve.edu.tr/haltas/FloodDataBase/Homepage.html>
- Calculating porous media water flow velocities using particle image velocimetry (PIV) method.  
<http://person.zirve.edu.tr/haltas/PorMedVelocity/Homepage.html>
- Real- or Near Real-Time Calculation of Porous Media Water Flow Velocities Using Particle Image Velocimetry (PIV) Method and Using The 2nd Velocity Vector Fields in Verification of The Existing Porous Media Solute Transport Models.

#### **G. National / Local Scientific and Technical Meetings, Seminars and Courses**

- 2<sup>nd</sup> Istanbul Somali Conference on Preparation for Future of Somali: Targets for 2015, 31 May-1 June 2012, Istanbul.
- National Hydrology Commission Workshop, 10-11 February 2013, Ankara.
- National Hydrology Commission Meeting, 20 February 2013, Ankara.

- D8 Water Cooperation Meeting With a Special Focus to Egypt and Nigeria, 21-22 February 2013.
- Water Law and Policies Workshop, 17-19 April 2013, Ankara.
- 3<sup>rd</sup> National Flood Symposium, 29-30 April 2013, Istanbul.
- Sharing Experiences for Karst Water Resources in the Middle East Workshop, 26-30 May 2013, Hacettepe University, International Karst Water Sources Research and Application Center, Ankara.
- 7<sup>th</sup> Hydrology Congress, 26-27 September 2013, Suleyman Demirel University, Isparta.
- First World Irrigation Forum, 29 September-5 Ekim 2013, Mardin.
- Water Safety in the 21<sup>st</sup> Century and Turkey Colloquia , 12-13 December 2013, Middle East Technical University, Ankara.
- Turkish National Hydrology Commission Workshop, 10-11 February 2014, State Hydraulic Works, Ankara.
- Dams Congress, 13-15 February 2014, Istanbul.
- International Integrated Basin Management Workshop, 25-26 February 2014, Istanbul.
- Water Safety and Water Law: Facing Challenges and Catching Opportunities, 27-29 May 2014, Istanbul.
- First World Irrigation Forum,,Irrigation and Drainage in the Changing World: Global Food Safety Challenges and Opportunities Meeting, 29 September- 5 October 2013, Mardin.
- 3<sup>rd</sup> International Istanbul Water Forum, 27-29 May 2014, Istanbul.
- 1<sup>st</sup> World Young Water Ambassadors Assembly Meeting, within the context of the 3<sup>rd</sup> International Istanbul Water Forum, 28 May 2014, Istanbul.
- Second International Conference on Water, Energy and the Environment Kusadası, Turkey. September 21-24, 2013.
- 5<sup>th</sup> International Water Engineering Symposium. 12-16 September 2011. DSI, Istanbul.

## **H. International Training Courses**

Turkey were hosted specific educational and training courses. Courses were arranged by SUEN and DSI. Following courses were hosted;

- Course on Cooperation Opportunities for participants from Gabon, 11 September 2012, Ankara.
- Course on Cooperation Opportunities for participants from Burkina Faso, 20 May 2013, Ankara.
- More than 300 engineers have received training at The Turkish Water Institute (SUEN) from various countries such as Azerbaijan, Saudi Arabia, Afghanistan and Ghana.
- The Turkish Water Institute (SUEN) gave trainings to the personnel of the Azerbaijan State Water Company AZERSU in the years 2012 and 2013 mainly in the fields of water and wastewater treatment and management. Total personnel trained were 240.
- The Turkish Water Institute (SUEN) organized a training programme in water and wastewater management and technologies to a group of 9 senior officials from the

Republic of Ghana Water Resources, Works and Housing Ministry between 28 April – 3 May 2014. The delegation also undertook site visits to the treatment facilities operated by the Istanbul Water and Sewerage Administration (ISKI) to observe the successful implementations and practices in place. Certificates were handed out to each participant at the end of the programme. The programme was carried out in cooperation with the Turkish Cooperation and Coordination Agency (TIKA) and it is the target to deliver similar training programmes to other countries in Africa.

- SUEN hosted a delegation of 6 senior officials from the Afghan Energy and Water Resources Ministry between 17 and 22 March 2014. The programme topic was Integrated Water Resources Management and was financed by the USA donor agency USAID.
- SUEN gave trainings to the engineers from several water and sewerage companies from Saudi Arabia in 2013 and 2014.

## **I. Activities Foreseen For the Future**

- 12<sup>th</sup> Session of The United Nations Convention to Combat Desertification Meeting will be held in Turkey in 2015.
- 8<sup>th</sup> National Hydrology Congress will be held in Sanliurfa in 2015.
- 4<sup>th</sup> International Istanbul Water Forum will be held in Istanbul in 2017.
- 4<sup>th</sup> National Hydrology Symposium on Isotope Techniques will be held in Istanbul in 2015.
- 9<sup>th</sup> World Congress - Changing World Conditions in Water Resources Management: Challenges and Opportunities will be held by European Water Resources association (EWRA), in Istanbul in 2015.
- 4<sup>th</sup> Water structures Symposium will be held on 19th- 20th November 2015 by Chamber of Civil Engineers.
- TUHK Steering committee will be held with the participation of the management board of TUHK and the chairs on the working groups in 16th March 2015 in Istanbul.

## **J. Publications Both National / International**

- Agaccioglu, H., M. E. Emiroglu , N. Kaya, (2012). Discharge coefficient of side weirs in curved channels. Proceedings of the Institution of Civil Engineers-Water Management, 165(6), 339-352.
- Akoz, M., M. Çobaner, M. Kırkgöz, A. Oner, (2011). Prediction Of Geometrical Properties Of Perfect Breaking Waves On Composite Breakwaters. Applied Ocean Research, no.3, pp.178-18.
- Aksoy, H., H. Wittenberg, E. Eris, (2014). Hydrograph Analysis and Baseflow Separation, Chapter in Handbook of Engineering Hydrology edited by Saeid Eslamian, CRC press.
- Aksoy, H., N.E. Unal, E. Eris, I Yuce, (2013). Stochastic modeling of Lake Van water level time series with jumps and multiple trends, Hydrology and Earth System Sciences, 17, 2297-2303.
- Aksoy, H., N.E. Unal, S. Cokgor, A. Gedikli, J. Yoon, K. Koca, S.B. Inci, E. Eris, (2012). A rainfall simulator for laboratory-scale assessment of rainfall-runoff-sediment transport processes over a two-dimensional flume, CATENA, 98: 63-72.

- Aksoy, H., N.E.Unal, S. Cokgor, A. Gedikli, J. Yoon, K. Koca, I. Boran , E.Eris, G. Pak, (2013). Laboratory experiments of sediment transport from a bare soil with rill, *Hydrological Sciences Journal*, 58(7): 1505-1518.
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**TURKISH NATIONAL UNION  
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**ANKARA**

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## **OUTLINE**

- ✧ **INTRODUCTION**
- ✧ **ACTIVITIES MADE BY TURKISH NATIONAL COMMISSION OF  
METEOROLOGY AND ATMOSPHERIC PHYSICS (TUMAK) IN THE  
PERIOD OF 2011-2014**
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## **INTRODUCTION**

From the very existence of human beings due to effects of meteorological phenomena on life; atmospheric events have always been researched. By this manner, human beings tried to find variable forecasting ways, either to benefit from positive effects or to protect from negative effects.

Turkish State Meteorological Service (TSMS) is a member of World Meteorological Organization (WMO) which also has 185 member services as the representative of countries under the umbrella of United Nations (UN). As one of the most successful sample of international cooperation since its establishment, WMO has increased societies interest on climate change and meteorological events based natural disasters. Moreover, World Climate Research Programme (WCRP) has been established by WMO and UNEP (United Nations Environment Programme). Meteorology Services studies on observing, weather forecasting, early warning and climate studies are also globally serving for health, food and water safety, poverty reduction.

Increase in world population, unplanned urbanization and migration problems and negative effects of global warming originated climate change and services need on food and water sources sectors have been increased and accessed new liabilities to the meteorological services.

### **Activities made by Turkish National Commission of Meteorology and Atmospheric Physics (TUMAK) in the period of 2011-2014**

- 1- Two-days WORKSHOP in “Aviation Meteorology” was held at Regional Directorate of Istanbul Meteorology on 21-23 June 2011. During the workshop, TAF and trend adjustments were told to the participants.

- 2- **WORKSHOP** on “Regional Flash Flood Guidance System – Black Sea and Middle East Regions as Part of the Global Flash Flood Guidance System (FFGS)” was held in Istanbul between 12-16 September 2011 under hospitality of the TSMS. The workshop was supported by WMO, US Hydrologic Research Center (HRC), NOAA Flood River Forecast Center (RFC), US UCAR, Russian State Hydrometeorological University, the French National Flood Forecast Centre (SCHAPI) and US National Weather Service (NWS) and several countries in the region participated in to the workshop along with the local institution and agency representatives from TSMS, State Hydraulic Works (DSI), General Directorate of Water Management, Disaster and Emergency Management Directorate (AFAD), METU, Gazi and Selcuk Universities and Water Foundation. The representatives who attended the meeting proposed TSMS to be Flash Flood Guiding Center for the Black Sea and Middle East regions.
- 3- **Regular General Assembly** of Turkish National Confederation of Geodesy and Geophysics (TUJJB) has been held in Regional Meteorological Directorate of Ankara in February 2012.
- 4- **Regional WORKSHOP** on “Modeling of Snow Parameters” was held in Ankara between 26-29 March 2012 under hospitality of the TSMS. The workshop was supported by USAID, HRC, NOAA.
- 5- Education on “Quantitative Precipitation Estimation and Quantitative Precipitation Assessment” were organized at Regional Training Center of WMO in Ankara between 05-09 September 2012. The workshop was supported by NCAR.
- 6- 6<sup>th</sup> International **COURSE** on “Meteorological Telecommunication and WMO Information System” was held in Antalya between 01-06 October 2012.
- 7- 6<sup>th</sup> International **TRAINING** on “Meteorological Radars” was held in Mugla between 08-12 October 2012.
- 8- 3<sup>rd</sup> International **COURSE** on “Upper Atmosphere Observation Systems” was held in Istanbul at Regional Training Center between 15-19 October 2012.

Several participants from Egypt, Germany, Hungary, Kazakhstan Senegal and Tunisia participated in to the course.

- 9- 6<sup>th</sup> Atmospheric Sciences Symposium was supported with articles of TUMAK groups.
- 10- WORKING GROUPS of TUMAK have been revised and several groups such as Atmospheric Modelling, Aviation Meteorology, Weather Forecasting, Hydrometeorology Climatology, Meteorological Observations, Remote Sensing, Meteorological Disasters and Geographical Informations Systems have been created in 2013.
- 11- 3<sup>th</sup> National SYMPOSIUM on “Flood” was held in Istanbul between 29-30 April 2013 with support of Istanbul Technical University.
- 12- 5<sup>th</sup> International WORKSHOP on “Climate Variability and Predictions” and SYMPOSIUM on “Global Climate Variability, Forecasts and Services” was held in Istanbul between 17-28 June 2013. The workshop was supported by NOAA, WMO and USAID.
- 13- International WORKSHOP on “Climate Change Monitoring and Evaluation” was held in Turkish Republic of Northern Cyprus between 25-27 September 2013.
- 14- ATTENDANCE provided to Meetings of European Working Group on Limited Area Modelling (EWGLAM) and Short Range Numerical Weather Prediction (SRNWP) 30 September – 04 October 2013.
- 15- International WORKSHOP on “HARMONIE (The non-hydrostatic convection-permitting model)” was held in Ankara Regional Training Center between 21-25 October 2013.
- 16- 3<sup>rd</sup> International WORKSHOP on “Meteorology, Sand and Dust Storm and Combating Desertification and Erosion” was held at Dragos institution of State Hydrolic Works in Istanbul between 28-31 October 2013. The workshop was supported by WMO, EUMETSAT, AEMET and BSC. Participants from several countries such as Saudi Arabia, Oman, Lebanon, Iran, Libya, Algeria participated in to the workshop along with lecturers from Serbia and Spain.

- 17- ATTENDANCE provided to 16<sup>th</sup> Commission Meeting of Atmospheric Sciences (CAS-16) in 20-26 November 2013.
- 18- International WORKSHOP on “Drought Management” was held in Ankara between 04-05 March 2014.
- 19- 10<sup>th</sup> International NATO’s ACO METOC CONFERENCE on “Meteorology and Oceanography” was held in Istanbul between 02-04 April 2014.
- 20- ATTENDANCE provided to 16<sup>th</sup> Session of Agricultural Meteorology Commission (CaGM) between 07-15 April 2014.
- 21- TRAINING on “Advanced Forecasting” was held in Ankara Regional Training Center for participants from Saudi Arabia between 26 May – 16 June 2014.
- 22- 6<sup>th</sup> International WORKSHOP on “Global Climate Variability, Forecasts and Services” was held in Istanbul between 04-16 August 2014. The workshop was supported by NOAA, WMO and USAID.
- 23- MEETING on “The South-East European Climate Outlook Forum” was held in Antalya between 17-22 November 2014.
- 24- Course on “Aviation Meteorology” was held in Ankara Regional Training Center for participants from Sudan between 15-17 December 2014.
- 25- ATTENDANCE provided to 5th Meeting of the Director Generals of the Economic Cooperation Agency (EIT) countries held in Istanbul between 15-17 December 2014 with aim of improving cultural and economic ties among the EIT countries.

## **SOME ACTIVITIES IN THE FIELD OF METEOROLOGY AND ATMOSPHERIC PHYSICS IN TURKEY (2008-2011)**

### **RESEARCH PROJECTS:**

#### **A.SUPPORTED BY TUJJB IN TUMEHAP**

- ▲ 2006-2011. Actual Erosion Risk Analysis Based on Surface Observations and Remote Sensing Techniques (in Turkish), TUJJB-TUMEHAP-01-06 project- **Principal Investigator: Zafer Aslan** (resulted).
- ▲ 2011 - . Model development for geographical information system based statistical flow forecasting at Kızılırmak basin (in Turkish) - **Principal Investigator: Zuhall Akyürek** (on going project).
- ▲ 2012 - . Examination of the ionospheric variability in İstanbul city (in Turkish) - **Principal Investigator: Zerefşan Kaymaz** (on going project).
- ▲ 2013 - . Determination of extreme climate indices by Regional Climate Model (in Turkish) - **Principal Investigator: Barış Önel** (on going project).

#### **B. SUPPORTED BY Turkish National Scientific and Research Council**

- ▲ TUBİTAK -Cost Project:111y234 Short Term Forecast of Solar Radiation via WRF Model (Coordinator: S.Incecik)
- ▲ Tujjb Project: Seasonal Modeling of Ozone Concentration over Istanbul (Coordinator: S.Incecik)
- ▲ TUBİTAK Project: Investigation Of Air Pollution Over Kağıthane Region – Researcher: S.Incecik)
- ▲ TUBİTAK Project, Short Term Wind Energy Forecast System, 110Y050, S. Menteş, Y.S. Ünal, S. Incecik, B. Önel, E. Tan, S. Topcu, Y. Borhan (2012-2014)
- ▲ TUBİTAK Project: A General Modeling of Input, Output, and Productivity Losses of The Wind-Solar Hybrid System in Istanbul (Researcher: Bihter TURNA).
- ▲ TUBİTAK 1007 KAMAG: Developing national wind energy systems – MİLRES (Researcher: Bihter TURNA).



### **C.Others:**

- ▲ EUMETSAT Project, Satellite Application Facility On Support To Operational Hydrology And Water Management (H-SAF), CDOP 2 (Coordinator: A.Öztopal)

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- Deniz.A, H. M. Çelebi, S. Incecik, H. Toros, Analysis of ozone and its precursors at an urbanized and industrialized creek valley (Golden Horn), Istanbul, Turkey, Fresenius Environmental Bulletin. 22, 2524-2532, 2013.
- Markakis, K., Im, U., Unal, A., Melas, D., Yenigun, O., Incecik, S. Compilation of a high resolution emissions inventory for the Greater Istanbul Area. Accepted for publication in Atmospheric Pollution Research. 3-5, 112-125, 2012
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- Tilev-Tanriover, S., Kahraman, A. (2013) Impact of Turkish Ground-based GPS-PW Data Assimilation on Regional Forecast: 8-9 March 2011 Heavy Snow Case. *Atmospheric Science Letters*- DOI: 10.1002/asl2.482
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**TURKISH NATIONAL UNION  
of  
GEODESY and GEOPHYSICS**

**NATIONAL REPORT  
OCEANOGRAPHIC COMMISSION OF  
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**to be presented at the  
XXVI. GENERAL ASSEMBLY  
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(TUOK)  
ANKARA 2014

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## **INTRODUCTION**

National Oceanography Commission of Turkey (TUOK) works and encourages studies on the subjects such as physical oceanography, hydrobiology, marine geology and geophysics. This National Report has been prepared for the XXVI General Assembly of IUGG to present newly and/or developed scientific researches of Turkish scientists. The National Report represents homage to our scientists and their colleagues.

## **PROJECTS**

### **Istanbul University**

#### **Faculty of Fisheries**

- PERSEUS (Policy-oriented marine Environmental Research for the Southern European Seas)
- COCONET (Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea) (2013-2014)
- Diversity and Adaptation of Mediterranean Octocorals to Climate Change (2013-2014)
- Causes and amount of gear losses in İstanbul. UDP/13696, 2011. Doç. Dr. S. Karakulak

#### **Institute of Marine Sciences and Management**

- Upgrade Black Sea Scene Project (Up BSScene) (EU 6th and 7th Framework Project) (Dokuz Eylul University Institute of Marine Sciences and Technology, Institute of Marine Sciences METU, Karadeniz Technical University Faculty of Marine Sciences, Istanbul University Institute of Marine Sciences and Management) (2008-2012)
- PEGASO Project (EU 6th and 7th Framework Project, Proposal No: 244170) (2008-2011)
- Protecting EuRopean SEas and borders through the intelligent Use of surveillance (PERSEUS).
- Confronting the 'Myth of the Bitter Sea': Pre-historic Exploitation of the Eastern Mediterranean Seascape
- National Geographic Society tarafından desteklenen "Landscape ecology and the end of antiquity : The archeology of deforestation in South coastal Turkey". Proje Yürütücüsü :Prof.Dr. Nicholas K. Rauh
- Convention of River Basin Protection Action Plans into River Basin Management Plans (127054/C/SER/Multi specific content)
- International Union of Pure and Applied Chemistry (IUPAC) Projesi, Proje No: 2008-031-1-500, Yürütücü: Prof. Dr. Reşat APAK "Methods of Measurement and Evaluation of Natural Antioxidant Capacity/Activity",
- UNDP Projesi (Adapting water resources management in the Comoros to increase capacity to cope with climate change) Araştırmacı: Prof. Dr. Z. Selmin BURAK

## **Middle East Technical University (METU)**

### **Institute of Marine Sciences**

- SINHA : Urban waste water management along coastal areas of Turkey: Reidentification of hot spots and sensitive areas, determination of assimilation capacities by monitoring and modelling and development of sustainable urban waste water investment plans (2008-2011). (supported by TUBITAK)
- Enhancing the Black Sea GOOS and sustaining its cooperation with the EU (BLACKGOOSE)
- EU-FP7, PERSEUS (Policy-oriented marine Environmental Research in the Southern European Seas) (2013-2014)
- Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential (2013-2014)

## **TUBITAK (Scientific and Technological Research Council of Turkey)**

### **Earth and Marine Sciences Institute (YDBE)**

- Seadatanet II: Pan-European Ocean Data Management (FP7) (2011-2015)
- Micro B3: Microbial Biodiversity, Bioinfo and Biotech (FP7) (2012-2015)
- HOT-Black Sea: Integrated Management of Hot Points and Protecting Black Sea Ecosystem (BS CBC) (2013-2017)
- EUROFLEETS-2: New operational steps towards an alliance of European research fleets (FP7) (2013-2014)
- IRIS-SES: Integrated Regional monitoring Implementation Strategy in the South European Seas (2013-2014)
- Ceyhan Marine Terminal Ballast Water Risk Assessment (2012-2013)
- HOT BLACK SEA: Integrated Hotspots Management and Saving the Living Black Sea Ecosystem

## **Boğaziçi University (BU)**

### **Kandilli Observatory and Earthquake Research Institute**

- UDIM Studies  
Sea Floor Systems providing Online (continuous) Data
- Sea Floor Systems providing Offline (continuous) Data
- Tsunami Modelling and Simulation Studies,
- Flooding Maps

### **General Directorate for Environmental Management**

- Determination of the Swimming water Profiles at the Turkish Coasts

### **Dokuz Eylül University**

#### **Institute Of Marine Sciences And Technology**

- Viewing the effects and results of “Big Canal Project” at the İzmir Bay Marine Environment
- Online Monitoring Digital Sediment Convection Modelling at the İzmir Bay
- North Anatolia Transform Faultline System at Marmara Sea- Examination of the evolution of Multi Line Transform Faultline after Quaternary
- Feasibility Study for Sinop Nuclear Power Station Project
- Determining the hazardous items at our coasts and transit waters and Ecologic Coast Dynamics Project
- Marmara Sea Gateway Project
- Biodiversity at the waters study
- Creating Environmentally Sustainable and Environment Friendly Fish Farms Systems
- Typology and Classification Studies at Turkey Coasts and Transit Waters

### **Ege University**

#### **Institute of Marine Sciences and Management**

- Determining the moving models of fishes at the artificial reefs and usage of this at small scale fisheries TUBİTAK -1001 TOVAG 112O383
- Determining the effects to the Marine Environment of Tunny stockfarming at open sea nets (Gerence, Aegean Sea) (Thunnus thynnus, L. 1758) E.Ü. Scientific Research Projects 11-SUF-025
- Determination and Management of solid waste at commercial trawl areas E.Ü. Scientific Research Projects 13- SUF-019
- Estimation of the anchovy stock biomass ovulating at the Edremit Bay by the method of the egg efficiency E.Ü. Scientific Research Projects 09/SUF/004
- Determining the effects of seasonal changes and habitat structure to the Sığacık Bay coastal shallow waters fish diversity E.Ü. Scientific Research Projects 12/SUF/05
- Distribution of biological silicium at İzmir Inner Bay water column and sediment E.Ü. Scientific Research Projects 13/SUF/002

- Effects of the Closed quicksilver mine on the sea sediments at Karaburun, İzmir, Türkiye  
E.Ü. Scientific Research Projects 12/BİL/033
- Indicators of coralline types for determining and monitoring the Mediterranean coastal waters “Good Environment Status” (CIGESMED) AB-SEAS ERA/TUBİTAK 112Y393

### **General Command of Mapping**

- TUDES --Turkish National Sea Level Monitoring System

### **ITU (İstanbul Technical University)**

#### **Maritime Faculty**

- Turkish Polar Research Program (TuPreP)

#### **Faculty of Naval Architecture and Marine Engineering**

- ISTKA Air Pollution based on the Ships at İstanbul Strait
- Hydrodynamic design of Underwater current turbines
- Determining the level and effects of contaminants caused by the shipyards and marina activities
- Increasing and developing biodiesel products from microalga and side products

### **Karadeniz Technical University**

#### **Institute of Marine Sciences**

- Heavy Metal measurements at the sediment and biodata of East Black Sea coast
- Solid waste and microplastic level at east Black Sea
- Usage of ponza stone to remove petrol waste

### **General Directorate of Mineral Research And Exploration**

- Investigating Geologic and geophysic properties of the South Datça Peninsula

## PUBLICATIONS:

### International Publications

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ERŞAN, M. S., BALKIS, N., MÜFTÜOĞLU, E., AKSU, A., BURAK, S. (2011) Metal pollution in surface sediments of the Golden Horn Estuary (Marmara Sea, Turkey) after the remedial actions. *Asian Journal of Chemistry (An International Peer Reviewed Research Journal of Chemistry)* ( in press).

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#### **International Oral Announcements**

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## **National Oral Announcements**

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**NATIONAL REPORT  
SEISMOLOGY AND PHYSICS OF THE EARTH'S INTERIOR  
COMMISSION OF  
TURKEY FOR 2011 - 2015**

**to be presented at the  
XXVI. GENERAL ASSEMBLY  
of the  
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22 JUNE - 02 JULY, 2015**

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### **ADHERING ORGANIZATION**

**REPUBLIC OF TURKEY  
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k. Sakarya University Faculty Of Engineering Department Of Geophysics, Sakarya	

- l. Kocaeli University Faculty Of Engineering Department Of Geophysics, Kocaeli
- m. Karadeniz Tecnic University Faculty Of Engineering Department Of Geophysics, Trabzon
- n. Kahramanmaraş Sütçü İmam University Faculty Of Engineering Department Of Geology, Kahramanmaraş
- o. General Directorate of Mineral Research and Exploration (MTA), Ankara
- p. Tübitak MAM Earth And Marine Sciences Institute, Gebze
- r. Cumhuriyet University, Geophysicsal Engineering Department, Sivas
- s. Hacettepe University Faculty Of Engineering Department Of Geology, Ankara
- t. İstanbul Technical University, Faculty of Mines, Geophysical Engineering Department, İstanbul
- u. Middle East Technical University Disaster Management Implementation And Research Center, Ankara
- v. Fırat University Faculty Of Engineering Geological Engineering, Elazığ
- w. Atatürk University

## **1. INTRODUCTION**

The Turkish National Commission for the Seismology and Physics of the Earth's interior, one of the commission of Turkish National Union of Geodesy and Geophysics, is authorized to coordinate the research activities on related topics as well as participate for improvement of activities in these fields. The commission is composed of members coming from the various governmental research organizations, establishments and universities.

The chairmanship and the secretariat of the commission, in accordance with the organisational and operational by-laws of Turkish Geodesy-Geophysics Union, are carried out by the Prime Ministry, Disaster and Emergency Management Presidency Earthquake Department. Besides, activities and studies are performed by means of "Coordination and Consultation Commission", which consists of representatives from 26 foundations, institutions and universities mentioned their presentations and outputs in the following parts.

This report includes summary of the TUSAK activities provided from commission members between 2011 and 2014.

## **2 . ACTIVITIES OF THE RESEARCH INSTITUTIONS AND UNIVERSITIES**

### **a. DISASTER AND EMERGENCY MANAGEMENT PRESIDENCY, ANKARA**

<http://www.afad.gov.tr>

<http://www.deprem.gov.tr>



Turkey ranks third in the world in terms of earthquake-related casualties and eighth with regard to the total number of people affected. Every year, the country experiences at least one 5+ magnitude earthquake – which renders the proper management and coordination of disasters absolutely crucial.

Turkey's disaster policy dates back to the aftermath of the 1939 Erzincan earthquake, which claimed nearly 33.000 lives and left at least 100.000 injured. Two decades later, the Turkish Parliament adopted the Law on Precautions to be taken due to Disaster Affecting Public Life and Assistance to be provided (No.7269) in order to fill the long-existing legal void. The legislative effort on disaster continued with the 1988 by-law on the Principles of the Organization and Planning of Emergency Assistance Regarding Disasters.

The 1999 Marmara earthquake, however, marked the turning point in the area of disaster management and coordination. This devastating disaster clearly demonstrated the need to reform disaster management and compelled the country to establish a single government institution to single-handedly coordinate and exercise legal authority in cases of disaster and emergencies. In line with this approach, the Turkish Parliament passed Law No.5902 in 2009 to form the Disaster and Emergency Management Authority (AFAD) under the Prime Ministry and abolish various agencies under whose jurisdiction the issue previously fell.

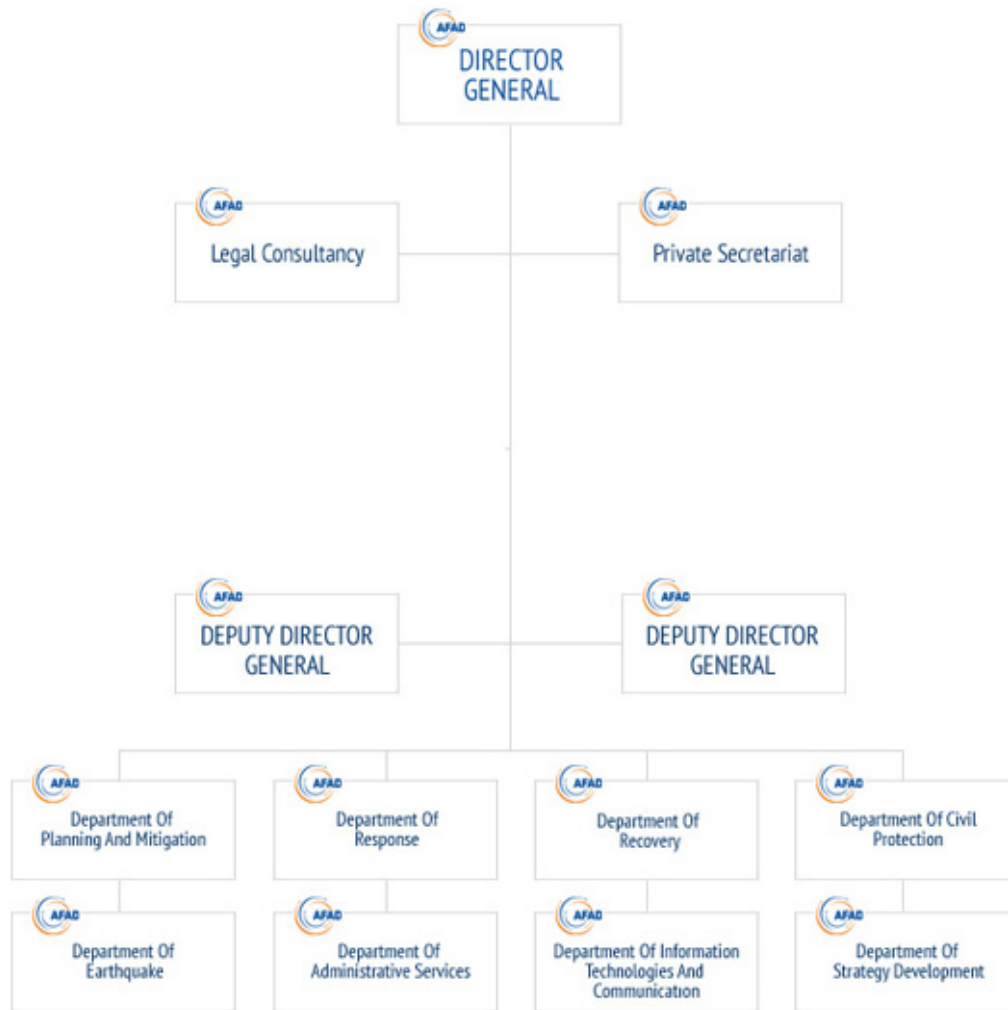
In this regard, the Disaster and Emergency Management Authority introduced a novel disaster management model which prioritizes Turkey's transition from crisis management to risk management – which came to be known as the Integrated Disaster Management System.

AFAD currently has 81 provincial branches across Turkey in addition to 11 search and rescue units.

Notwithstanding its position as the sole authority on disasters and emergencies, AFAD cooperates with a range of government institutions and non-governmental organizations depending on the nature and severity of individual cases.

In general, AFAD is responsible from implementing and coordinating;

- pre-disaster works such as preparedness, mitigation and risk management,
- syn-disaster works such as response, emergency aid,
- post disaster works such as recovery and reconstruction.



## EARTHQUAKE DEPARTMENT

In order to mitigate disaster losses, it is necessary to establish an effective disaster management and risk system. The first step of the management is continued by preparedness studies before the earthquake (disaster). For the disaster and risk determination it is necessary to have a strong seismological observation network.

At the beginning, for this purpose, in 1976, The National Strong Motion Network consisting of 67 accelerometers and in 1989, The National Telemetric Network, consisting of 12 weak motion stations, were established so as to observe, record, evaluate and archive the earthquakes in the country-wide scale and thus to inform to the public authority.

Now, Disaster and Emergency Management Presidency Earthquake Department has become an official authority in Turkey about where all real-time data recorded (weak and strong motion) at the existing stations in Turkey are collected, stored, archived and shared with all users. Furthermore, with the leading of AFAD Earthquake Department, **The National Earthquake Data Center** has been put into practice and then enacted in order to create common sharing and operating platform by providing cooperation and coordination among data providers with the all national or local weak and strong motion stations throughout the Turkey. In addition to this aim, after the any earthquake, it is also intended to announce for public areas and local authorities without causing any confusion.



General appearance of the **National Earthquake Data Center** web site.

After 1999 destructive earthquakes, Turkey implemented several earthquake mitigation measures and projects including legislative arrangements, technical capacity development, scientific projects and structural and non-structural mitigation measures. The series of these activities and attempts have been organized for the purpose of enhancing the country's capacity to struggle against earthquakes and mitigation these painful losses as soon as possible. However, all those efforts were not scheduled to any strategy or an action plan. One more shortcoming that has been identified as the missing point has been the lack of a road map with time. AFAD has undertaken a rapid endeavor to handle this deficiency. In this context, the new strategic approach of Turkey has been constituted named ***National Earthquake Strategy and Action Plan of Turkey (UDSEP-2023)***. It is a national roadmap in order to reduce earthquake related losses by 2023 and achieve earthquake resistant and resilient country within this period of time. By 2015 this strategy has been in effect and tested for 3 years, when this paper was submitted. Every action within UDSEP-2023 has an overall target in order to achieve earthquake loss reduction. Like many other natural hazards, prevention of earthquakes cannot be achieved completely but desired achievement on the reduction of loss of life, property and economy is the main target of earthquake strategy and action plan. Multi-stakeholder participation and realistic and manageable actions was the key both in preparation and managing the UDSEP-2023.

Earthquake Strategy and Action Plan is the roadmap of Turkey in order to reduce earthquake related losses by the year 2023 by implementing 87 actions. The strategy document is formed along three principal themes, seven objectives, 29 strategies and 87 action items for which 13 responsible agencies have been designated for implementing the cooperative work. This strategy includes 87 actions those will be achieved within 3 time periods namely; Short Term (2012-2013), Mid-Term (2012-2017) and Long Term (2012-2023). The fundamental philosophy of the National Earthquake Strategy and Action Plan-2023 (UDSEP-2023) can be summarized as "achievement of new earthquake-resilient, safe, well prepared and sustainable settlements so that the physical, economic, social, environmental and political harms and losses that may be engendered by earthquakes are prevented, or their effects reduced". The document aims to reduce the earthquake risk and enable a society that is prepared against this form of hazard through examining the institutional framework for this objective and establish the priorities of the R-D programs on the subject.

The scope of UDSEP-2023 is comprised of works to be done in the following areas:

1. Earthquake Information Infrastructure Research,
2. Earthquake Hazard Analysis and Maps
3. Earthquake Mitigation Plans (scenario-risk analysis),

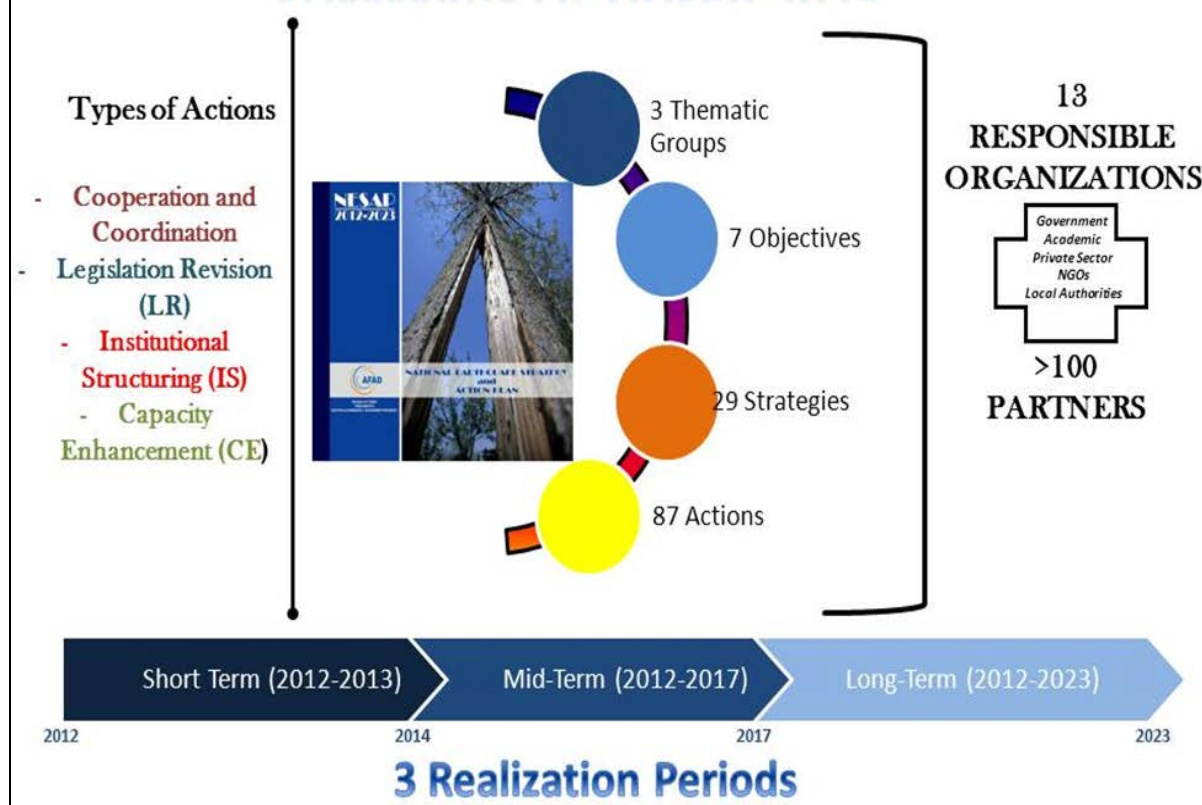
4. Earthquake Safe Settlements and Development,
5. Education and Enhancement of Public Awareness,
6. Protection of the Historic and Cultural Property from Earthquakes,
7. Emergency Management,
8. Legislation Development and Financial Arrangements.

For each area given above special groups were structured and each working group prepared detailed reports. In sum, almost 100 specialists contributed to the final version of UDSEP-2023. Within UDSEP-2023, in accordance with the general scope, risk reduction activities are dominant with some actions devoted for the development of emergency management and post disaster recovery activities.

By 2015, 24 actions of 87 were successfully completed.



# SUMMARY OF UDSEP-2023



## Learning about earthquakes

- STRATEGY A.1.1.1. Coordination shall be achieved in the R-D efforts for disaster information base, establishing priority R-D areas for support.
- STRATEGY A.1.1.2. An Earthquake Databank will be instituted and its function will be made continuous.
- STRATEGY A.1.1.3. Earthquake observation networks will be developed.
- STRATEGY A.1.1.4. A national preliminary earthquake damage estimation and early warning system shall be developed.
- STRATEGY A.1.1.5. Administrations and public authorities will be informed from a single source following assessment of earthquake activity.
- STRATEGY A.1.1.6. Steps will be taken to ensure that information contamination that occurs prior to and following all disasters, led by earthquakes, is prevented so that the public is informed accurately.
- STRATEGY A.1.1.7. An early tsunami warning system will be installed and made compatible with similar systems elsewhere.
- STRATEGY A.2.1. Comprehensive background surveys shall be carried out for preparation of regional and local seismic hazard maps
- STRATEGY A.2.2. The principles for seismic risk analysis and preparation of earthquake scenarios will be determined.

## Earthquake safe settlement and construction

- STRATEGY B.1.1.1. Procedures that emphasize hazard and risk in planning, environment and urban activities will be accorded priority and primacy.
- STRATEGY B.1.1.2. The building inventory in Turkey led by schools and hospitals shall be extracted and all existing buildings shall be grouped on the basis of their damageability and risk.
- STRATEGY B.1.1.3. Activities that cover earthquake resistant building design, materials and standards shall be supported.
- STRATEGY B.1.1.4. A coordinated system shall be set up for the purpose of ensuring that existing earthquake engineering laboratories provide more efficient and accessible service for the relevant community.
- STRATEGY B.1.1.5. The current seismic design code shall be updated and revised in keeping with Eurocode 8.
- STRATEGY B.1.1.6. Methods shall be developed, standardized and implemented for seismic safety assessment and building retrofit based on Turkish construction technology practices for bridges, viaducts and transportation networks as well as buried or surficial life line distribution systems (pipelines, natural gas lines, electric power networks and communication systems, etc.).
- STRATEGY B.1.1.7. Professional in service training shall be provided for the workforce in the construction industry.
- STRATEGY B.2.1.1. Technical information on the assessment of the earthquake safety of historic structures and their strengthening will be developed and disseminated.

## Coping with consequences of earthquakes

- STRATEGY C.1.1. Consensus and consistent language among administrators and decision makers for disaster and emergency management will be realized.
- STRATEGY C.1.2. Increase in the number of specialist disaster managers and widening of training in disaster management shall be assured.
- STRATEGY C.1.3. Earthquake museums shall be opened in provinces that have been hit by major earthquakes.
- STRATEGY C.1.4. A system for disaster volunteers shall be set up.
- STRATEGY C.2.1. In the preparation of a new law for disasters, existing laws and regulations on earthquakes shall be actively used.
- STRATEGY C.2.2. The preparation of the National Disaster Strategy and Action Plan will be assured.
- STRATEGY C.2.3. Special arrangements will be allowed for groups that embody risky individuals.
- STRATEGY C.2.4. The coverage of the Mandatory Earthquake Insurance will be expanded.
- STRATEGY C.2.5. An exercise for developing a new financial model will be launched.
- STRATEGY C.3.1. The post-disaster intervention system will be improved.
- STRATEGY C.3.2. Disaster health organisation shall be fostered.
- STRATEGY C.3.3. Information sharing and cooperation for damage assessment shall be advanced.

In addition to these activities, conducted by our Presidency, **“National Earthquake Research Program (NERP)”** has been constituted for the purpose of carrying out the actions in the NESAP with a particular discipline. Thanks to this program, the research projects, which include functional and earthquake-oriented results, can be supported.

Even though, there are several organizations working on different phases of earthquake risk management in our country, Earthquake Department of AFAD is the sole governmental organization of which duties and responsibilities are given by laws.

Leading a lot of important attempts since its inception date, 1969, AFAD Earthquake Department is one of the greatest data center not only in Europe and Middle East but also in the world with its 220 Broadband network based on 24/7 and 546 real-time accelerometric network.

#### **(1) THE NATIONAL SEISMOLOGICAL OBSERVATION NETWORK**

In order to determinate disaster and risk information it is necessary to have a seismological observation network. Due to the monitoring of the earthquakes in the country-wide scale, recording, evaluation, archiving and to inform to the public authority. The project named “Development of the National Seismic Network Project-USAG” has been started in 2005. In this context, 86 seismic stations was established between 2011 and 2014 and 110478 seismic events were determined at the same period. As of March 2015, total 230 seismic stations have been operated by AFAD.

Disaster and Emergency Management Authority is a official authority in Turkey about where all real-time data recorded (weak and strong motion) at existent station in Turkey is collected, stored, archived and shared with all users. All of the stations transmit continuously their signal to the Turkey Earthquake Data Center in Ankara. Earthquake activity in Turkey and surrounding region has been observed 7 days / 24 hours, in DDA data center in Ankara.

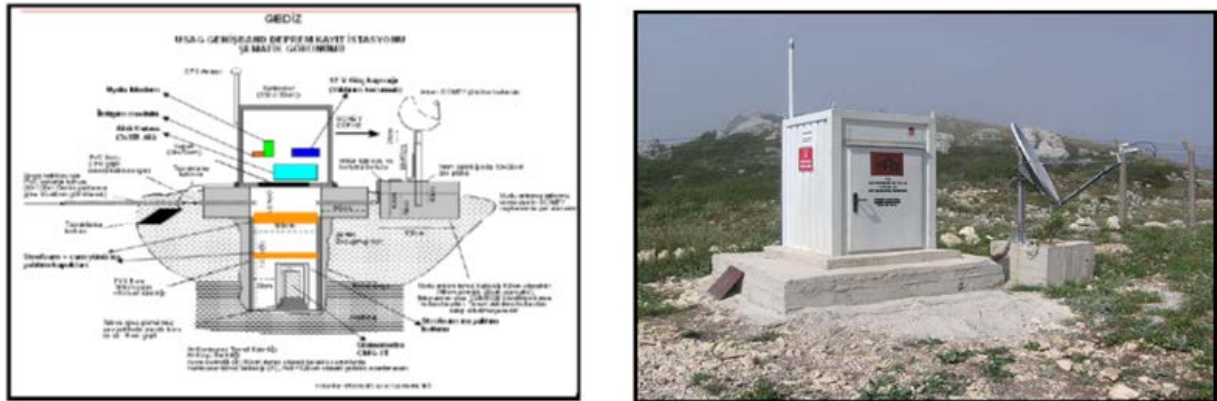


Figure 2: Broad-Band Stations and cross section.

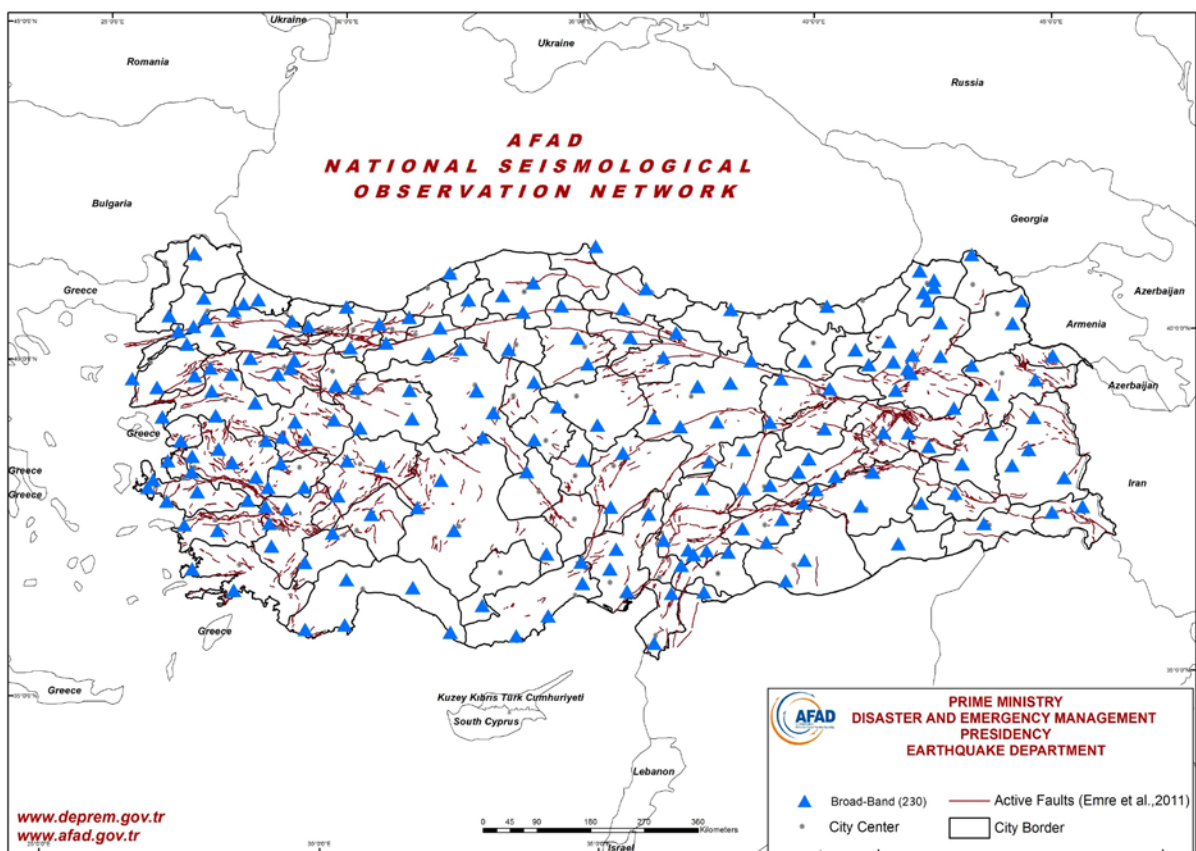


Fig-1. Distribution of the USAG weak motion stations as of March 2015

### Data Communication Type

All of the stations transmit continuously their signal real-time to the Turkey Earthquake Data Center.(via VSAT system from broad-band stations and via leased line from short-period station)

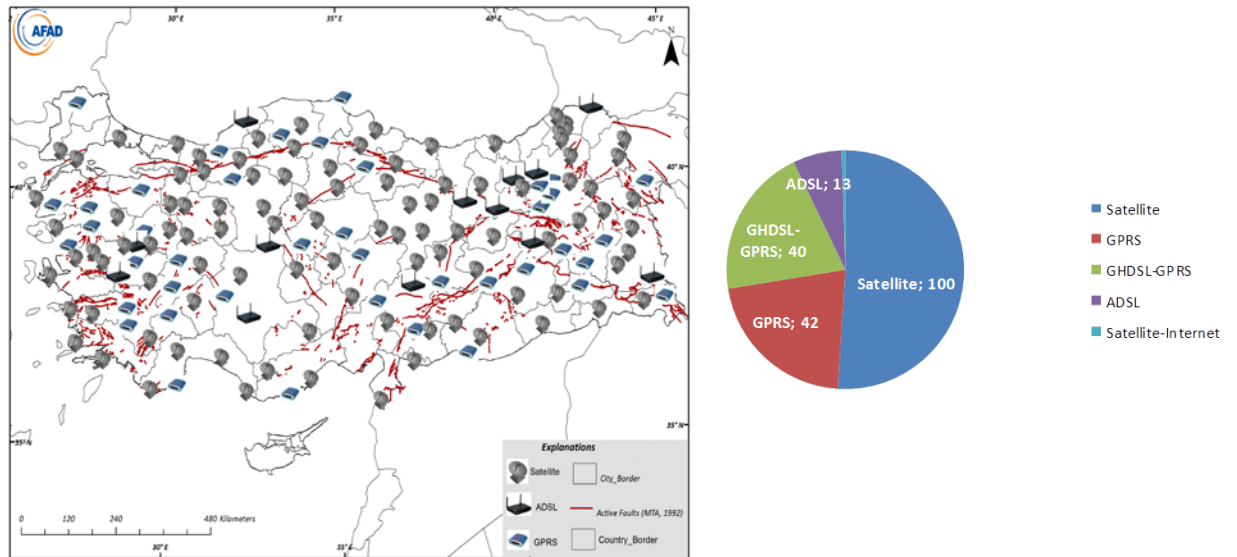


Figure 3: Communication Types of Stations

## SPECIFICATION OF THE SYSTEM

- The data acquisition program by Scream, Seiscomp3 and Seedlink
- Data archive and Data acquisition format GCF and mSEED
- Request methods from Web on TDVM
- Archiving, Scream file System, SDS (Seiscomp Data Structure) for waveform data
- MSSQL for Metadata (bulletin and catalog)
- Earthquake Analysis Program EA , Seisan, Seiscomp3
- Station info for PDCC\_Dataless
- Magnitude Types; MS, mb, Mw, Ml, Md, Ms
- Moment Tensor Solution, Isola-Gui, SEISAN



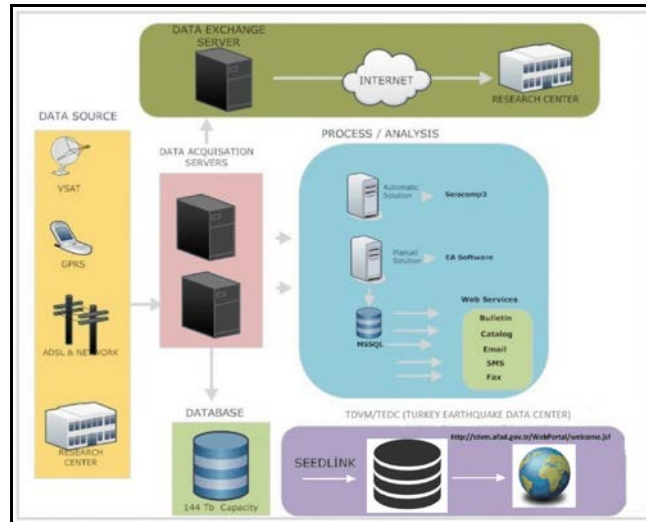


Figure 4: Transformation of Data

## DETERMINATION OF EARTHQUAKE PARAMETERS

Capability of the network is to determine an earthquake which is minimum local magnitude  $ML = 1.0$  generally, the places where the stations are concentrated. In addition to the manual solutions, automatic solutions programs are used for the solutions of earthquake as Seiscomp3. After the earthquake which is magnitude greater than 4.0 focal mechanism solutions are performed according to p wave first motion and moment tensor.

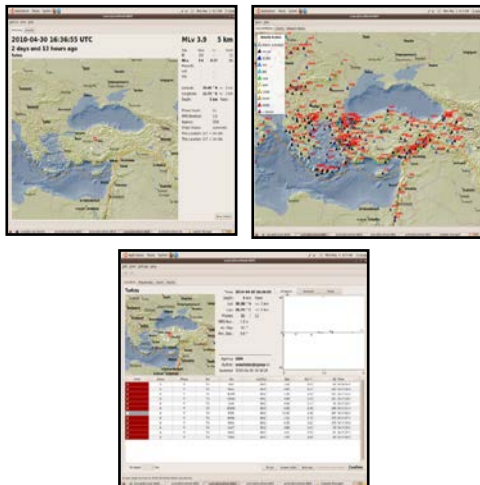


Figure 5: Automatic Solution Seiscomp3

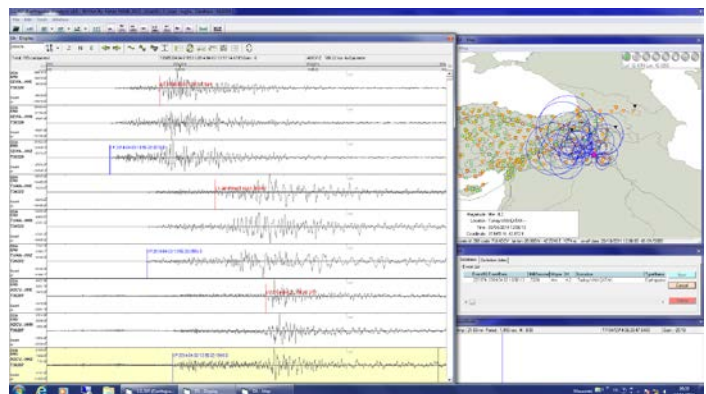
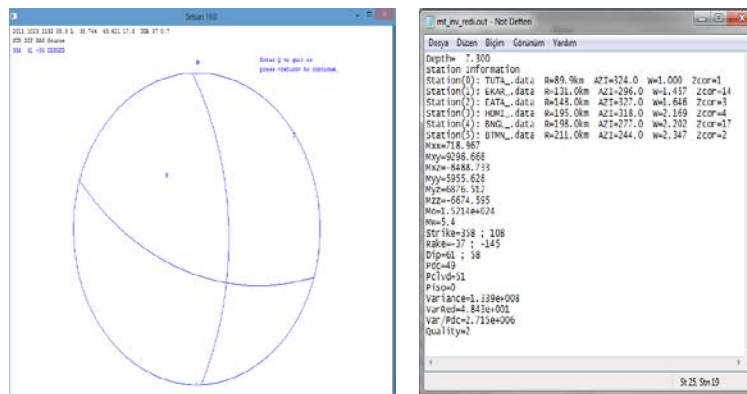
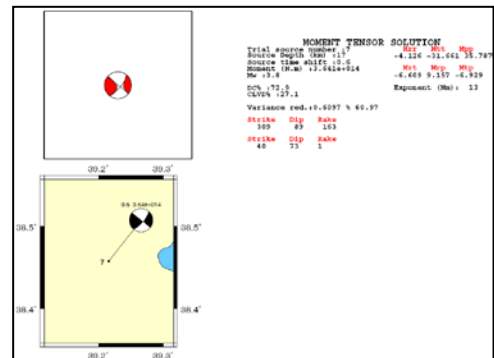
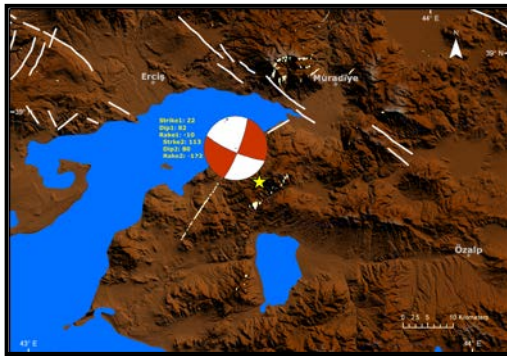


Figure 6: Manual Solution (EA)



## PROJECTS

- AFAD Turkey Earthquake Data Center (AFAD-TDVM)

AFAD, Disaster and Emergency Management Authority initiated AFAD Turkey Earthquake Data Center Project in 2010 with power given by the law and financial support by Ministry of Development. With this project it is aimed to be center where all real-time data recorded (weak and strong motion) at existent station that have been operated by AFAD, another universities and institutions in Turkey is collected, stored, archived and shared with all users. Establishment of the center was performed by AFAD (executive institution) and other relevant universities. Data collect, stored and prepared to share has been performed by TUBITAK-ULAKBIM. Transformation of the data, control, edited and convert to common format and shared with all users has been performed by AFAD. Aforsaid center came into service with Turkish Parliamentary Law No:6525 that was published on official journal 27/02/2014 on the other hand, official launch of the center was performed on April, 23, 2013. Today, 12 different institutions, universities and local authorities have provided their data to TDVM.

- A Deep Geophysical Observatory at the North Anatolian Fault (GONAF) Projesi

The first Borehole Seismometer Project GONAF was started in 2011 with a protocole between AFAD and German Research Center for Geosciences. With this project it is aimed at installing a borehole-based seismometer network at the offshore part of the NAFZ along the Princes Islands segment that includes the transition between the 1999 Izmit rupture and the current seismic gap (GONAF - Geophysical Observatory at the North Anatolian Fault). The principal scientific objective is to study physical processes acting before, during and after the expected  $M > 7$  earthquake along the Princes Islands segment of the North Anatolian Fault Zone (NAFZ) by monitoring microseismic activity at significantly reduced magnitude detection threshold and improved hypocentral resolution. It is also intended to study wave propagation characteristics of a large earthquake using downhole seismic recordings at several different spots along the potential rupture. Within the scope of this project, 8 borehole have been located around the Marmara Sea and first records have been recorded.

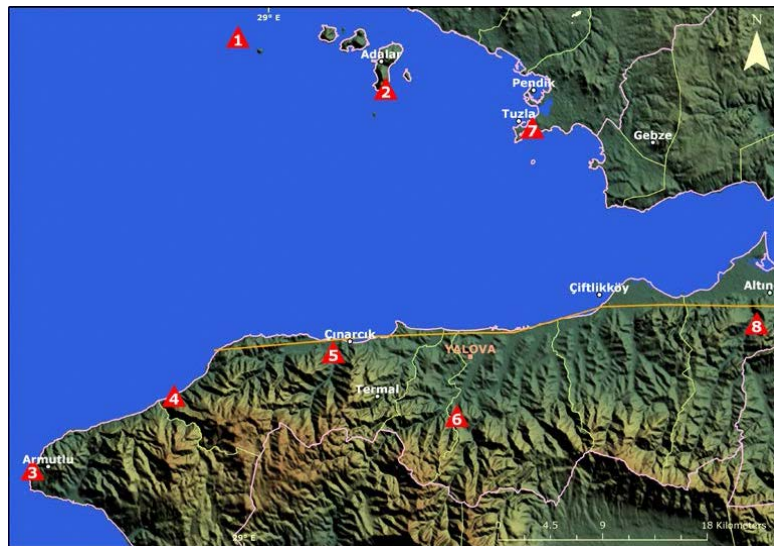


Figure 2: Distribution of the GONAF stations

- Developments, Programing and Calibration of the Mw, Ms and Ml Magnitude Determination Scale for Turkey National Seismic Record Network Project

The project have been performed by AFAD Earthquake Department, Erzurum Atatürk University and Bergen University (Norvey) under the AFAD, Earthquake Department “National Earthquake Research Program”. Aim of the project is by the help of the National Record Network Data, calibration of local magnitude scale for Turkey, determination of average absorption parameters ( $Q_0$ ,  $\alpha$ ,  $\kappa$ ) for whole Turkey and preparation and testing of ML, MS, MB and Mw calculation module to Earthquake Analysis (EA) Program (in addition during the studies Ms and mb



magnitudes were included in the program)

- Seismotectonic Map of Turkey Project

Whitin the scope of NESAP 2023 that was published by AFAD, Seismotectonic Map of Turkey project is launched under the coordination of MTA. One of the work package of this project is “Arrangement of the Instrumental Period Earthquake Catalogue”. Mentioned studies have been performed by AFAD, Earthquake Department National Seismological Observation Network Working Group between 2012 and 2014. Thanks to this work, 12674 earthquakes with magnitude greater than 4.0 between 1900 and 2012 were arranged by the help of the many national and international references for Turkey and Near Surrounding. Publishing of this catalogue will be performed by MTA within 2015 and will be taken into service to scientific community. Besides, mentioned catalogue have been used as a database for the other project which is “Updating of Seismic Hazard Map of Turkey”

- Determination of Data Quality With Analysis of Background Noises in Turkey National Seismic Record Network Project.

Mentioned Project is launched to determine and enhance the seismic data quality which is obtained from National Earthquake Observation Network have been operated by AFAD, Earthquake Department. This project have been performed within the scope of “National Earthquake Research Program” by AFAD, Earthquake Department, Erzurum Atatürk University and Norway Bergen University since 2014.

## **INTERNATIONAL PROJECTS**

- European Plate Observing System (EPOS)

The goal of EPOS is to promote and make possible innovative approaches for a better understanding of the physical processes controlling earthquakes, volcanic eruptions, unrest episodes and tsunamis as well as those driving tectonics and Earth surface dynamics. AFAD, Earthquake Department is involved in this project as a “Beneficiary” and National Seismological Observation Network Working Group will be involved in “Work Package 8: TCS (Thematic Core Services) for Seismology”

## **INTERNATIONAL DATA SHARING PROTOCOLS**

Since the 2011, AFAD Earthquake Department have attempted the sharing of seismic data issues with particularly our neighboring countries and Eastern European Countries. In this context, data sharing protocol is signed with Georgia and Hungary. On the other hand the same procedure is continuing with Serbia. Online data sharing is continuing between the mentioned countries and AFAD-TDVM.

## **ACTIVITIES and MEETINGS IN THE FIELD OF SEISMOLOGY**

Black Sea Earthquake Safety Net(work)-ESNET Project Opening Meeting (19-21 June 2012 Rumania-Bucharest)

Black Sea Earthquake Safety Net(work)-ESNET Project Press Briefing Meeting (12-13 July 2012, İstanbul)

The main duty of this project is to contribute to the prevention of natural disasters generated by earthquakes in Black Sea basin by developing a joint monitoring and intervention concept. In this context, M.Sc. Geophysical Engineer Sami ZÜNBÜL provided participaiton to the mentioned meeting and presented the paper which are “An Overview of Disaster and Emergency Management System of Turkey and National Seismological Network System of Turkey Operated by AFAD-Earthquake Department” and “Seismic Hazard of Turkey”. On the other side interviews were conducted with participants regarding the data sharing issues.

2nd ILP-Liebenberg Workshop: From Microseismicity to Large Earthquakes (26-30 Ağustos 2013, Liebenberg, Berlin, Germany)

To the aforesaid workshop, M.Sc. Geophysical Engineer Recai Feyiz KARTAL and M.Sc. Geological Engineer Filiz Tuba KADİRİOĞLU provided participation and the presentation that is “The Last Developments in the National Seismological Observation Network of Turkey and ongoing Projects 2013” was presented and total 25 researcher were participated to the workshop. After the presentations, current situation of the GONAF project and future plans were discussed with project partners.

Organization of the Black Sea Economic Cooperation, Seismic Risk Experts Meeting (2 June 2014 İstanbul)

To the aforesaid workshop, Geophysical Engineer Meltem Türkoğlu, former Head of Earthquake Department Dr. Murat NURLU, M.Sc. Geological Engineer Kerem KUTERDEM, Bekir Murat TEKİN and M.Sc. Civil Engineer Teoman Selçuk KÖKSAL provided participants and the presentation that is “Rep.Of Turkey Prime Ministry Disaster and Emergency Management Authority –National Seismology Observation Network And Turkey AFAD-Earthquake Data Center” was presented by Meltem Türkoğlu

AFAD-MLIT (Cooperation in Disaster Management Turkey-Japan) Workshop (02-04 July 2014, Ankara)

This workshop was held by AFAD and Japan cooperation in AFAD Ankara as a host institution and in this meeting the presentation which is “AFAD, Turkey Earthquake Data Center” was presented by M.Sc. Geological Engineer Filiz Tuba KADİRİOĞLU

ECEES (2nd European Conferance on Earthquake Engineering and Seismology) (24-29 August 2014, İstanbul)

2nd European Conference on Earthquake Engineering and Seismology was held in İstanbul with the cooperation between AFAD and Turkey Earthquake Foundation on August, 24-29, 2014 in İstanbul. Plenty of seismologists were attended the conference from Turkey and whole world and 13 keynote speaker, 40 thematic lesson, 750 oral presentation and 800 poster presentation were performed by participants. On the other hand, 2nd European Conference on Earthquake Engineering and Seismology, European Earthquake Engineering Community and European Seismological Commission general assembly meetings were held in the same meeting. Deputy Prime Minister Beşir ATALAY and President of AFAD Dr. Fuat OKTAY participated to opening speech session and former Head of Earthquake Department Dr. Murat NURLU attended as a moderator in various sessions. Also, seismic data sharing meetings were held with DPPI-SEE countries and AFAD

Turkish World Engineering and Architecture Association Cooperation Meeting (2-7 September 2014 Kyrgyzstan)

To the aforesaid workshop, Geophysical Engineer Meltem TÜRKOĞLU and Head of Earthquake Department Ulubey ÇEKEN attended the meeting and the presentation which is “AFAD- USAG, Turkey Earthquake Data Center and Collaborations” was presented by Meltem TÜRKOĞLU. In the meeting, draft collaboration protocol distributed to the contributor countries which are Turkmenistan, Kyrgyzstan, Tajikistan, Kazakstan, Russia, Azerbaijan, Hungary, Macedonia

DPPI See (Disaster Preparedness And Prevention Initiative For South Eastern Europe) Disaster Governance and Voluntariness Systems Workshop (08-11 December 2014, İzmir)

The workshop was held in İzmir with participations of DPPI\_SEE Countries and Geophysical Engineers Meltem TÜRKOĞLU and Derya Kökbudak provided participation.

## **PUBLICATIONS (2011-2014)**

### International Article:

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2. Kartal, R. F., Beyhan G., Keskinsezer, A. and Kadirioğlu, F. T., (2014). Seismic hazard analysis of Mersin province, Turkey using probabilistic and statistical methods. Arabian Journal of Geosciences. 7:4443-4459, DOI 10.1007/s12517-013-1104-1.
3. Kartal, R. F., Beyhan G. and Keskinsezer, A., (2014). Seismic hazard analysis of Sinop province, Turkey using probabilistic and statistical methods.

Journal of Earth System Science. 123:565-579, DOI 10.1007/s12040-014-0424-1.

4. Diğdem Acael, Fatih Bulut, Marco Bohnhoff, Recai Kartal, (2014). Coseismic velocity change associated with the 2011 Van earthquake (M7.1): Crustal response to a major event. Geophysical Research Letters. 41:4519-4526, doi:10.1002/2014GL060624.
5. Pasquale De Gori, Aybige Akinci, Franceso Pio Lucente, and Tuğbay Kılıç, Spatial and Temporal Variations of Aftershock Activity of the 23 October 2011 Mw 7.1 Van, Turkey, Earthquake Bulletin of the Seismological Society of America April 2014 104:913-930

#### National Article:

1. Kilic, T., Utkucu, M., A Seismic Moment Tensor Catalogue Comprising years 2007 and 2008 for  $M > 4.0$  Earthquakes in Turkey, Bulletin of the Earth Sciences Application and Research Centre of Hacettepe University, 2012 33(3), 219-238.
2. Kartal, R. F., ve Kadirioğlu, F. T., (2014). 2011-2012 Simav Depremleri ( $M_l=5.7$ ,  $M_l=5.0$ ,  $M_l=5.4$ ) ve Bölgenin Tektonik Yapısı ile İlişkisi. Hacettepe Üniversitesi Yerbilimleri Uygulama ve Araştırma Merkezi Bülteni, 35-3:185-198.

#### International Presentations:

1. Kaplan M., Türkoğlu M., Kılıç T., Zünbül S., Yanık K., Kartal R.F., Kadirioğlu F.T., İde A., Karaağaç D., Demir M. Van Earthquake; Hypo DD and Swift Program Results. European Seismological Commission 33-rd General Assembly, August 19-24, 2012- Moscow –Rusya
2. Kılıç, T., Kadirioğlu, F. T., Kartal, R. F., Zünbül, S., Kaplan, M., Yanık, K., Türkoğlu, M., Demir, M., Karaağaç, D., Özkan, Akdeniz, A., (2012). Seismological Observation Network, ORFEUS Network Coordination Meeting, 12-14 Kasım 2012, İstanbul
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## **(2) THE NATIONAL STRONG MOTION NETWORK OF TURKEY**

The First Strong Motion Observations in Turkey was initiated in 1973 under the Ministry of Republic Works and Settlement General Directorate of Disaster Affairs. But since 2009, it has carried on its activities under the Prime Ministry, Disaster and Emergency Management Presidency Earthquake Department.

The aim of the Network has the primary responsibility for recording each damaging earthquake in the Turkey on the ground and structures in active fault zone and densely urbanized areas to improve public earthquake safety. The TR-KYH maintains national network, data center, and a supporting strong-motion data analyses and research center in support of this responsibility. In addition, fundamental for earthquake engineering studies such as advanced structural analyses, seismic hazard evaluation, site effects and calibration of ground motion attenuation relationships.

Initially, the network was initiated its activity with 67 accelerometers. The first strong ground motion recording was recorded in 1976. Once, all stations were analog in accordance with the existing technology, but today, data have been reached to real time and high quality level due to developing technology and increasing number of stations year by year. At the end of 2011, it is aimed to have 450 stations in the network. Furthermore, total station number will be 1000 in the network until 2023.

The accelerometers are mostly installed on the North Anatolian Fault Zone (NAFZ), East Anatolian Fault Zone (EAFZ) and Aegean Graben System, where the big earthquakes occurred or the expected active areas. Currently, there are 3 different models and total number of 546 digital accelerometers (Figure1,2).

Since the establishment of the Network, acceleration data of earthquake, which is occurred in Turkey are collected, stored and always updated. To date, KYH was recorded more than 5000 earthquakes' acceleration records that are presented through Internet (<http://kyh.deprem.gov.tr>) to all researchers and scientific areas.



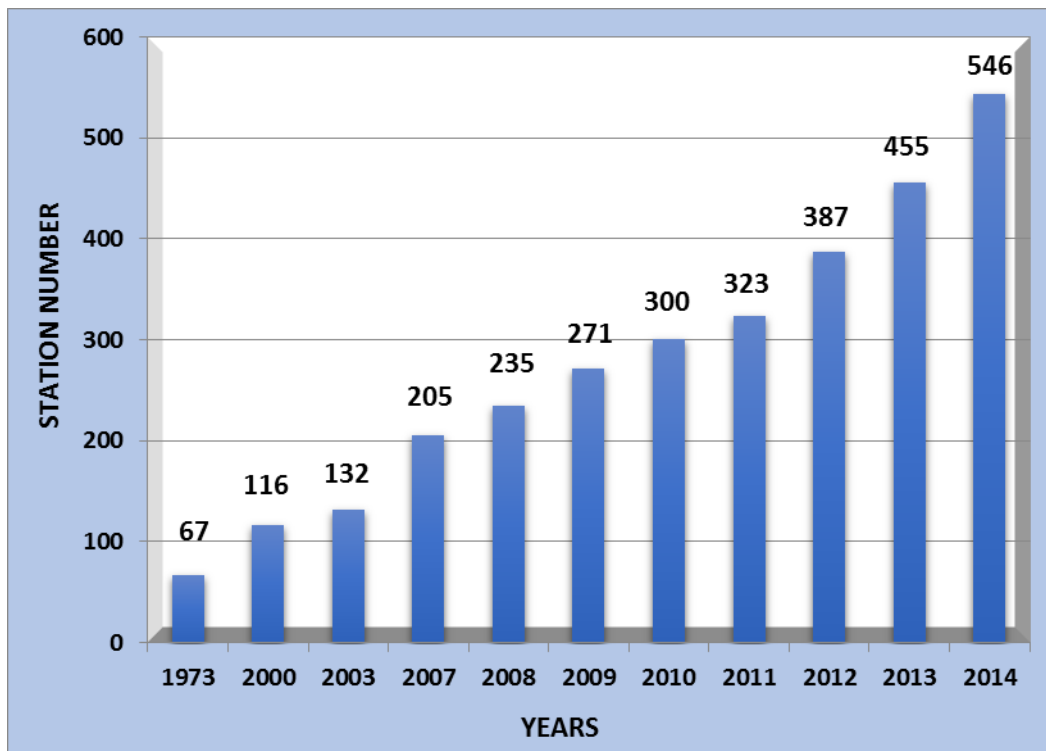


Figure 1. Number of the stations by years.

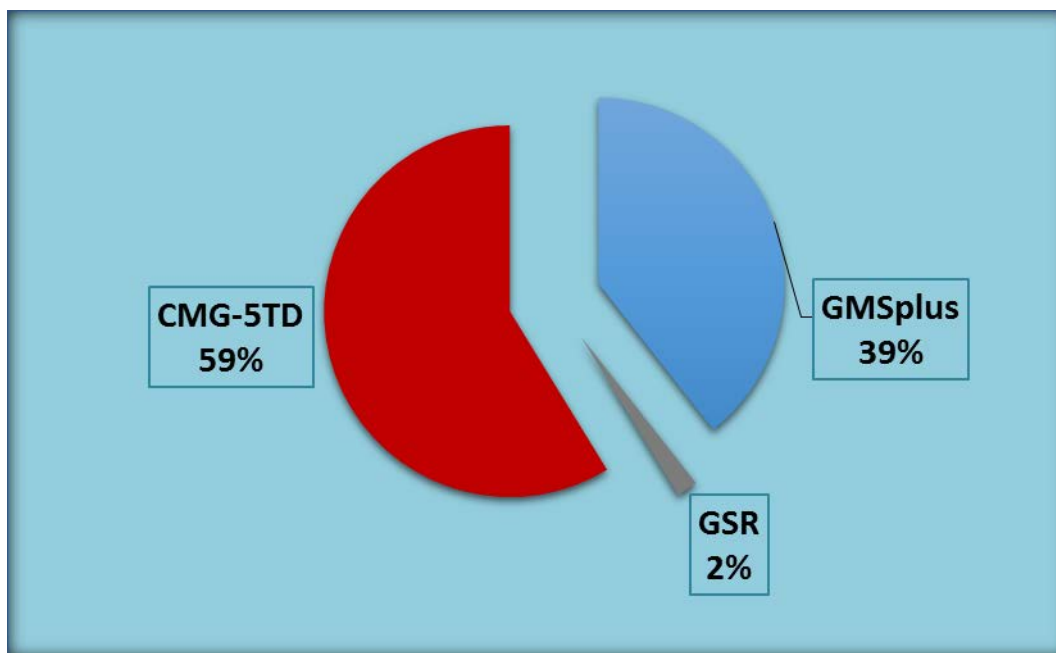
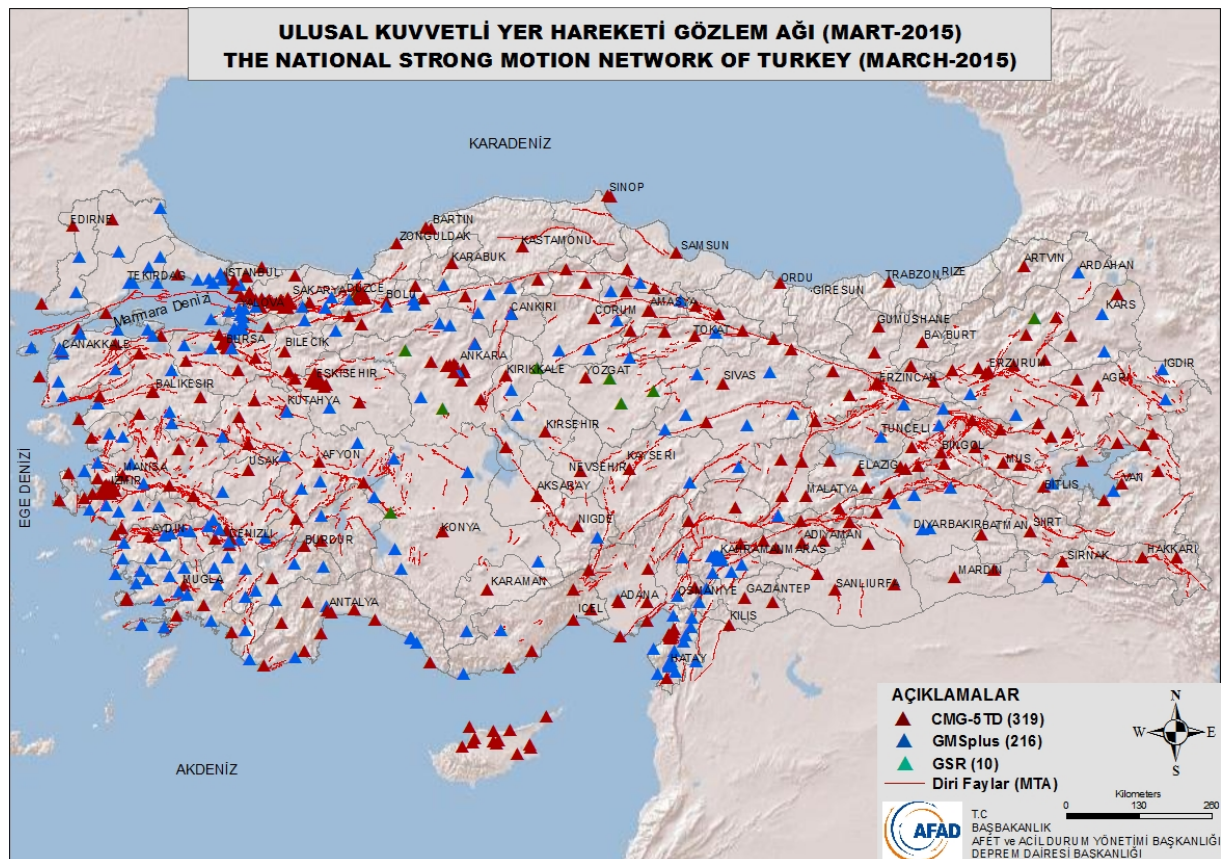


Figure 2. Type of Accelerometers.



## LOCAL NETWORKS

Local networks have also been operated within the framework of the different projects or cooperation. These are deployed with specific geometrical arrays on active fault systems in order to observe seismic activity closely. The aim of this local Networks is to determine physics of the fracture, the distribution of destructive waves, earthquake and site-building relation in urban and regional scale, secure zones for secure buildings, spectral characteristic of the earthquake and develop more reliable attenuation relationships.

In time, all local networks have been enhanced in terms of number and instrument quality. At present, with different regions and arrays, 11 local networks have been operated under the TR-NSMN (Table1 and Figure 4).

Table 1. List of the Local Networks.

N	LOCAL NETWORKS	PROVINCE	STATION NUMBER	COOPERATION
1	BYT-NET	Bursa-Yalova	27	AFAD-Bursa Osmangazi Belediyesi
2	MAT-NET	K.Maraş-Hatay-G.Antep-Osmaniye-Kilis	55	AFAD
3	DAT-NET	Denizli-Aydın	18	AFAD
4	DUZ-NET	Düzce	8	Düzce Belediyesi-AFAD
5	KOC-NET	Kocaeli	25	Kocaeli Belediyesi-AFAD
6	ANT-NET	Antalya	14	Antalya Valiliği-AFAD
7	ANA-NET	Eskişehir	15	Anadolu Ün.-AFAD
8	IZMIR-NET	İzmir	32	Dokuz Eylül Ün.-AFAD
9	ISK-NET	İskenderun	10	İskenderun Belediyesi-AFAD
10	KKTC-NET	Cyprus	10	Cyprus METU-AFAD
11	ANK-NET	Ankara	19	Gazi Ün.-AFAD

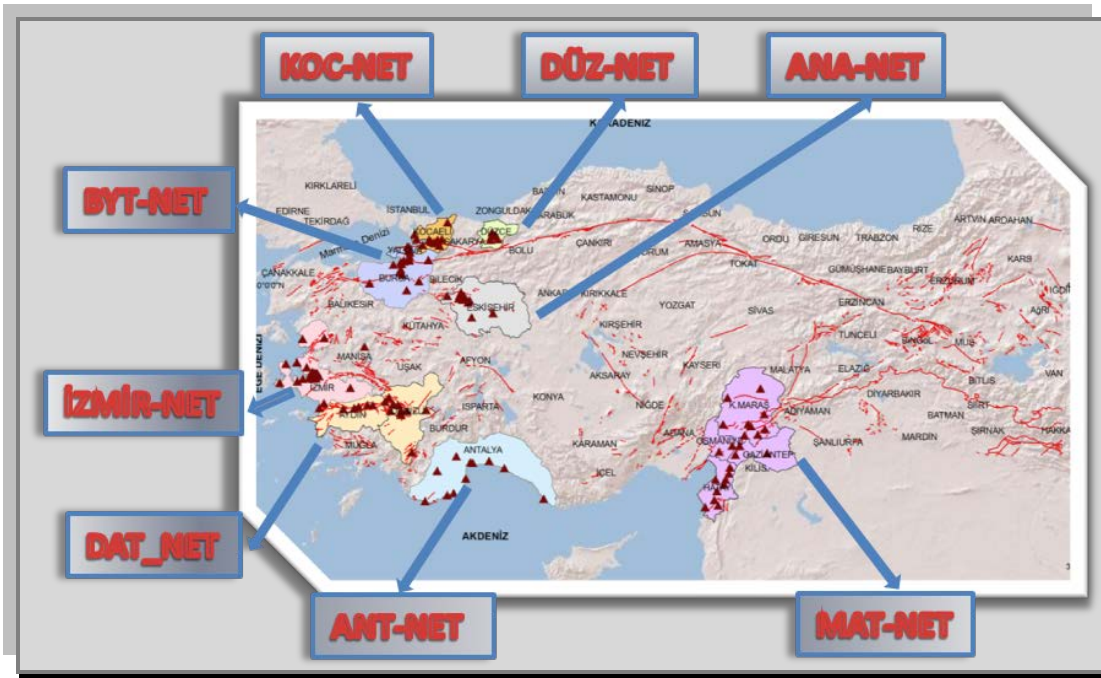


Figure 4. General Appearance of the Local Networks.

Apart from local networks, within the framework of the AFAD RED Project (Rapid Loss Estimation Project), designed for estimation of probable damage and losses after the earthquake immediately, 20 accelerometers were installed both K.Maraş and Hatay provinces in 2013. Similarly, 20 accelerometers have been deployed in south-west part of the Turkey covering Muğla, Denizli, Burdur, Aydın and Antalya in 2014. With a specific purpose, scope of the project will be extended and implemented at the various regions in the next years as well.

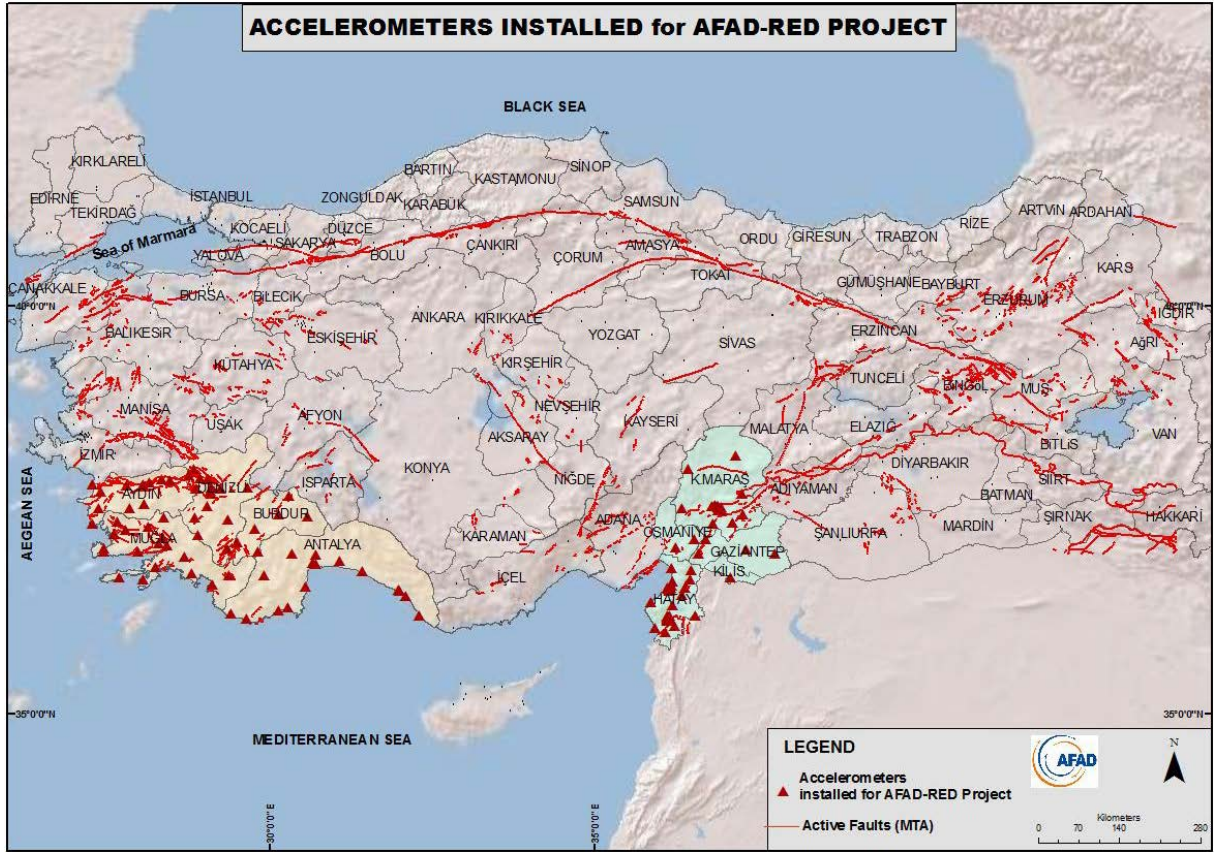


Figure 5. General appearance of the accelerometers installed for AFAD RED project.

## THE ACCELEROMETER STATIONS

Accelerometers are installed as free-field in the special constructed containers (Figure 6).

For site selection of stations, first of all the active tectonic lines of our country and the intensity of building for different geological structures, energy, communication, security, environmental noise, transportation etc. are considered.





Figure 6. Internal and External Appearance of a TR-NSMN Station.

Infrastructure of the stations is built according to a specific plan as seen in the figure 7.

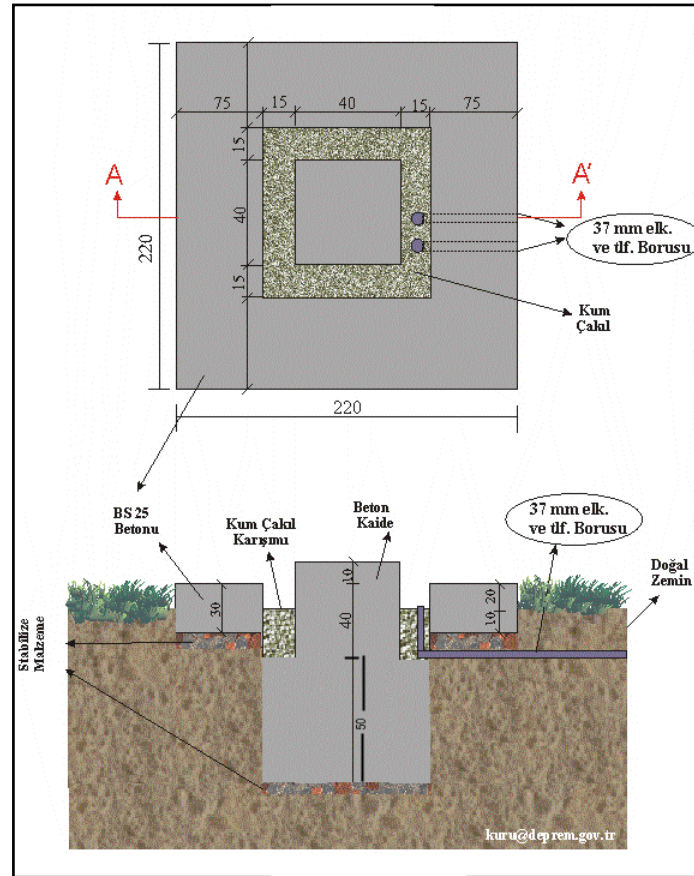


Figure 7. Infrastructure of the TR-KYH Station.

The data coming from field are transmitted to the data center by means of Dial-Up, ADSL, GPRS and Satellite. Most of them are GPRS (EDGE).

## SITE INVESTIGATION OF THE STATIONS

Local site conditions of stations have been carried out by in-situ geotechnical and geophysical surveys. The average of shear-wave velocity for upper 30m soil layer (VS30) is obtained at the each strong-motion site thanks to multi-channel analysis of surface waves (MASW), which is used for definition of soil classification. On the web page, VS30 values are available in the station information form through which related researchers are able to access to it by using search engine. (Figure 8).

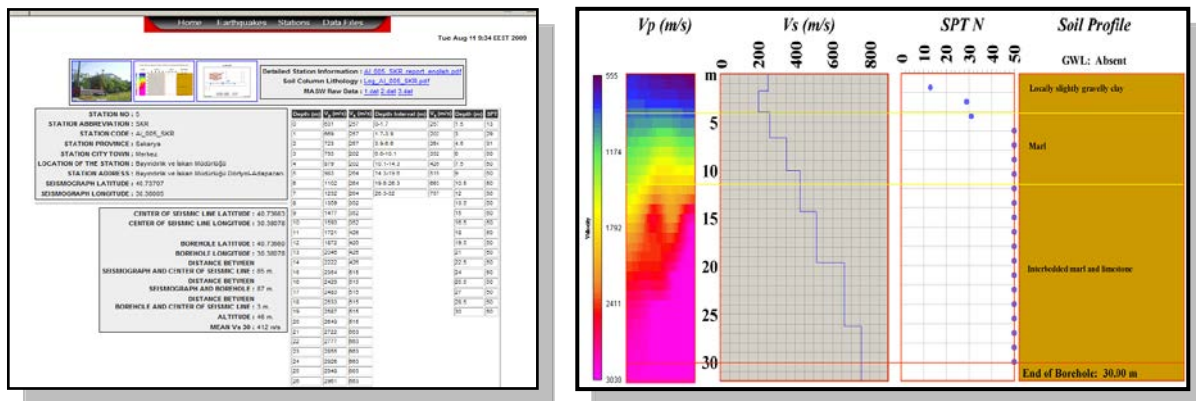


Figure 8. Site Profile and Site Information Form of a Stations.

## DATA FORMAT

Since the establishment of TR-NSMN data center (1973), it is possible to access to all accelerograms.

File names are generated and saved as in this example:

Date(yyyymmdd)+time(hhmmss)+abbreviation of the station (1201)(ex.20030501002704\_1201).

All records are created as ASCII format as seen in figure 9. Beneath the header information there are three components of acceleration data like; N-S(North-South), E-W(East-West) and U-D(Up-Down). Besides, sample interval value for each record can be found in the header information.

There isn't any process implemented on acceleration data, except for base-line correction, in the other words, records on the web page are entirely raw data and unit of PGA values is  $\text{cm}/\text{sn}^2$  (gal).

```

STRONG GROUND MOTION RECORDS OF TURKIYE
PLACE : DENIZLI MERKEZ METEOROLOJİ MUDURLUGU
EARTHQUAKE DATE : 19/08/1976 01:12:39 (GMT)
EPICENTER COORDINATES : 37.71000N-29.00000E
EARTHQUAKE DEPTH (km) : 20
EARTHQUAKE MAGNITUDE : 5.0ML
STATION ID : 2001
STATION COORDINATES : 37.76219N-29.09222E
STATION ALTITUDE (m) : 427
RECORDER TYPE : SMA-1
RECORDER SERIAL NO : 986
RECORD TIME : 19/08/1976 01:12:40 (GMT)
NUMBER OF DATA : 1601
SAMPLING INTERVAL (sec) : 0.01000000
RAW PGA VALUES (gal) : (N-S) 348.5268 (E-W) 290.3560 (U-D) 173.2901
Copyright EARTHQUAKE RESEARCH DEPARTMENT
GENERAL DIRECTORATE OF DISASTER AFFAIRS
      N-S      E-W      U-D
-13.107400  -47.950600  -18.514590
-13.104980  -47.952520  -27.176980
-12.865700  -46.140580  -22.777830
-11.157570  -41.740460   6.933893
    ...      ...      ...
    ...      ...      ...

```

Figure 9. Data Format (ASCII)

In accordance with increasing number of the stations, records have also considerably soared. As of beginning of the 2015, 15.000 records, belonging to 5000 earthquake, are submitted to the users.

## PROJECTS

**Enhancement of the National Strong Motion Network and Establishing Seismic Arrays in Turkey**  
(Nato Science For Peace Program – Sfp977484)

**“BYTNet and DATNet”**

**Establishment of Local Strong Motion Seismic Array**

**“MATNet”**

(TÜBİTAK İÇTAG-1578/YMAÜ )

**Establishment of Local Strong Motion Seismic Array**

**“AnaNet”**

(Project Number: 040302)

**Compilation of The National Strong Motion Network Database According to International Standart**

(TUBİTAK Project Number :105G016)



<a href="#"><u>Shake Map Implamantation</u></a>
<a href="#"><u>UDAP Project (Ongoing Project)</u></a>
<a href="#"><u>Site Invastigation of The Stations</u></a>
<a href="#"><u>UDAP Project (Submitted)</u></a>

## WEB PAGE AND DATA COMMUNICATION

TR-NSMN's web address is <http://kyh.deprem.gov.tr>. In this web page, daily strong motion records, earthquake reports (M □4), station characteristics and photographs from external and internal, and maps are available and also always up to date. By using search engine users can easily provide the station or earthquake information and also download the Raw Data. Detailed Special Reports including significant strong motion parameters are also published after the destructive earthquake occurred.

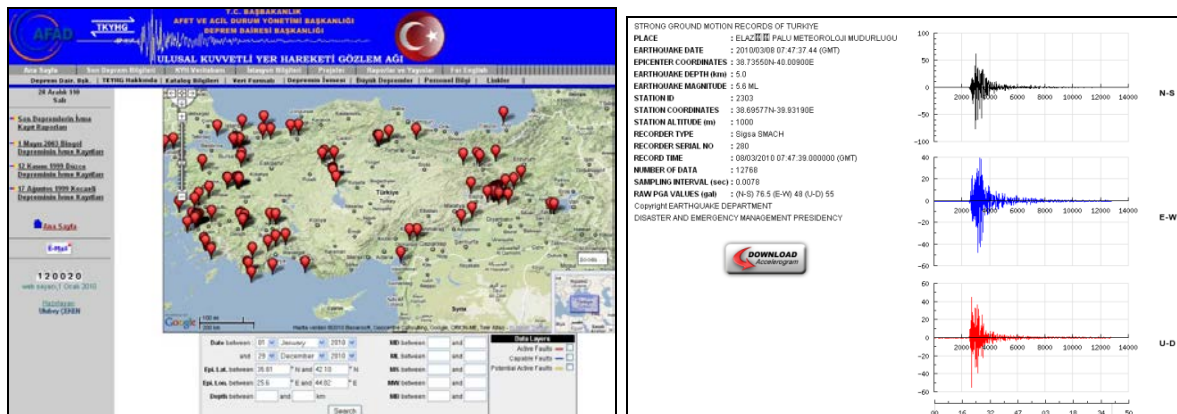


Figure 9. Web Page of TR-KYH.

## OUTSTANDING FEATURES ABOUT TR-NSMN:

- ✓ Responsible for “National-Wide Scale” observation.
- ✓ At the same time supply data to the AFAD-TDVM as continuous mode.
- ✓ Not only one of the greatest acceleration data provider in the Europe and Middle East, but also one of the greatest in the world.
- ✓ All acc. are new generation and digital.
- ✓ All acc. have triaxial force balance sensor.
- ✓ All acc. provide real-time information.
- ✓ All acc. transmit data as continuous mode.

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### **(3) EARTHQUAKE INFORMATION SYSTEMS**

Within the scope of working of the Earthquake Information Systems, AFAD-RED Project and AFAD-Earthquake Application for Smart Phone are performed.

#### **AFAD-RED IMPLEMENTATION**

AFAD-RED is an application software in furtherance of immediate and efficient response right after a major earthquake. The process of the software is composed of accumulating real time seismic data from two network called officially as National Seismological Monitoring Network of Turkey and National Strong Motion Network of Turkey – where they are located at AFAD Department of Earthquake - and creating shaking maps afterwards in parallel with this creating intensity maps and earthquake losses maps.

The real time online data from National Seismological Monitoring Network of Turkey that integrated into AFAD-RED are source parameters such as magnitude and epicenter, hypocenter coordinate of the earthquakes. These data are analysed by

engineers while an earthquake occurs with the informations coming from 230 seismic station on all over Turkey.

After the source parameters have been added into AFAD-RED, second data are integrated into the program as in Peak Ground Acceleration (PGA), Peak Ground Velocity (PGV), Spectral Displacements (SD) which they are known as engineering parameters and provided by strong motion network that there are 545 accelerometer stations in Turkey.

In paralel with these session ; B/C Soil level's shaking parameters are computed by removing the soil effects so that the shaking parameters of the areas around of the earthquake epicenter will be estimated. Afterwards recorded data with these estimated parameters are integrated based on the radial distance between the record locations, earthquake epicenter and fault locations. Then the soil amplification is applied and intensity maps are created. The total process of estimating shake map parameters is given at Figure 1.

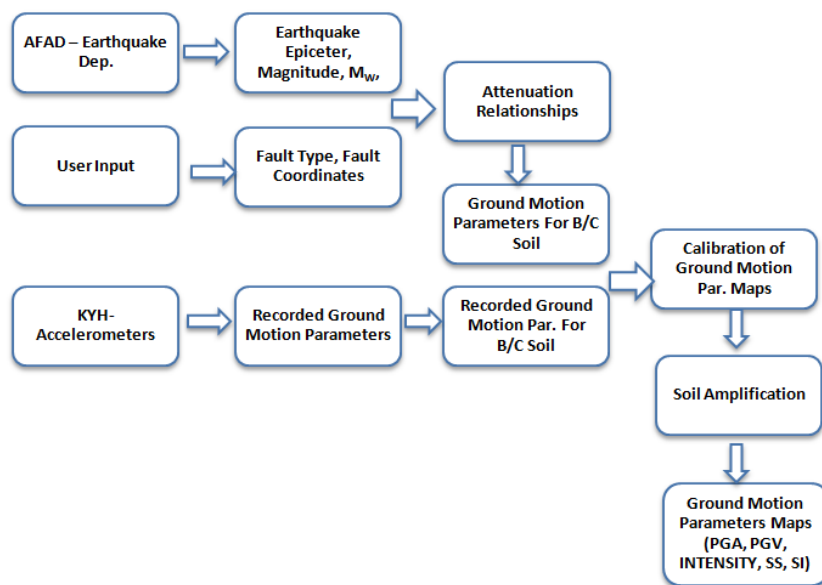


Figure 1 : Estimation of shake map parameters.

The shake maps are used as the basis for the automatic preparation of building damage and fatality loses maps. The generation of rapid loss information is based on both spectral displacements and instrumental intensities. These methodologies are coded into online computer program. Both of spectral displacements and instrumental intensities essentially rely on the building inventory database, fragility curves and the methodology developments.

Using the estimated shake maps of response spectra and the instrumental intensities the building damage and the casualties are computed separately by using the spectral-displacement based and intensity based fragility curves. The computations are conducted at the centers of user defined grid system comprised of geo-cells. The building inventories for each geocell together with their spectral displacement and intensity based fragility curves are incorporated in the software. The casualties are estimated on the basis of the number of collapsed buildings and degree of damage. The total process of AFAD Red is given in the figure 2.

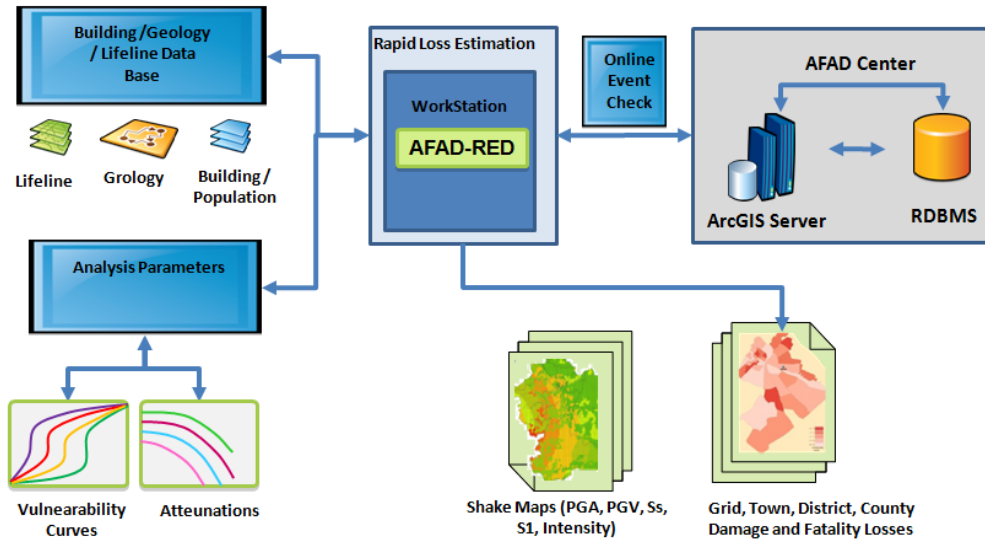


Figure 2 : AFAD RED System for shake maps and earthquake damage estimation

Features of Software; AFAD RED system is developed for all Turkey where the country districts have different population density, life culture, tectonics and earthquake potential to estimate the losses in disaster area as nearly in real time after a major earthquake.

AFAD RED is user friendly software that has simple interface and online monitoring for the weak motion and strong motion systems in AFAD (Figure 3). The software is working in both online and offline modes and can be able to automatically generated shake and risk maps. AFAD RED system is developed under VB-Net and C# environments for the system design and the Arc-Object is used for mapping and geographic information system. Different attenuation relationships can be used as a weighted average and the calculation of structural damage for different building types, the fragility curves can be used simultaneously for both intensity and spectral-based. The casualties loss can be estimated based on both intensity and damage level of buildings. AFAD-RED system can also be utilized to run earthquake scenarios for the risk assessment due to a scenario earthquake. The output of risk assessment analysis is used for planning and execution of the management and mitigation of the seismic disaster and damage within the study area.

Example of intensity map that results for earthquake combining the estimated and recorded strong motion parameters data is provided in Figure 4.

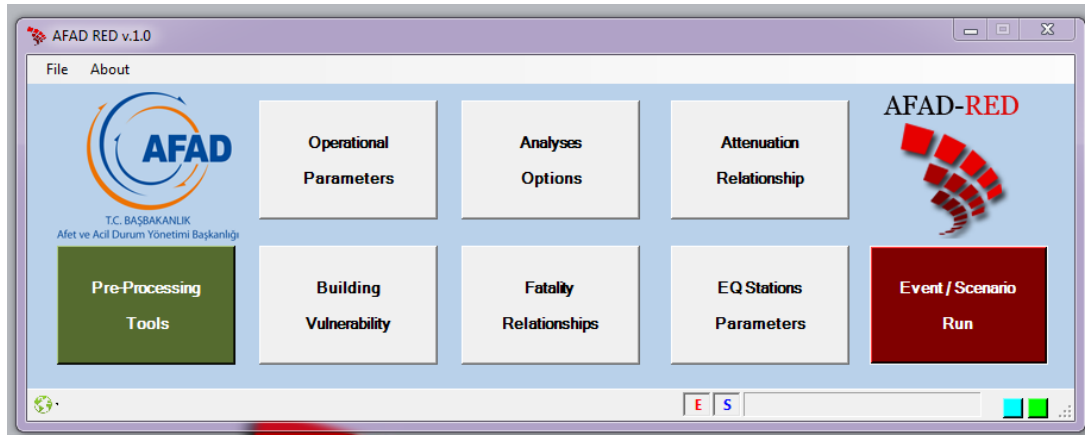


Figure 3 : User Interface of AFAD-RED Program

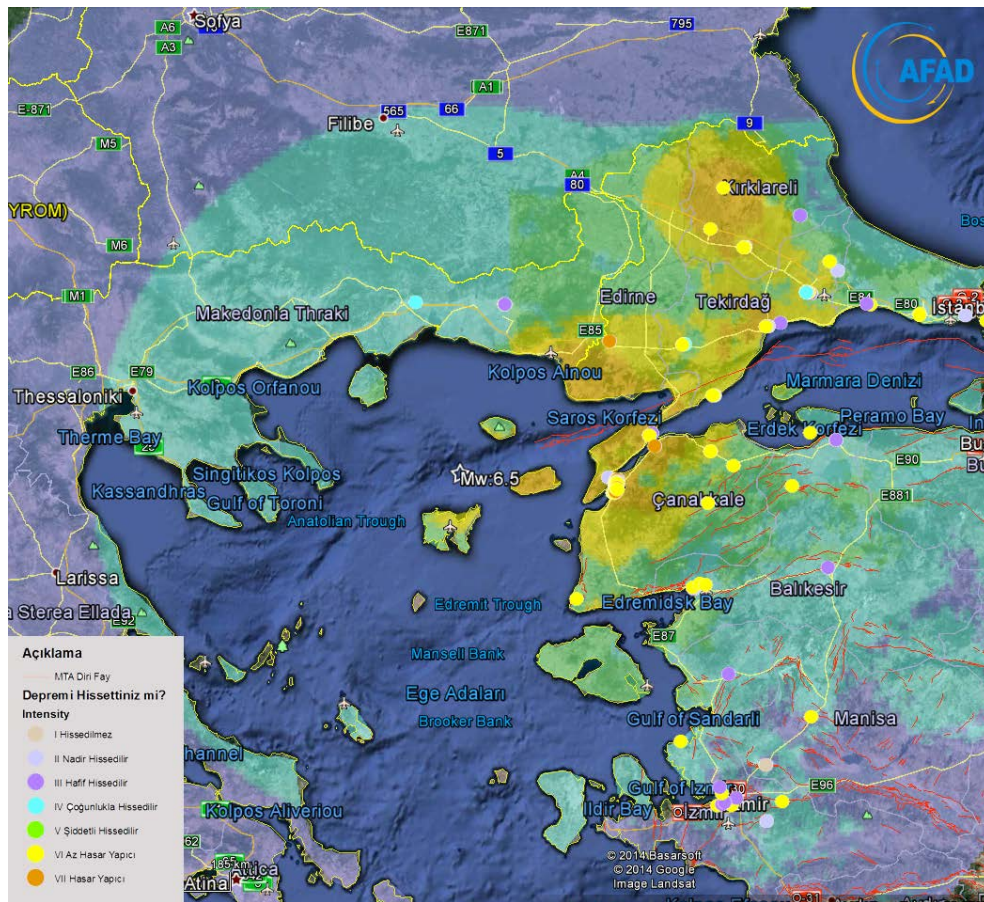


Figure 4. Simulated intensity map of real earthquake

## AFAD-EARTHQUAKE SMART PHONE APPLICATION



AFAD-Deprem program is designed for IOS and Android operating systems users on phones with the purpose of providing quick and reliable estimation of occurred earthquake intensities around Turkey with the data provided by the real experience of the users who felt the earthquake. The felt-intensity estimation algorithm is designed based on kind of simple questionnaire that can be answered easily by the these users. Right after the occurrence of the earthquake, AFAD-Deprem application will sent the users notifications of the event and allows the users in the vicinity of the earthquake area to answer questionnaire to estimate intensity and send the answer with an option to send buildings damage photos to the main server. The application in the main server will analyze the information sent by the users, verify them, and then map them together with the estimated intensity of the earthquake. AFAD-Deprem Mobile Application enhances utilizing the modern technologies in rapid response after the earthquake; in addition, it will motivate the active participation of the citizens of the post-earthquake intervention studies.

AFAD-DEPREM is a free application for IOS and Android operating systems users that send the users a notifications of earthquakes, its magnitude and location on a Google Map based on the earthquake parameters obtained from Earthquake Observation Stations that operated by AFAD Department of Earthquake (Figure 1). Users can receive information optionally via audible warning and a written notification for the selected earthquake magnitude and location ranges (Figure 2). The application also provides information about historical earthquakes and seismic hazard maps. In addition, the application has special sections devoted for children (Figure 1).

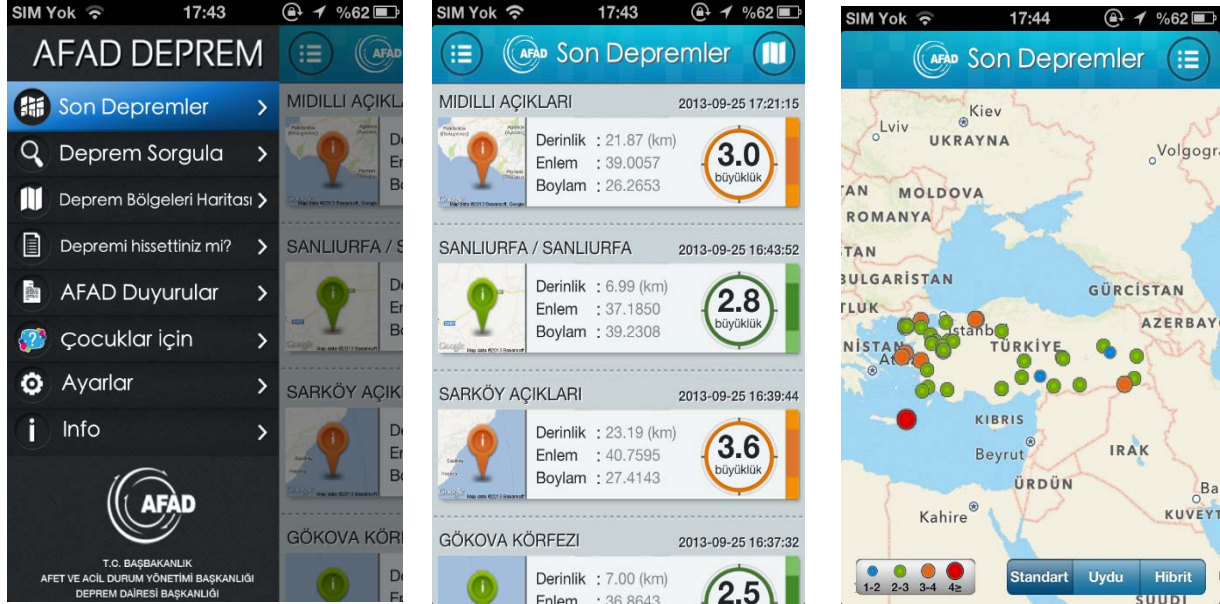


Figure 1: AFAD-DEPREM notifications for users

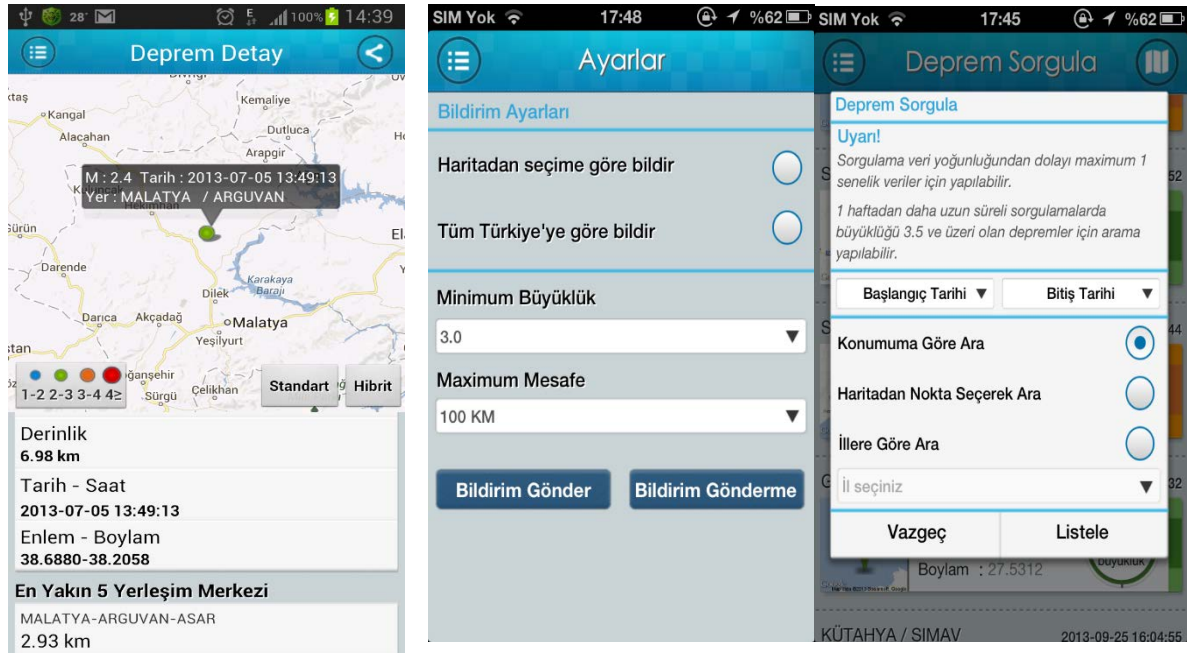


Figure 2: Screen shots of AFAD-Deprem application

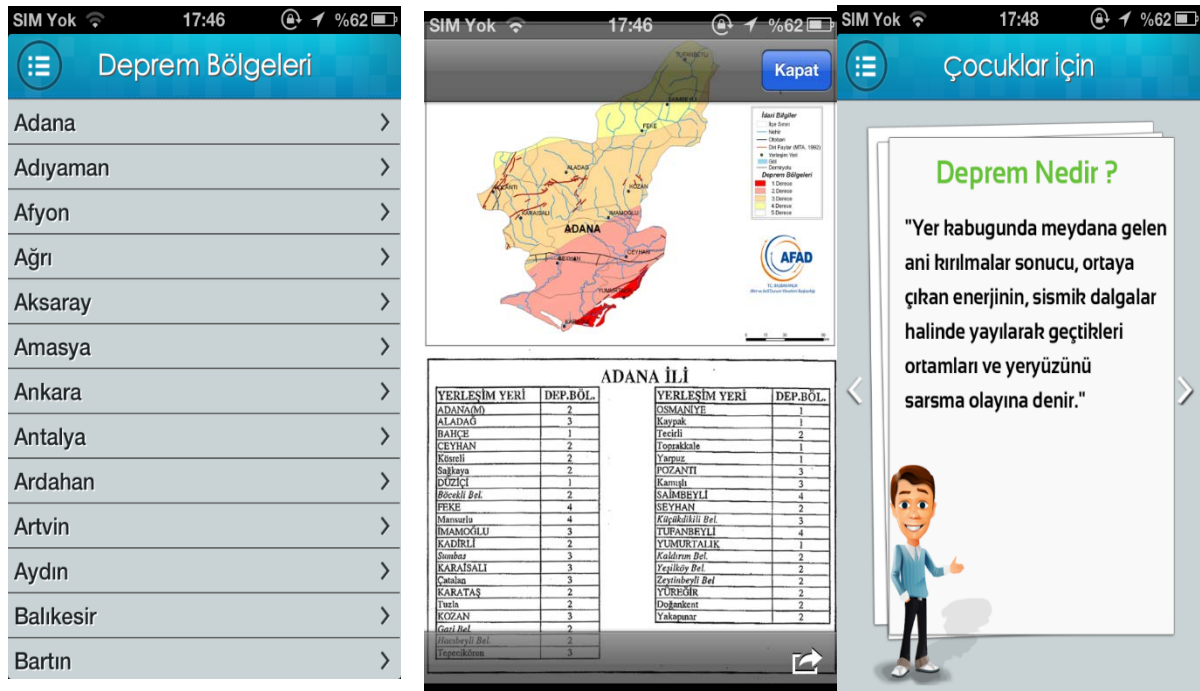


Figure 3: Special sections devoted for children in AFAD-Deprem application

"Did you feel the earthquake?" Section is a part of "AFAD-Deprem" application and activated after the occurrence of earthquake to collect data about the felt intensity of the earthquake from the rapidly growing mobile users and to motivate them for active role of the post-earthquake intervention studies. This section is based on "Mercalli Intensity scale" and felt-intensity is estimated for each



user using self-adoptive questionnaire that can be answered easily by the users who felt the earthquake. The applications is activated after the earthquake of magnitude  $M \geq 4.5$  also activated in response to demand from the survey, optionally for  $M \geq 4.0$  earthquakes within a certain epictral distance limit depending on the earthquake magnitude. The application in the main server will process the information sent by the users, verify them, and then map them together with the estimated intensity of the earthquake as shown in Figure 4.

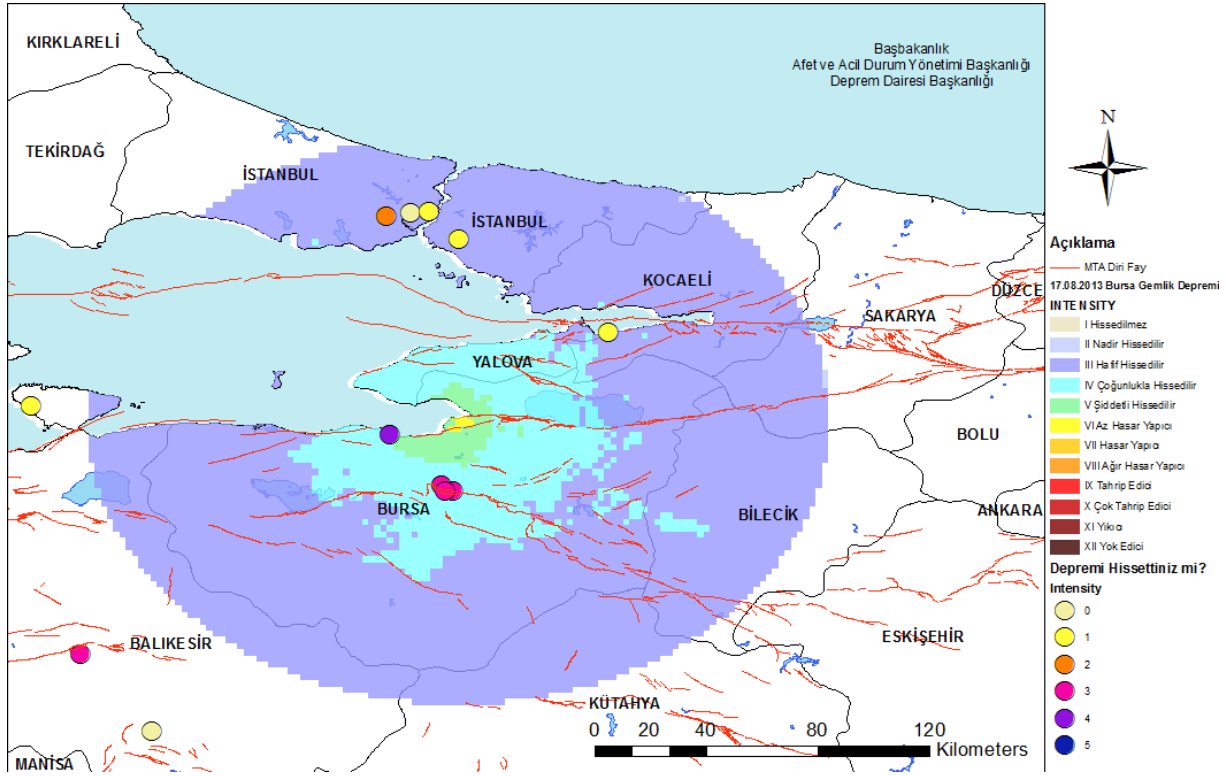


Figure 4: Estimated Intensity map for 17.08.2013 Bursa –Gemlik M:4.5 Earthquake

In addition, users who had the survey add their own personal experience, thoughts and estimation of the felt earthquake. Some of these comments and personal experiences of the Aegean Sea earthquake in May 24, 2014 are listed in Table 1.

Table 1 : . A few of The 24.05.2014 Mw:6.5 Gökçeada Earthquake ( Aegean Sea) questionnaire results.

RecordID	EventID	UserLat	UserLon	UserComment	Intensity
1226	20140524092502.50	38.4008	27.1049	40 seconds shaking	3
1235	20140524092502.50	41.0757	28.2546	It starts weak vibrations; It increased at the 10th sec. At this point, I estimate the intensity to be 6.5. I did not feel the aftershocks.	6
1248	20140524092502.50	41.158	27.7965	Çorlu was shaking almost like cradle at12:25	6
1289	20140524092502.50	40.1456	26.4206	It was very bad earthquake. At that moment I was at university canteen and I got difficulty to stand in balance.	7
1292	20140524092502.50	40.6111	27.1186	After 9 min of 4.8 magnitude earthquake, there was earthquake with magnitude 4.5. It was not felt by all people.	2
1315	20140524092502.50	41.1201	25.6337	We were shaking very bad, location Greece	6
1316	20140524092502.50	41.1201	25.6337	We were shaking very bad, location Greece	6
1328	20140524092502.50	40.2302	27.2418	I am 35 old, until now I never felt so clear and so long earthquake.	6
1331	20140524092502.50	40.1476	26.4125	It will be bad earthquake, Çanakkale starts to shake	6
1281	20140524092502.50	39.6665	27.8844	Slight, chandelier was shaking slightly	3
1244	20140524092502.50	40.3955	27.7919	At the 7th floor of Erdek State Hospital. We felt it very strong at the dining hall. I thought that I may die	6
1257	20140524092502.50	40.1684	26.3875	I felt the earthquake at the basement. Within 10 sec I was outside. I felt the ground slide beneath my feet and I saw the cars and buildings were shaking	6
1271	20140524092502.50	40.3448	26.6873	It felts stronger at Lapseki county. The effect of the earthquake was high. It created a lot of fear.	7
1234	20140524092502.50	39.571	26.9415	I am 13 years old. It was my biggest earthquake. Me and my mother and father were afraid. My father advised us to be calm. We went out after the earthquake.	3
1278	20140524092502.50	39.5752	26.9442	I felt slight and short vibrations. I was lying. Even thought I did not looked at the lamps, I do not think that there were shaken. Yesterday's 6.5 was terrific. It was the biggest earthquake I had felt since 1999 earthquake. At the 1999 earthquake, I was at Susurluk. Now I am at Edremit/Ak	2
1317	20140524092502.50	40.1325	26.4062	Suddenly I heard loud vibration noises. I thought that the building may collapse.	7

## **PUBLICATIONS**

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- Fahjan, Y. Eravcı, B. Baykal, M. Yanık, K. Yenilmez, G. Yalçın, D. (2014). Rapid Information And Intensity Estimation After Earthquake In Turkey Using Smart-Phones. Second European Conference on Engineering and Seismology (24-29 August 2014). İstanbul.
- Nurlu, M. Fahjan, Y. Eravcı, B. Baykal, M. Yenilmez, G. Yalçın, D. Yanık, K. F. Kara, İ. Pakdamar, F. Rapid Estimation of Earthquake Losses in Turkey Using Afad-RED System. Second European Conference on Engineering and Seismology (24-29 August 2014). İstanbul.

**b. BOĞAZIÇI UNIVERSITY KANDILLI OBSERVATORY AND EARTHQUAKE RESEARCH INSTITUTE (KOERI), ISTANBUL**

<http://www.koeri.boun.edu.tr>



KOERI, established in 1868 as the Imperial Observatory, has a long tradition of earth observation and science. From 1868 to today, the development of the Observatory and the researches conducted can be summarized into three important periods: 1868-1909-1911-1982, and from 1982 to the present: an Academic Institute. After annexed to Boğaziçi University and given an institutional academic status, Kandilli Observatory and Earthquake Research Institute (KOERI) extended its activities into various observational fields with the main emphasis oriented towards earthquake research, education and relevant observational service activities. KOERI today has evolved into a multidisciplinary earthquake research organization providing graduate education in three departments namely Earthquake Engineering, Geodesy, and Geophysics. KOERI is a unique organization in Turkey encompassing earthquake observation, research, education and application services within a single, integrated body. Besides this, the Astronomy, Meteorology and Magnetism observatories have been updated with state of art technology.

**KOERI Regional Earthquake and Tsunami Monitoring Center**

KOERI's Regional Earthquake and Tsunami Monitoring Center (RETMC) is 24/7 operational center comprising 135 Broadband (BB) and 83 Strong Motion sensors at the national level. KOERI also operates 5 sea-floor multi-instrument observation systems in the Sea of Marmara and is the National Tsunami Warning Centre for Turkey under the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and connected seas (ICG/NEAMTWS) initiative. KOERI officially declared its Interim Candidate Tsunami Service Provider Status covering Eastern

Mediterranean, Aegean, Marmara and Black Seas as of 1 July 2012 to the ICG/NEAMTWS Secretariat in June 2012.

Turkey, as a country with a history of devastating earthquakes and with a coastline of 8333 km, has been also affected by more than 100 tsunamis during the observation period over 3500 years. A possible tsunami today affecting the coastal areas of Turkey may cause considerable damage, especially considering the densely populated coastal areas, infrastructure and harbours. Coastal cities cover less than 5% of the total surface area of Turkey, but they have over 30 million inhabitants and are growing rapidly. The Marmara region around Istanbul has the highest population density of all regions. At the same time, more than 60% of the Turkish Gross National Product (GNP) is produced in the coastal strip along the northern shoreline of the Marmara Sea. Continued urbanization and tourist development will further increase exposure to tsunami hazard. Currently, the consequences of a possible tsunami are ignored in coastal management, and although strengthening of coastal management mechanisms is required for a number of reasons, tsunami hazard should be considered an important long-term issue. The determination of inundation limits for a range of credible tsunami scenarios at the coastal areas is of high importance in order to assess vulnerability and develop, coastal protection, land-use planning and evacuation plans.

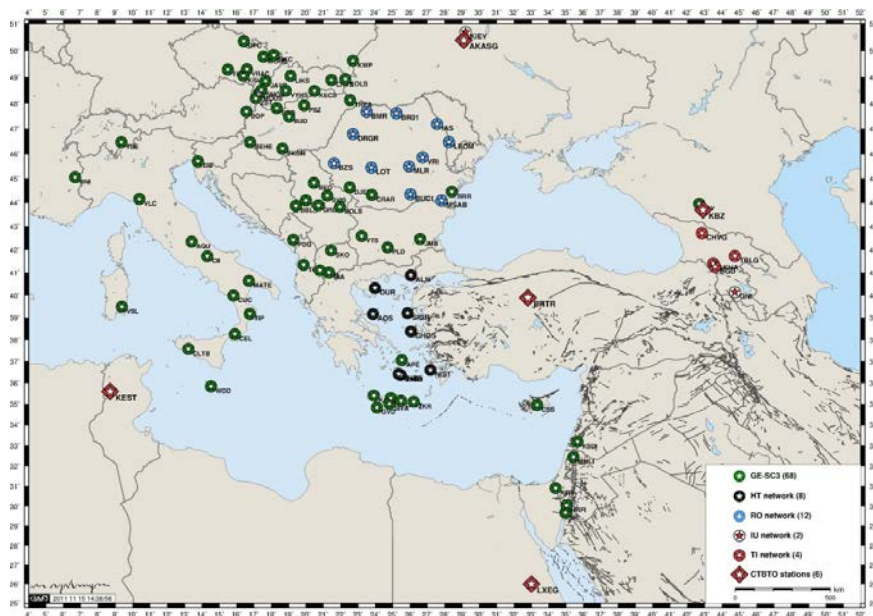


Figure 1: Distributions of regional seismic stations around Turkey available with real-time data.

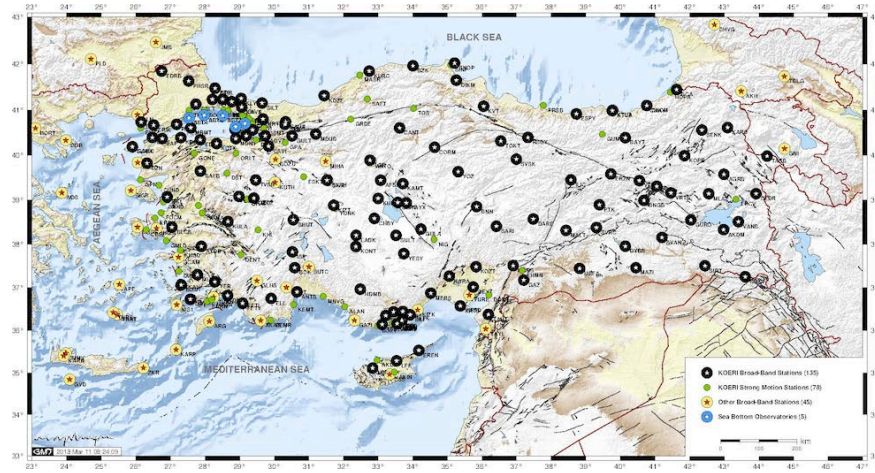


Figure 2: Seismological Network of the Regional Earthquake and Tsunami Monitoring Center of KOERI

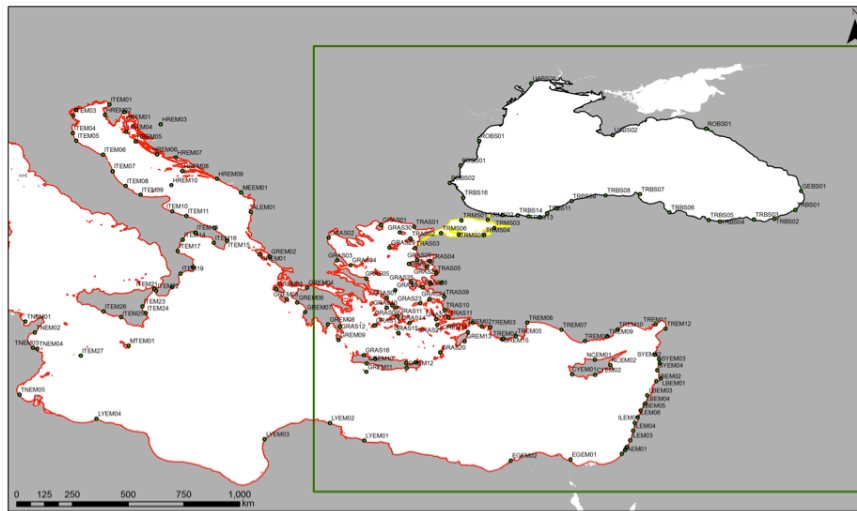


Figure 3: KOERI- Regional Earthquake and Tsunami Monitoring Center Service Area. Earthquake monitoring area is shown in green rectangle as the area monitored by KOERI to assess the tsunamigenic potential of an earthquake. whereas disseminated messages include Tsunami Forecast Points as indicated on the map.

Based on an agreement with the Disaster and Emergency Management Presidency (AFAD), data from 10 BB stations located in the Aegean and Mediterranean Coast is now transmitted in real time to KOERI. Real-time data transmission from 6 primary and 10 auxiliary stations from the International Monitoring System is in place based on an agreement concluded with the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) in 2011. In an agreement with a major Turkish GSM company, KOERI is enlarging its strong-motion network to promote real-time seismology and to extend Earthquake Early Warning system countrywide. 25 accelerometers (included in the number given above) have been purchased and installed at Base Transceiver Station Sites in

coastal regions within the scope of this initiative. Data from 7 tide gauge stations operated by General Command of Mapping (GCM) is being transmitted to KOERI via satellite connection and the aim is to integrate all tide-gauge stations operated by GCM into NTWC-TR.

Duty officers of the RETMC perform internal tests of the Tsunami Warning System on a daily basis based on pre-determined set of scenarios. In addition, KOERI performs a Communication Test Exercise with other CTSPs on every Tuesday of the every first full week of each month. A collaborative agreement has been signed with the European Commission - Joint Research Centre (EC- JRC) and MOD1 & MOD2 Tsunami Scenario Databases and TAT (Tsunami Analysis Tool) are received by KOERI and user training was provided. The database and the tool are linked to SeisComp3 and currently operational. In addition KOERI is continuing the work towards providing contributions to JRC in order to develop an improved database (MOD2-TR), and also continuing work related to the development of its own scenario database using NAMI DANCE Tsunami Simulation and Visualization Software. Further improvement of the Tsunami Warning System at the NTWC-TR will be accomplished through KOERI's participation in the FP-7 Project TRIDEC focusing on new technologies for real-time intelligent earth information management to be used in Tsunami Early Warning Systems. In cooperation with Turkish State Meteorological Service (TSMS), KOERI has its own GTS system now and connected to GTS via its own satellite hub. The system has been successfully utilized during the First Enlarged Communication Test Exercise (NEAMTWS/ECTE1), where KOERI acted as the message provider. KOERI is providing guidance and assistance to a working group established within the AFAD on issues such as Communication and Tsunami Exercises, National Procedures and National Tsunami Response Plan. KOERI has also participated in NEAMTIC (North-Eastern Atlantic and Mediterranean Tsunami Information Centre) Project.



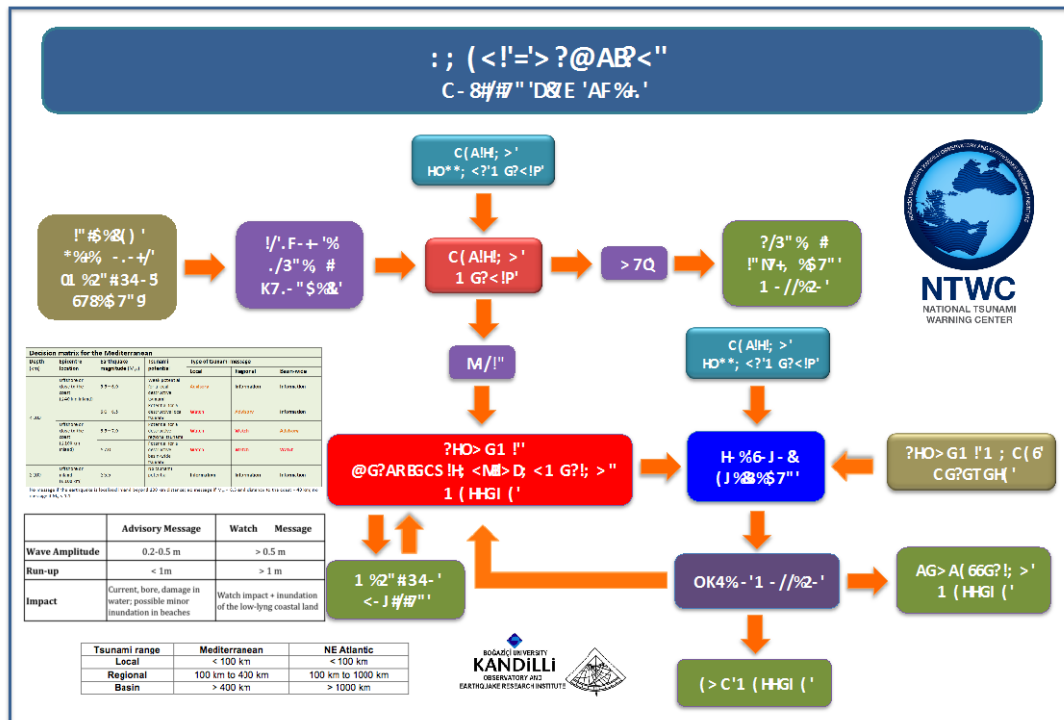


Figure 3: Concept of Operations at NTWC/CTSP-TR

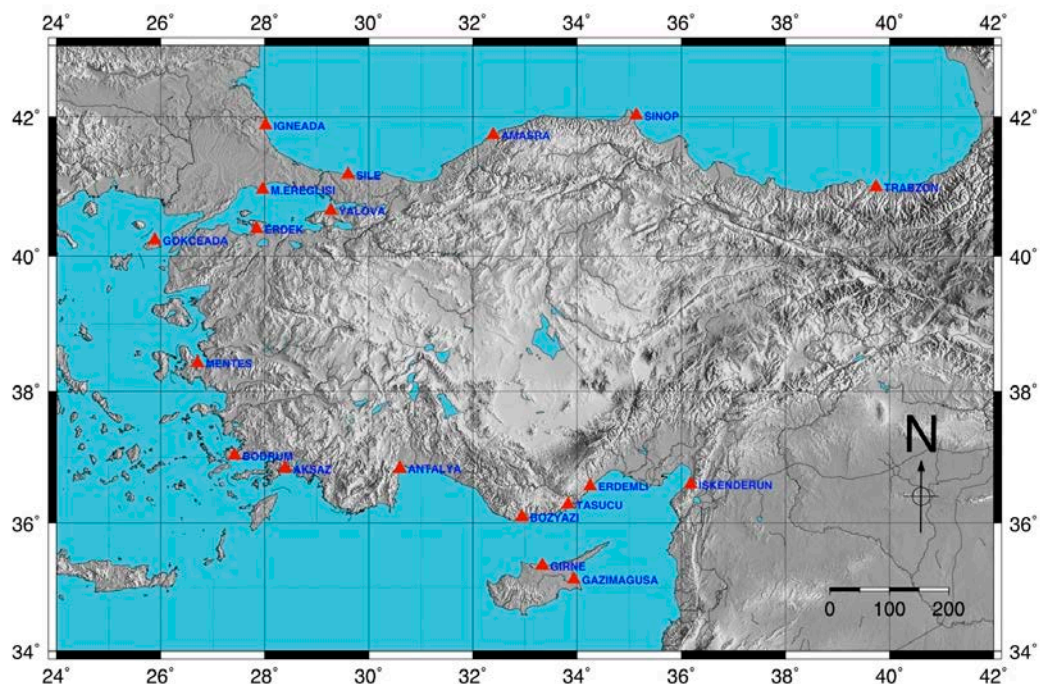


Figure 4: Map of sea-level stations in Turkey operated by General Command of Mapping. Currently, real-time data is available from Sinop, Marmara Ereğlisi, Gökçeada, Bodrum, Bozyazı, Erdemli and Iskenderun. Upgrading of the remaining stations is expected to be finalized by 2014.



## KOERI's Experience in ICG/NEAMTWS Communication Test and Tsunami Exercises

The Candidate Tsunami Watch Providers (CTSP), National Tsunami Warning Centres (NTWC) and Tsunami Warning Focal Points (TWFP) must keep a high level of readiness so as to be able to act efficiently and effectively to provide watch (CTSP) and warnings (NTWC/TWFP) for the public's safety during fast-onset and rapidly-evolving natural disasters like the tsunamis. To maintain this high state of operational readiness, and especially for infrequent events such as tsunamis, tsunami watch/warning centres and emergency agencies must regularly practice their response procedures to ensure that vital communication links work seamlessly, and that agencies and response personnel know the roles that they will need to play during an actual event. Initial Communication Test Exercises were planned, conducted and evaluated by the ICG/NEAMTWS Task Team on Communication Test Exercises (TT-CTE) in June and September 2010. The communication links used were limited to e-mail and fax. Despite the small-scale and limitations, these two first Communication Test Exercises provided the required capacity building that opened the way to the first Enlarged Communication Test.

The scope of these exercises was limited to the Tsunami Watch Providers candidates at this time (Greece, France, Portugal and Turkey), in order to make a thorough evaluation on the procedures to broadcast and receive the tsunami messages. All participants found the exercises useful and the few anomalies detected demonstrated the need for a regular schedule of CTEs. All participants performed an extended set of activities at their institutions to prepare them for the exercises. A set of technical recommendations and suggestions were elaborated that need to be addressed in future exercises. The NEAMTWS is mature for an extended Communication Test Exercise. KOERI was the Message Provider at the 1st Enlarged Communication Test Exercise (ECTE1) in 2011 with the involvement of all the Tsunami Warning Focal Points (TWFP) with 139 end-users in 31 countries of the NEAM region. The second NEAMTWS Communication Test Exercise was conducted on 22 May 2012, where CENALT (France) acted as the Message Provider. KOERI successfully participated also in the CTE2 (22 May 2012, CENALT as the Message Provider) and CTE3 (1 October 2013, NOA as the Message Provider).



Figure 5: Map showing participants of ECTE1 (left), CTE2 (middle) and CTE3 (right)

KOERI has also successfully participated in NEAMWave12, the first Tsunami Exercise in NEAM region, as a Candidate Tsunami Watch Provider with a scenario based on Mw=8.4 worst-case interpretation of the 8 August 1303 Crete and Dodecanese Islands earthquake resulting in destructive inundation in the Eastern Mediterranean. 12 messages were disseminated within a 3-hour time-frame to the relevant end-users in total, where four dedicated messages were sent to the NEAMTWS Member States via e-mail, fax and GTS targeting the subscribers of the KOERI Scenario in terms of scenario affected areas. Besides the NEAMTWS messages, KOERI has also sent messages in Turkish to the Disaster and Emergency Management Presidency of Turkey (AFAD). AFAD and other selected internal end-users were also provided with the messages produced by the TRIDEC Natural Crisis Management System, currently being developed within the same titled EC-FP7 Project, where end-users were also provided with hazard maps. In addition, KOERI has also monitored IPMA (Instituto Português do Mar e da Atmosfera, Portugal) Scenario through the unique system-to-system communication capabilities of TRIDEC. The final evaluation of the exercise indicates that the messages were disseminated successfully and both KOERI and AFAD benefited from the exercise considerably, where the NEAMTWS Tsunami Warning Chain System has been tested to a full scale for the first time.

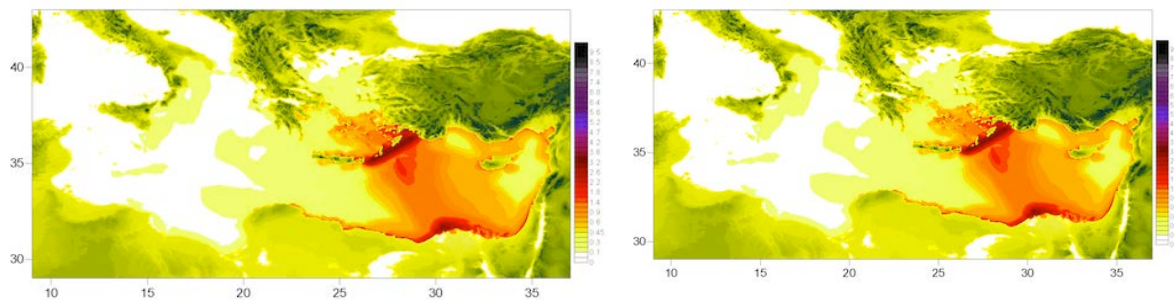


Figure 6: Maximum wave height distribution of the Mw=8.4 worst-case interpretation of the 1303 Crete and Dodecanese Islands earthquake used in NEAMWave12 by KOERI (left) and KOERI's Operations Room during the Exercise (right).

NEAMWave 14, as the second Tsunami Exercise in NEAM, was held on 28-30 October 2014. NEAMWave14 involved the simulation of the assessment of a tsunami, based on an earthquake-driven scenario followed by alert message dissemination by Candidate Tsunami ServiceProviders-CTSP (Phase A) and continued with the simulation of the Tsunami Warning Focal Points/National Tsunami Warning Centres (TWFP/NTWC) and Civil Protection Authorities (CPA) actions (Phase B), as soon as the message produced in Phase A has been received. Different from the tsunami exercise in 2012, NEAMWave14 also included Phase C which covered the simulation of activation of the Union Civil Protection Mechanism at international level as soon as the message produced in Phase A has been received by the European Commission Emergency Response and Coordination Centre (ERCC). In NEAMWave14, KOERI acted as the Message Provider for a Black

Sea Scenario, where Black Sea was covered for the first time in a NEAMTWS Tsunami Exercise.

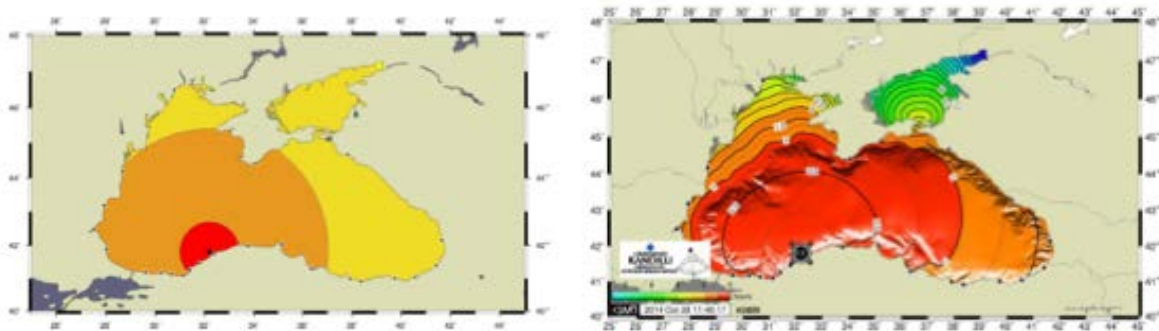


Figure7: Distance Based Tsunami Alert Map (left) and Tsunami Travel Time Map disseminated to Turkish CPA in NEAMWave14 (right).

Phase A covers the simulation of a tsunami assessment triggered by an earthquake scenario, tsunami alert message dissemination by CTSP and the message reception and evaluation by Tsunami Warning Focal Points (TWFP). Each CTSP selected one single earthquake scenario and computed the corresponding prescheduled tsunami assessment. The schedule of events list followed by KOERI includes the dissemination of 5 messages at the 5th, 15th, 60nd, 110th and 180th minutes of the event, respectively. In addition to the NEAMTWS messages, KOERI has disseminated 5 Turkish alert messages to the Disaster and Emergency Management Presidency of Turkey (AFAD) as the authorized CPA in Turkey, where the first message included enhanced products such as Tsunami Travel Map, Tsunami Forecast Point Alert Level Map and Distance Based Tsunami Alert Maps. In NEAMWave14, KOERI also disseminated tsunami exercise message via SMS to the subscribed recipients. In NEAMWave14, KOERI disseminated the tsunami alert messages to the recipients from the countries of Bulgaria, Belgium, Cape Verde, Croatia, Cyprus, Denmark, Egypt, Estonia, Finland, France, Germany, Greece, Ireland, Israel, Italy, Lebanon, Malta, Monaco, Netherlands, Poland, Portugal, Romania, Russian Federation, Slovenia, Spain, Sweden, Syria, Turkey, Ukraine and United Kingdom. The messages were sent to 92 recipients via email, 87 recipients via fax and 65 recipients via sms using KOERI's in-house developed back-up Tsunami Message Dissemination Tool "TWS\_Messenger". In addition to the countries listed above, KOERI also disseminated tsunami alert messages within NEAMWAVE14 to Intergovernmental Oceanographic Commission (IOC) via fax and Monitoring and Information Centre (MIC) both via fax and email.

### **Istanbul Rapid Response and Earthquake and Early Warning System (IRREW)**

The initiatives on the establishment of the Istanbul Earthquake Rapid Response and Early Warning System proposed by Boğaziçi University in 1998 (before the 1999 Kocaeli earthquake) became valid after the decree of Council of Minister on 2001 Fiscal Year following the 1999 Kocaeli and Duzce earthquakes. The system is designed and operated by Bogazici University with the logistical support of the Governorate of Istanbul, First Army Headquarters and Istanbul

Metropolitan Municipality. The construction of the system is realized by the GeoSig and EWE (Switzerland) consortium. Communications are provided by AVEA GSM service provider. In the initial configuration, 100+10 strong motion recorders were stationed in the Metropolitan area Rapid Damage information and 10+2 strong motion stations were sited as close as possible to the Great Marmara Fault for Earthquake Early Warning information. The strong motions instruments operating in the Early Warning and Rapid Response network were replaced with CMG-5TCDE accelerometers in December, 2012 with support of Istanbul Governorate and Sentez Earth and Structure Ltd. adding in 20 new instruments, now 120 rapid response and 10 early warning stations are operating.

The strong motion accelerographs utilized in the IRREW System have the following basic specifications:

Overall recording range:  $\pm 2g$

18-bit (dial-up stations) or 24-bit (on-line) resolution. The least significant bit (LSB) resolution is 0.015mg.

On-site recording for 2 hours or more GPS absolute time (UTC).

200 samples per second

All of the instruments were calibrated in the laboratory using a air-bed electro-magnetic shaker for calibration of the sensitivity constants of the sensors. Additional bi-directional tilt tests at site were conducted for confirmation.

IRREW System consists of the following components:

- (1) Monitoring system composed of various sensors,
- (2) Communication link (off-line for the Rapid Response and on-line for the Early Warning) that transmits data from the sensors to computers,
- (3) Data processing facilities that converts data to information, and
- (4) System that issues and communicates the rapid response information and early warning.

The Rapid Response part of the IRREW System is designed to satisfy the COSMOS (The Consortium of Organizations for Strong-Motion Observation Systems) Urban Strong-Motion Reference Station Guidelines for the location of instruments, instrument specifications and housing specifications.

For the location of instruments the results of deterministic earthquake hazard/risk assessment for Istanbul is used in consideration of

1. Highest likelihood of shaking (Short and Long Period),
2. High probability of damage (Damage Distribution Maps) and
3. High probability of casualties (Casualty Distribution Maps)



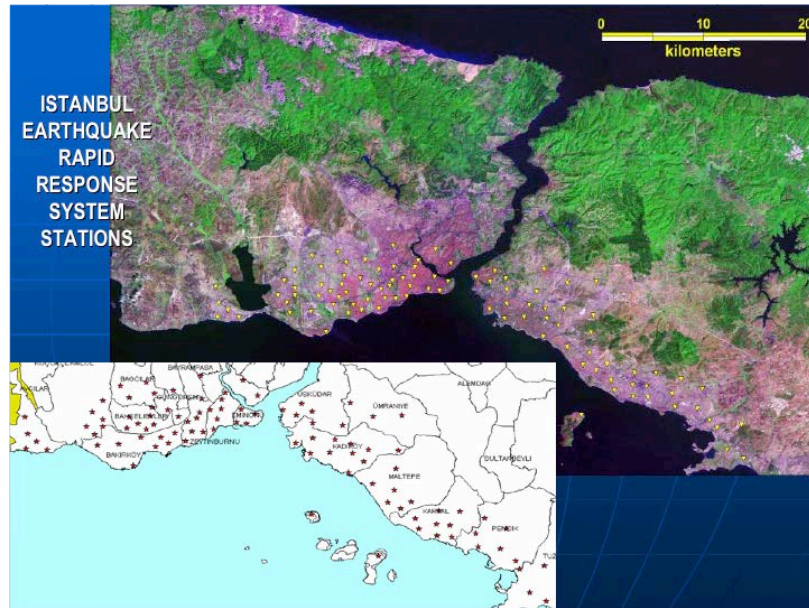


Figure 8: Istanbul Rapid Response System Stations

Rapid Response part of the IRREW has the objective of providing:

1. Reliable information for accurate, effective characterization of the shaking and damage by rapid post-earthquake maps (Shake, Damage and Casualty maps) for rapid response;
2. Recorded motion for post-earthquake performance analysis of structures;
3. Empirical basis for long-term improvements in seismic microzonation, seismic provisions of building codes and construction guidelines; and
- 4 Seismological data to improve the understanding of earthquake generation at the source and seismic wave propagation.

After triggered by an earthquake, each station processes the streaming three-channel strong motion data to yield the

- Spectral accelerations at specific periods,
- 12Hz filtered PGA and
- PGV

and sends these parameters in the form of SMS messages at every 20s directly to the main data center through the GSM communication system by using several base stations, microwave system and landlines. Spectral displacements obtained from the SMS messages sent from stations are interpolated to determine the spectral displacement values at the center of each geo-cell ( $0.01^\circ \times 0.01^\circ$ ). The seismic demand at the center of each geo-cell is computed using these spectral displacements. Using the capacities of the buildings (24 types) in each geo-cell the building damage is computed by using the spectral-displacement based fragility curves (HAZUS Procedure).

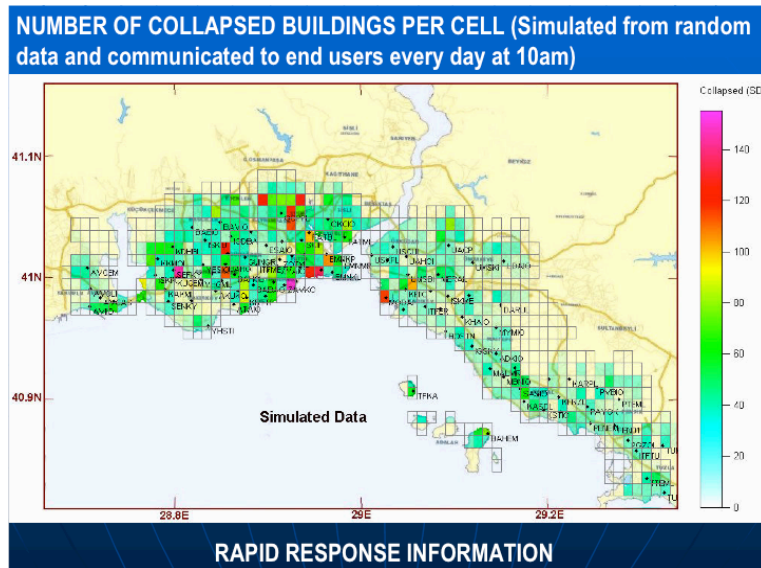


Figure 9: Rapid Response System Information

The Early Warning part of the I-NET 10+2 strong motion stations were located as close as possible to the Great Marmara Fault zone in “on-line” mode. Data Transmission is provided with Spread Spectrum Radio Modem and Satellite. The continuous on-line data from these stations is used to provide real time warning for emerging 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 (band-pass filtered accelerations and the cumulative absolute velocity) is implemented. The early warning information (consisting three alarm levels) will be (are) communicated to the appropriate servo shut-down systems of the recipient facilities, which will automatically decide proper action based on the alarm level. Depending on the location of the earthquake (initiation of fault rupture) and the recipient facility the alarm time can be as high as about 8s.

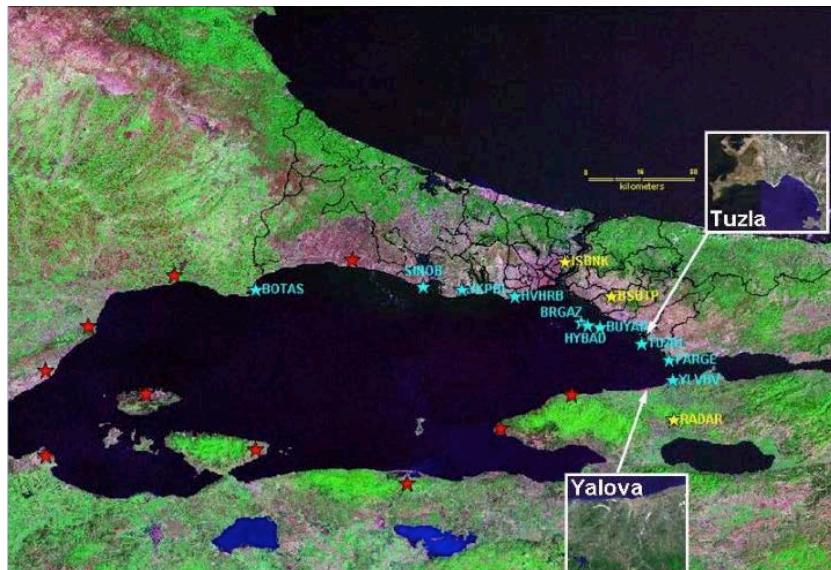


Figure 10: Expansion of the Istanbul Earthquake Rapid Response System

### Sea Bottom Observation System in Marmara

KOERI started a new era in its observational capabilities by installing 5 sea floor observation system in the Sea of Marmara within the Sea Bottom Observatory Project supported by Turkish Telecom, including broadband seismometers and differential pressuremeters, pressure transducer, strong-motion sensor, hydrophone, temperature measurement device and flow meter. The first sea bottom observation element was installed in December 2009 with real-time data transmission to KOERI. The seismic component of the sea floor observation system improves the azimuthal and spatial distribution of the existing NEMC network and reduces the early warning time and the minimum magnitude threshold down to 1.0 in the Marmara Sea, especially close to the northern branch of North Anatolian Fault (NAF), which is the most active fault zone in the Marmara Sea. As of today, all observatories have been removed for instrument maintenance and improvements and is expected to be deployed again in near future upon which real-time data communication to KOERI will be re-established. The near-future aim is to initiate research on noise and signal analysis, together with seismologic and seismotectonic studies.

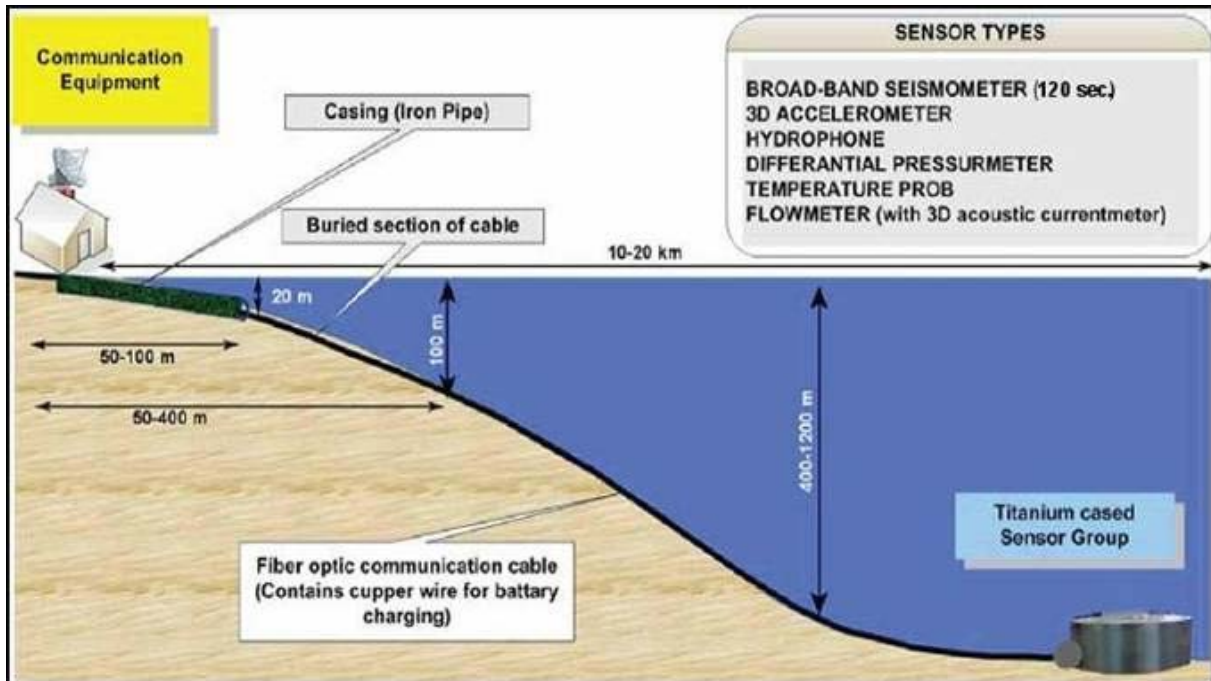


Figure 11: Elements and the architectural configuration of the SBO system in Marmara





Figure 12: Scenes from the deployment of the SBO System in Marmara Sea

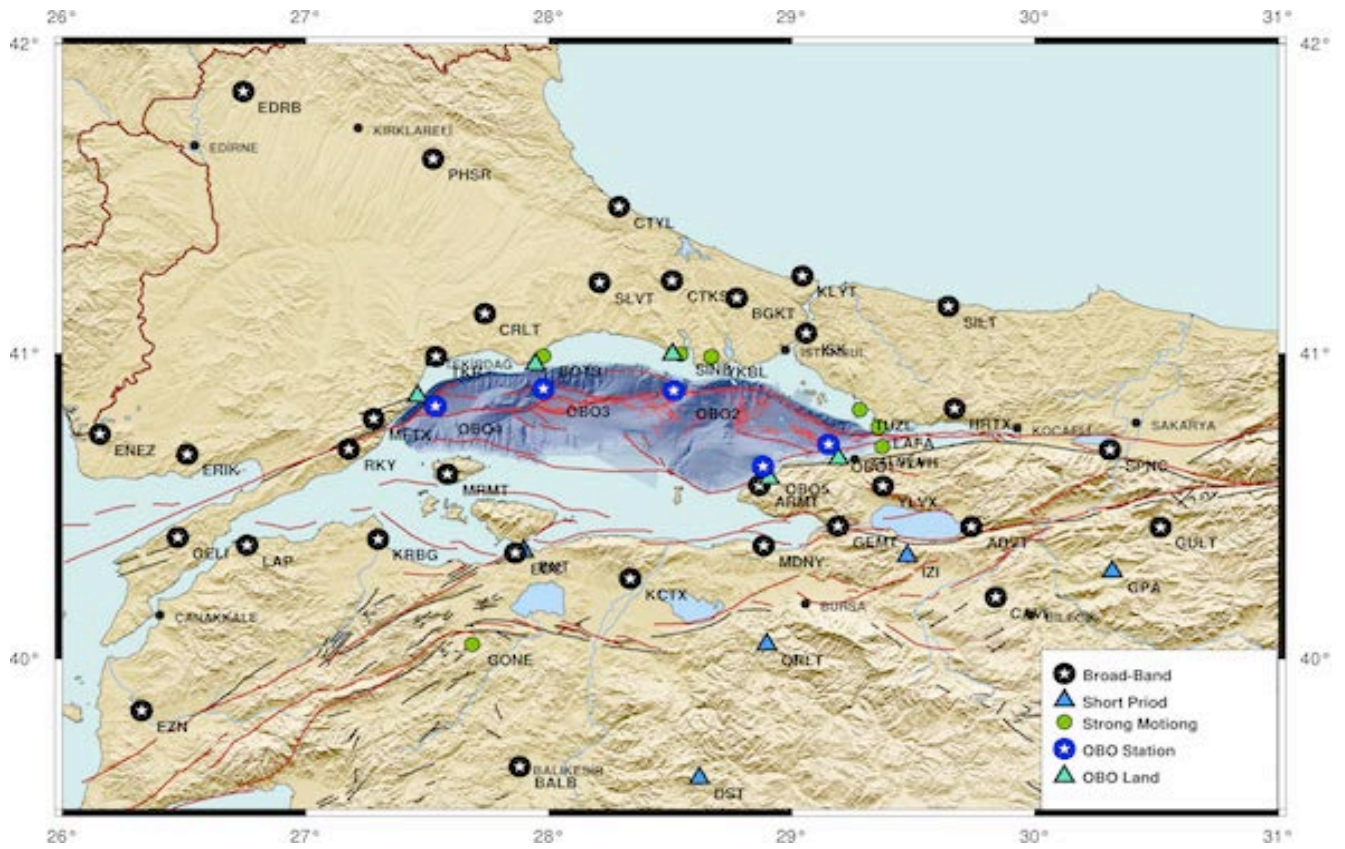


Figure 13: Sea-bottom observation system currently operational in Marmara Sea

## THE EARTHQUAKE ENGINEERING DEPARTMENT (EED)

The Earthquake Engineering Department (EED) is a department in Kandilli Observatory and Earthquake Research Institute (KOERI) at Bogazici University (BU) in İstanbul.

Being established in 1868, KOERI (then, Imperial Observatory) has a tradition of science that encompasses the initiation of the formal meteorological observations in 1911 and also the start of the systematic seismological measurements in 1926 in the country. After annexation to Bogazici University (originally founded in 1863 in Istanbul as Robert College), KOERI has evolved into a



multidisciplinary earthquake research organization providing graduate education under the Earthquake Engineering, Geophysics and Geodesy departments and encompassing earthquake observation, research and application services within a single, integrated body. The National Earthquake Observation Center of KOERI provides seismological observation services with its continuously expanding network distributed throughout Turkey. Currently, the 102-station network is operational with on-line connections. For the observation of seismicity in Northeast Turkey (Marmara) region 43 stations are used in several network configurations. Other stations, including 13 broadband stations are distributed throughout the country.

EED has started its activities in 1989 as a graduate department under KOERI of BU. The overall mandate of the department is to conduct graduate level training, research and implementation that will contribute to seismically safer structures, systems and environment. The department is the first and only academic unit in Turkey that can provide graduate level training on Earthquake Engineering leading to M.Sc. and Ph.D. degrees in Earthquake Engineering.

Earthquake Engineering can be viewed as a multi-phased process that ranges from the description of earthquake source process to seismic disaster mitigation procedures. Earthquake response analysis of site and structures and the assessment of the strong ground motion that will emanate from an earthquake constitute the two main ingredients of the discipline. The emphasis of our academic activities are placed on: Earthquake hazard and risk analysis; Development of urban earthquake damage scenarios; Characteristics of strong earthquake ground motion; Site and soil response analysis; Earthquake response of buildings, historical monuments, industrial facilities, bridges and dams; Soil-structure interaction; Dynamic testing of small-scale model and prototype structures; Retrofitting and post earthquake strengthening of structures; Damage evaluation and earthquake insurance; and the Development of earthquake resistant design codes.

KOERI-EED has played a leading role in Turkey for the advancement of the earthquake risk mitigation by taking part in the various National Committees (i.e. Turkish National Earthquake Council in the preparation of the report on National Strategies for Mitigating Earthquake Damage) in the nationally funded projects (i.e. Istanbul Metropolitan Municipality Earthquake Master Plan).

The Department of Earthquake Engineering enjoys close ties and exchange of students and faculty with relevant institutions throughout the world. These include several international organisations, university research centers and government establishments.

EED has done pioneering work on many aspects of earthquake engineering, in seismic hazard and risk analysis, earthquake occurrence and ground motion modeling, component and system reliability, experimental research on structures

and components, evaluation of damage potential of ground motions, and development of seismic design methodologies.

Following is a list of the main research areas at EED:

- Strong Ground Motion
- Earthquake Hazard
- Urban Earthquake Loss
- Seismic Microzonation
- Performance Based Seismic Evaluation and Design
- Earthquake Protection of Cultural Heritage

### **EED Shaking Table**

Turkey is confronted with the problem of earthquakes. The role of shaking table test is increasingly important in assuring the performance of structures during earthquake. The Department of Earthquake Engineering at Kandilli observatory earthquake engineering research institute of Bogazici University has recently acquired two shake table facilities to conduct experimentation in structural dynamics and particularly how to monitor and actively control structures subjected to earthquake ground motions or other force excitations. The central feature of the new established Shaking laboratory is an advanced, closed-loop, servo-controlled electro-hydraulic seismic simulator or shake table. This high performance seismic simulator can accurately reproduce earthquake ground motions and a variety of other input wave forms, and can configured for wide range of testing applications. It can be used for seismic research and qualification testing of equipment, structural components and scale models. Since the experimental research is an important factor in the developing of the construction industry of Turkey the shaking table Laboratory has been equipped with the most contemporary devices and has become a laboratory of research in order to improve technology in every field of structural and earthquake engineering.

### **GEODESY DEPARTMENT**

Geodetic methods make major contributions to geodynamic studies. Microgeodetic networks which are designed for detecting crustal movements in seismically active areas are capable of monitoring 3D position changes with a few mm. The study of monitoring horizontal crustal movements on the western part of NAFZ has started by Geodesy Department of Kandilli Observatory and Earthquake Research Institute (KOERI) of Bogazici University in 1990. Three geodetic control networks were established in Iznik, Sapanca, and Akyazi regions in order to monitor crustal displacements. There are also several on-going and also completed projects which are being conducted by scientists from the universities and the other research institutes for the region of interest.

Since the year 1994, the department has been carrying out their activities in different parts of Turkey (such as western and eastern Turkey) by using GPS technique through the research projects supported by the Bogazici University

Scientific Research Projects Fund and Scientific and Technological Research Council of Turkey (TUBITAK).

## **GEOFYSICS DEPARTMENT**

Geophysics department at Boğaziçi University, Kandilli Observatory and Earthquake Research Institute gives the highest priority to original research with the aim of promoting young researchers and scientists reflecting the mobility of the modern science and the fast progress in technology within their research, together with the essential human qualities such as environmental awareness and preservation of the nature, while identifying and providing solutions in the part of the world we are living.

The core elements of the MSc and PhD curriculum at our department provides necessary mathematics and physics background and aiming at educating young researchers in the field seismology with a wide range of topics, such as elastic wave propagation, earthquake source mechanisms, signal processing, strong ground motion and instrumentation.

Investigation of earth's crust using seismic, electrical, magnetic and electromagnetic methods, engineering seismology, geo-magnetism, paleo-magnetism and archeomagnetism applications are among the main fields of study in our department.

Identification of active faults and understanding related lithospheric forces, seismicity, seismic hazard and risk; landslide and avalanche studies; industrial raw material; mine, underground water, oil and natural gas prospection studies; soil investigations for various sizes of engineering structures; the composition of the Earth's interior and crust and their physical properties are among the department's fields of interest.

## **SELECTED PROJECTS**

EC-FP7 MARSite PROJECT: New Directions in Seismic Hazard Assessment through Focused Earth Observation in the Marmara Supersite

KOERI is the Coordinator of the EC-FP7 Project MARSite started in November 2012. MARSite aims assessing the “state of the art” of seismic risk evaluation and management at European level to establish a starting point to move a “step forward” towards new concepts of risk mitigation and management by long-term monitoring activities carried out both on land and at sea. The Project will coordinate research groups with different scientific skills in a comprehensive monitoring activity developed both in the Marmara Sea and in the surrounding urban and country areas. The project plans to coordinate initiatives to collect multidisciplinary data, to be shared, interpreted and merged in consistent theoretical and practical models suitable for the implementation of good practices to move the necessary information to the end users. MARSite proposed to identify the Marmara region as a ‘Supersite’ within European initiatives to aggregate on-shore,

off-shore and space-based observations, comprehensive geophysical monitoring, improved hazard and risk assessments encompassed in an integrated set of activities.

The MARSite Consortium brings together 18 major European research institutions with a long record of scientific history and success, and 3 SMEs, from 7 nations of the Euro-Mediterranean area. The consortium is very balanced, both in terms of specialities and in terms of distribution between EU-countries, EU-supported international organizations and Turkish national institutions. MARSite has 11 Work Packages dealing with Management, Research and Development, Data Integration and Dissemination activities. WP5 will concentrate on real- and quasi-real-time Earthquake & Tsunami Hazard Monitoring, where an integrated approach by harmonizing geodetic and seismic data to be used in early warning applications will be implemented, so that in addition a quick determination of the rupture characteristics could also assist the identification of the tsunamigenic potential of an earthquake in combination with a tectonic origin tsunami scenario database, and WP9 will focus on Early Warning and Development of the Real-time shake and loss information for the supersite.

KOERI is coordinator of the FP7 MARSite “New Directions in Seismic Hazard assessment through Focused Earth Observation in the Marmara Supersite” Project and an essential partner in FP7 Project TRIDEC “Collaborative, Complex and Critical Decision-Support in Evolving Crises”, focusing on new technologies for real-time intelligent earth information management to be used in tsunami early warning systems. Other FP7 projects are REAKT, NERA “Network of European Research Infrastructures for Earthquake Risk Assessment and Mitigation” and SHARE “Seismic Hazard Harmonization in Europe”. The previous ASTARTE relevant experience of KOERI includes the development of IEEWS (Istanbul Earthquake Early Warning System), IERRS (Istanbul Earthquake Rapid Response System); participation to SOSEWIN (Self Organizing Seismic Early Warning Information Network), EC-FP6 SAFER and NERIES Projects. Other international Projects KOERI is involved are “TerraFirma Extension, Tectonic Theme - TFX-TT”, EMME “Earthquake Model of the Middle East Region”, and GEMECD “Global Earthquake Model - Earthquake Consequence Database” projects.  
([www.marsite.eu](http://www.marsite.eu))

### **Other Projects**

EU -FP7 SHARE – Seismic Hazard Harmonization in Europe (2009 – 2012)  
(<http://www.share-eu.org/>)

EU-FP7 REAKT Strategies and tools for Real Time Earthquake Risk Reduction (2011-2014)  
(<http://www.reaktproject.eu/>)

EU-FP7 NERA – Network of European Research Infrastructures for Earthquake Risk Assessment and Mitigation (2010 – 2014)

EU – FP7 TRIDEC – Collaborative, Complex and Critical Decision- Support in Evolving Crises

(2010 - 2013) (<http://tridec.gfz-potsdam.de/>)

EU- FP7 SERIES – Seismic Engineering Research Infrastructures for European Synergies (2010 - 2014)  
(<http://www.series.upatras.gr/> )

NATO Project - Seismic Hazard and Risk Assesment for Southern Caucasus-Eastern Turkey Energy Corridors (SHRAP). SFP 983038

Global Earthquake Model (GEM) <http://www.globalearthquakemodel.org>

EMME- Earthquake Model of the Middle East region (<http://www.emme-gem.org/>)

JAMSTEC/JST project “EARTHQUAKE AND TSUNAMI DISASTER MITIGATION IN THE MARMARA REGION AND DISASTER EDUCATION IN TURKEY (April 2013 – March 2018)

**c. ANKARA UNIVERSITY FACULTY OF ENGINEERING DEPARTMENT  
OF GEOPHYSIC**

<http://geop.eng.ankara.edu.tr>



**ANKARA UNIVERSITY EARTHQUAKE RESEARCH AND APPLICATION  
CENTRE (ADAUM)**

Earthquake Research and Application Centre (ADAUM) were founded in 2003 to establish and expand seismological networks for earthquake observation, re-processing of national data, and detailed research on Seismology, Engineering Geology and Geophysics, regulate related scientific, educational and practical activities. The management and advisory board of the Centre were organized from different branches of science such as Geophysics, Geology, Agriculture, Law and Education departments of Ankara University. The Centre completed two national projects; the total budget of the projects was about five million dollars and has been started two new projects in 6-years period. Centre has published a number of international and national scientific papers and reports in the last two years. In addition to scientific activities within the scope of the earthquake, the centre gives special attention to issues directly related to human life such as measurement and calculation of earthquake resistant design parameters, modelling the dynamic behaviour of soils especially in urban sites. For this purpose, the Centre organises the ongoing independent researches on earthquakes and related fields to make them certain projects under directing the scientific and societal goals.

**PROJECTS**

1. Water Content Determination and Geotechnical Applications by means of multi-parameter dataset (BAP, No: 11B6055001)
2. What is an Earthquake? Raising awareness of elementary and high school students (BAP, 2011)

**d. ANADOLU UNIVERSITY SPACE AND SATELLITE RESEARCH  
INSTITUTE**

<http://www.uube.anadolu.edu.tr>



Remote sensing and Geographical Information Systems studies in Anadolu University were started in 1989 in the Computer Center of Anadolu University and formally continued their studies in Space and Satellite Research Institute in 1993. At the end of 1996, Institute was moved to a new campus of Anadolu University called İki Eylül Campus. Recently, Remote Sensing and Geographical Information Technologies, Disaster Management, Space Researches, Distant Education, Earth System Sciences and Documentation of Cultural Assets Groups' were established in the Institute. These groups carry out several research projects in collaboration with the academic units of Anadolu University, other universities, and several public foundations like Governor of Eskişehir, Disaster and Emergency Management Department, Municipalities, besides their own projects.

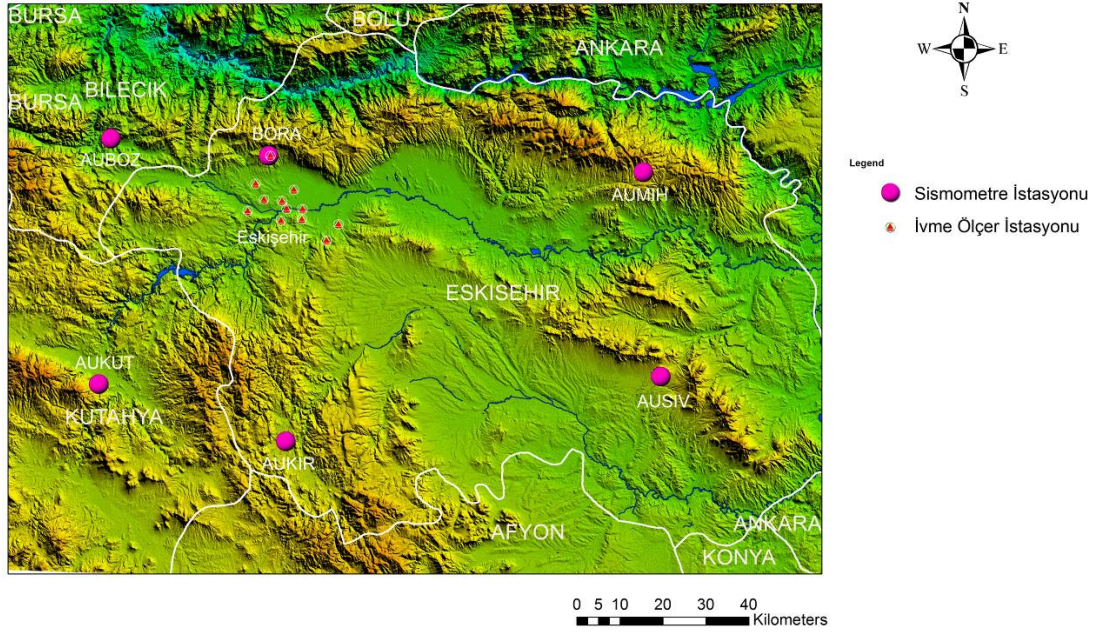
**Tasks on the Construction and Operation of a Local Seismic Network**

**Purpose:**

Solution to earthquake locations and production of tremor maps, providing of local earthquake solving capability to the City Disaster and Emergency Management Directorate.

**Context:**

Building, operating and real time data transferring infrastructure of 12 accelerometer and 6 seismometer stations.



Map showing locations of the earthquake recording stations of Anadolu University.

## **Seismic Studies**

### **Purpose:**

One of the main topics of earthquake researches is the use of seismic reflection studies to determine the fault locations. While researching the faults, studies based on surface geology fails in alluvial area. Although trench digging may provide some solutions, it is time consuming, tedious and difficult. Under this circumstances, geophysical methods are implemented. Among various geophysical technics, the best method to image the faults is the seismic reflection method. To determine the faults, multi- channel seismic reflection technics are widely used.

### **Context:**

Presently, an important fault, threatening Eskişehir City, and cannot be observed by surface geological researches, is determined via seismic reflection method, and trench digging stage is reached. The knowledge and experiences obtained in Eskişehir City are transferred to Bolu City. Similar studies will be implemented to Zonguldak City. Besides earthquake researches, tasks to explore subsurface resources (geothermal and coal) are about to begin.

## **The Study Of Determining Structural Properties**

### **Purpose:**



Developing the method of inventory information collection and building scoring for existing building stock and new buildings that are appropriate to Turkish Construction Specifications utilizing technologies of Information System.

**Context:**

Pilot study area that has dense housing and high vulnerability risk due to the structural defects and soil defects.

In order to generate the information of building inventory, a new building assessment form was developed imitating the DUR-TES Method that were conducted by Department of Civil Engineering of İstanbul University in Bakirkoy region. Eight district in Tepebasi region that has alluvial soil properties, densely populated and a large part of total building stock was determined as a pilot region of the study. 1100 multi-storey (four and above) buildings were examined by the rapid assessment methodology.

There are various queries such as general, load bearing system and material properties of the building in the assessment form. In the first phase of the study, project drawing of the buildings were examined and buildings were examined on-site in the second phase.

**Tasks on the Determination of the Soil Properties**

**Purpose:**

Determination of the soil sturcture (soil type and soil parameters) in densely populated areas and researches on the risks related local soil conditions.

**Context:**

Under the scope of the research projects previously completed by the State Water Works Local Directorate, re-evaluation of drilling data, in case it is needed, 30 m and 100 m depth drilling, cone penetration taste (CPT), microtermor measurements will be achieved by the local municipalities in the center of the Eskisehir City.

Microtremor measurements in 286 different stations were obtained during 45 minutes in average with single-station microtremor. Tasks were conducted to determine horizontal to vertical amplitude amplification ratio of the soil dominant tremor frequency.

**Tasks on the Geographical Information Systems:**

**Purpose:**

In disaster management, to build the coordination among institutions, an understanding of coordination comprising the priorities, the cooperated work principles, performance evaluations and development of coordination rules must be achieved.

**Context:**

An information system should be developed to produce a reliable and updated fast data flow to the coordination center, means to start tasks for developing basic information system to start implementations.

**Contribution to Public Activities:****Purpose:**

Recently recruited personnel of City Disaster and Emergency Management Directorate were trained.

**Context:**

The protocol signed between Anadolu University and City Disaster and Emergency Management Directorate provides both institutes a joint work area to determine the disaster risks and disaster management plans.

**e. DOKUZ EYLUL UNIVERSITY DEPARTMENT OF GEOPHYSICAL  
ENGINEERING**

<http://www.eng.deu.edu.tr>



Department of Geophysical Engineering founded in Science Faculty of Ege University in 1974, has been continued to its education under the frame of Dokuz Eylul University (DEU) on July 20, 1982. Today, it has been going on its education and research facilities as one of the 11th departments belonging to the Engineering Faculty. It is unique department of Izmir which is 3rd biggest city in the country with its more than 3.5 million inhabitants, and cultural/industrial capital of the Aegean region of Turkey. In addition, our students can be able to find close cooperation with other departments across Tinaztepe Kaynaklar Campus in Buca to develop interdisciplinary approaches for solving engineering and geosciences problems.

Targets of the department are to educate engineers and academicians in applied geophysics, seismology and earth physics by using present instrumental and scientific technologies, to train human resources who investigate underground resources to support national economy, and providing additional support to design structures by detecting site properties especially in the region.

Many graduates of our department are employed in the applied geophysics industry, primarily in exploration of underground resources such as groundwater, geothermal, valuable mines, marine geophysics, hydrocarbons such as petroleum, gas hydrats and natural gas. A significant percentage of our graduates go on to pursue MSc or PhD study before seeking either petroleum or seismology employment. Others working fields are site investigations, environmental problems, earthquake analysis, disaster and hazard mitigation studies. Undergraduate section of the department has MUDEK and EUR-ACE (EUROpean ACcredited Engineer) accreditation labels till September 30, 2013.

Education members of our departments have been leading two research centers belonging to the Dokuz Eylul University. These are Earthquake Research and Implementation Center (DAUM), and Center for Near Surface Geophysics and Archaeological Prospection (SAMER). The DAUM aims observing seismic activity in Aegean Region of Turkey while SAMER promotes to seek buried underground

structures close to the surface. Both centers conduct variety of research projects and scientific organizations within the department.

Departmental instrument park, examples of projects for each institution, and of scientific publications in the last 6 years can be found at below table.

### **DEPARTMENTAL INSTRUMENT PARK**

24-channel seismic equipments, resistivity, VLF, GPR, SP and micro-gravity instruments

### **PROJECTS**

Duration	: 3 years (2008-2011)
Institution	: Department of Geophysics of the DEU
Name	: Investigation of underground structure of South of Izmir by using micro-gravity and GPS methods
Support	: TUBITAK-CAYDAG (108Y285)
Aim	: Basement topography of Izmir will be investigated by using micro-gravity and GPS campaign measurements. Deformation field and earthquake prone area will be revealed after analyzing and joint-interpreting the data.
Duration	: 3 years (2008-2011)
Institution	: DAUM-Izmir, AFAD-Ankara
Name	: Modeling of Seismic Site Response for Earthquake Resistant Structural Design in Izmir Metropolitan Area and Aliaga-Menemen Districts
Support	: TUBITAK-KAMAG (106G159)
Aim	: Acquiring strong ground motion characteristics of geological structures by installing local accelerometer network in Metropolitan Izmir, determining of the basement topography using micro-gravity measurements, revealing site characteristics by using applied geophysics and ambient noise measurements.
Duration	: 2 years (2011-2013)
Name	: Determination of Velocity Structure in the vicinity of Izmir using seismic-noise relationship
Support	: TÜBİTAK-1001 Project (111Y015)

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7. 2014: Timur, E., Investigation of roadside pollution in Aliaga Industrial Zone (Izmir/Turkey) by using magnetic susceptibility, EGU 27/04/2014 - 02/05/2014, Vienna-Autria,
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29. 2011: Yurdakul A and Hager B, Delineation of Deformation Using Finite Element Modeling: A Case From Western Turkey, EGU 03/04/2011 - 08/04/2011, Vienna-Austria.
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  33. 2011: Gonenc T, Mustafa Ergün, Crustal Structure around the Marmara Sea and the Western Black sea, European Geoscience Union 2011, Austria
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**f. ÇANAKKALE ONSEKİZ MART UNIVERSITY DEPARTMENT OF  
GEOPHYSICAL ENGINEERING**

<http://jeofizik.comu.edu.tr/>



The department was founded in 2001 and developing rapidly. The mission of the Department of Geophysics Engineering to provide an environment in which students can improve themselves according to their interest area and to graduate as geophysical engineers whom are highly regarded by both companies and academic institutions.

Our curriculum is based on the applications related to mining, geological, civil, and environmental engineering and seismology disciplines and on the developing software for geophysical methods. Our undergraduate and graduate programs have been updated in response to developments in geophysics engineering. Our department is in continuous development of its educational and research programs and infrastructure. The department, currently, offers B.Sc. and

MSc degrees in geophysics engineering. First graduate and undergraduate degrees were offered in 2001 and 2002, respectively.

The faculty has a dynamic and young structure from diverse fields including mining, civil and environmental geophysics, and seismology. The Department of Geophysics Engineering has run various projects for engineering and environmental problems that have been vital for municipalities. In addition, our staffs participate in international projects.

## PROJECTS

(ÇOMÜ-BAP) / *Geophysical Characterization of Lapseki-Adatepe Landslide Area By Electrical Resistivity and Seismic Refraction Methods*

(TÜBİTAK) / *Neotectonic and Seismotectonic Characteristics between Simav Fault and Kütahya Fault (Emet-Middle-Western Anatolia)*

(TÜBİTAK) / *Paleoseismology of Troia Fault*

Türkiye'nin Meteorit Çarpma Kraterleri Envanteri: Kraterlerin Morfolojik Özellikleri ve Uydu Görüntüleriyle Bulunması (TÜBİTAK)

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### 2012

Komut, T., Gray, R., Göğüş, H. O. and Pysklywec, R. N., 2012, Mantle Flow Uplift of Western Anatolia and the Aegean: Interpretations from Geophysical Analyses and Geodynamic Modeling.. Journal of Geophysical Research, 117, B11412.

Reis, S., Yalcin, A., Atasoy, M., Nisanci, R., Bayrak, T., Erduran, M., Sancar, C. ve Erduran, M., “Remote sensing and GIS-based landslide susceptibility mapping using frequency ratio and analytical hierarchy methods in Rize province (NE Turkey)” Environmental Earth Sciences, 66 (7), 2063-2073

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Bekler, T., Ekinici, Y.L., Demirci, A., Erginal, A.E., and Ertekin, C., Characterization of a Landslide Using Seismic Refraction, Electrical Resistivity and Hydrometer Methods, Adatepe-Çanakkale, NW Turkey. Journal of Environmental and Engineering Geophysics, 16 (3): 115-126. DOI: 10.2113/JEEG16.3.115

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## **g. GAZİ UNIVERSITY EARTHQUAKE ENGINEERING APPLICATION AND RESEARCH CENTER**

<http://www.mf.gazi.edu.tr>



Gazi University Earthquake Engineering Application and Research Center (DEMAR) was established in April 22, 2005 as a center under Gazi University Rectorate.

### **Aims of the Center:**

- a) To conduct, promote and coordinate theoretical and applied researches on the sources of earthquakes, their occurrences, their effects on engineered structures and people and the mitigation of seismic risks, to provide consultancy service and organize scientific meetings, courses and seminars on those subjects,
- b) To communicate, cooperate with similar centers in the country and abroad, to assist in the development of courses and programs for graduate studies, to provide and spread the knowledge.

**Fields of Studies in the Center:**

- a) To conduct studies aiming to inform the local authorities and the public about the precautions before earthquakes and raise the awareness on those topics,
- b) To make researches regarding the planning and conducting of emergency and rescue operations after earthquakes,
- c) To develop plans on the probable damages and corresponding precautions in the regions with high earthquake risk,
- d) To conduct applied researches on the retrofitting of inadequately engineered problematic buildings prior to the occurrence of earthquakes and on the repair of damaged buildings after the occurrence,
- e) To provide consultancy service on the implementation of the retrofitting and repair methods developed by the support of the center,
- f) To provide knowledge sharing settings by organizing scientific meetings, courses and seminars regarding studies and researches supported by the center on earthquakes and earthquake engineering
- g) To assist in the development of undergraduate and graduate courses and programs for civil engineering departments of the universities and to contribute to the informing of students.

**Mission of the Center**

To carry out multidisciplinary research and development (RD) studies on the earthquake threat, the determination of risk and the mitigation of hazardous effects of earthquakes,

To present the results of these studies and the past experiences for the information and the benefit of researchers, central and local authorities and the public,

To support local authorities on prevention and damage mitigation (risk management), intervention and rehabilitation (emergency management), preparation and implementation of plans and to carry out the studies on training and informing of the public in a way increasing the awareness.

### **Vision of the Center**

The vision of the center is to become the most efficient and most qualified Earthquake Engineering Application and Research Center at national scale as well as to be reputable, well known center with continuous improvement in the cooperation potentials at international arena.

### **Some Examples of the Works Carried Out**

#### **1- Seismic Hazard Map of Turkey and Development of Earthquake Regulations**

The first act on the mitigation of earthquake damages was issued in July 22, 1944 under the name of “*Law Regarding Precautions Before and After Earthquakes*”. As required by this law, 4623, there prepared “*Seismic Hazard Map*” and “*Earthquake Specification*” in relation to the map for the first time in Turkey by Ministries of Public Works and National Education.

The developments in engineering seismology, the increase in tectonic and sismotectonic findings as well as the increase in earthquake recordings, Seismic Hazard Maps (1945, 1947, 1963, 1972 and 1996) and Specifications for Structures to be Built in Disaster Areas (1947, 1953, 1962, 1968, 1975, 1996 and 2007) were changed several times. With this study, there compiled the information about the Seismic Hazard Maps and Specifications for structures to be built in disaster areas that were approved by Cabinet Decree and inured. Moreover, there prepared a reference guide for the ones that will work on the upcoming seismic hazard maps and specifications for structures to be built in disaster areas including the basis that the older versions considered during the preparation of maps.

#### **2- Network of Weak and Strong Ground Motion Records in Ankara Region (ANKARA-NET)**

With this project, there installed seismic stations to record the weak and strong ground motions in Ankara and its surroundings. It is aimed to contribute to the development of earthquake resistant building techniques by using the ground

accelerations during earthquakes and determining the forces that come with earthquake and cause damage in any type of building. Besides, the parameters like the location of earthquake, magnitude, depth etc are determined to investigate the seismicity/seismic activity of Ankara and its surroundings in a detailed way.

### **3-Earthquake Hazard and Risk of Ankara Workshop**

To put forth the seismic risk state of Ankara with scientific studies, in March 19, 2008 at Gazi University Rectorate Mimar Kemaleddin Hall there organized “*Earthquake Hazard and Risk of Ankara Workshop*”. Besides, at the panel called “Is Ankara ready for an earthquake?” after the workshop, the current state of Ankara in terms of earthquake, necessary studies to be done and suggestions for the solutions were discussed in a detailed way.

### **4- Disaster Management and Earthquake Trainings**

Our country is a country that is located on one of the most active faults and always had, have and will have the risk of earthquakes. Education occupies an important role in the risk mitigation activities. With the collaboration of related Public Agencies and Institutions, Governorships, Municipalities, Nongovernmental organizations, Private Companies, there carried out training studies on Earthquake and Disaster Management to mitigate the effects of earthquakes, decrease the losses to minimum, to train the informed, conscious and responsible individuals, managers and personals.

### **5- Disaster and Emergency Plans**

“Special Provincial Administration Law” enumerated as 5302, “Municipality Law” as 5393 and “Metropolitan Municipality Law” as 5216 entails special provincial administrations and municipalities to be protected from the natural disasters or to make disaster and emergency plans to mitigate the hazardous effects, to carry out the public education actions, to prepare the necessary equipment and equipages. Our center provides consultancy service for the preparation of Disaster and Emergency Plans that Special Provincial Administrations, Metropolitan Municipalities and other municipalities are obliged to prepare.

### **6- Repair and Retrofitting Studies**

For the repair/retrofitting of many public and private buildings there conducted several studies and produced as-built projects after Dinar (1995), Adana-Ceyhan (1998), Marmara (1999) earthquakes.

#### **h. SÜLEYMAN DEMİREL UNIVERSITY EARTHQUAKE & GEOTECHNICAL RESEARCH CENTER**

<http://mmf.sdu.edu.tr/bolumler/jeofizik>



Earthquake and Geotechnical Research Centre was established in 1996, for the purpose of observing earthquakes, by SDU and Potsdam University. The center has supports in a multidisciplinary earthquake research center providing graduate education in three departments Geophysics, Geology and Civil engineering.

The center has provides seismological observation in lakes region and also has four seismological station with on-line connection in same area.

#### **Equipment**

- Micro Gravity -Scintrex CG-5
- Elektro Magnetic - Geonics-EM34
- Magnetometer - Scintrex SM5 Cesium NAVMAG
- Multi – electrode Resistivity- GF Instrument (48 elektrot)
- GPR - MALA
- Ultrasonic P-S - NDT Instruments
- TotalStation - Leica TPS 400
- Spectrometer - Gf Instrument

## **PROJECTS**

- Bakırlitepe TUBITAK National Observatory Station Investigations
- Geotechnical Study of the Municipality of Antalya Storey Car Park
- Geotechnical Study of the Municipality of Isparta Storey Car Park
- Elmalı, Eşen Hydroelectric Power Plant Geotechnical Investigations
- Golcuk Naval Base Residential Area Geotechnical Investigations
- Burdur City Centre and the nearby settlement of Conformity Assessment of Environment
- Geotechnical Study of Denizli Province
- Gravity Investigation of Crustal Structure Study on the Aegean Region (Project owner:Dokuz Eylul University ).



**i. İSTANBUL UNIVERSITY FACULTY OF ENGINEERING DEPARTMENT  
OF GEOPHYSICAL ENGINEERING**

<http://www.istanbul.edu.tr/eng/jfm>



**j. YILDIZ TECHNICAL UNIVERSITY NATURAL SCIENCES RESEARCH  
CENTER**

<http://www.dogabilimleri.yildiz.edu.tr>



**VISION :**

- a- To study multidisciplinary for earthsciences
- b- Geological and geophysical geodesy approaching to internal issues of dynamic earth such as crustal deformations and earthquake, tsunami, subsidence, volcanoes etc.
- c- Geologic and geomorphologic approaching to external issues of dynamic earth such as mass movements, flood, erosion, hydrologic issues, coastal and environmental issues
- d- Coastal management
- e- Disaster management

**MISSION :**

- a- To establish data bank for studies mentioned above

- b- to give a scientific support and contribution to younger scientists
- c- to give a contribution to global science
- d- presentation of data to international scientific communities with publications, presentations, conferences etc. for criticism, discussion
- e- to find domestic and abroad partnership for earthscience projects

**k. SAKARYA UNIVERSITY FACULTY OF ENGINEERING DEPARTMENT  
OF GEOPHYSICS**

<http://www.jfm.sakarya.edu.tr>



Department of Geophysics of the Sakarya University was established in 1997 under the Faculty of Engineering. Following the acceptance of students to the department, teaching for the BSc and MSc degrees in Geophysics commenced in 2001-2002 academic year. Besides the daytime teaching program, the night-time teaching program started in the 2004-2005 academic year and the first graduate degrees were given in the same academic year. PhD degree program in the department was activated in the 2008-2009 academic year.

Presently, there are two undergraduate programs: Day and Evening Programs in the Department of Geophysical Engineering. First graduates obtained their degrees at the end of the 2004-2005 Academic Year from the Day Program and at the end of the 2007-2008 Academic Year from the Evening program. Currently there are 10 Faculty members and 7 researchers in the Department of Geophysical Engineering. There are 409 undergraduate students in the department. 268 of them are enrolled in the Day Program and 141 of them are enrolled in the Evening Program. There is also a Graduate program that grants MSc and PhD degrees. There are 76 MSc and 8 PhD students enrolled in the Department of Geophysical Engineering.

Program	Female	Male
Day Program	73	195
Evening Program	27	114
<b>Total</b>	<b>100</b>	<b>309</b>
<b>Total Student Enrollment</b>		<b>409</b>

#### SOME ACTIVITIES OF THE DEPARTMENT OF GEOPHYSICAL ENGINEERING (2011-2014)

- ✓ Earthquake Monitoring And Research Center (EMARC-DIVAM)

##### SAU-1 Seismic Station

Sakarya University Seismic Station (SAU-1) was established jointly by the Sakarya University, Department of Geophysical Engineering and the Boğaziçi University, Kandilli Observatory and Earthquake Research Institute on February 7, 2012 within the Sakarya University Campus.

The SAU-1 Seismic Station is equipped with one broadband (Güralp CMG 6T) seismometer and one strong ground motion (Güralp CMG 5T) accelerometer.

## PROJECTS

- ✓ International Projects

1	EMME- Earthquake Model of Middle East region: Hazard, Risk Assessment, Economics and Mitigation Uluslar arası araştırma projesi, Aktif Faylar ve Sismik Zonlar Koordinatörü (Prof. Dr. Levent GÜLEN) ve Türkiye kısmı sorumluluğu (Prof. Dr. Levent GÜLEN, Doç.Dr. Murat UTKUCU, Yrd. Doç. Dr. Mehmet Dinçer KÖKSAL, Araş.Gör. Hilal DOMAÇ ve Yüksek Lisans öğrencisi Yiğit İNCE)
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2	GEM- Global Earthquake Model, Uluslararası araştırma projesi, (Prof. Dr. Levent GÜLEN)
3	Central Asian Seismic Research Initiative, Uluslararası araştırma projesi, (Prof. Dr. Levent GÜLEN)
4	Extension of the CAUSIN Study into Central Asia, Uluslararası araştırma projesi, (Prof. Dr. Levent GÜLEN)
5	Caucasus Seismic Initiative Network, Uluslararası araştırma projesi, (Prof. Dr. Levent GÜLEN)
6	

### ✓ National Projects ( DPT – TÜBİTAK )

1	"Sapanca gölünün ayrıntılı batimetri, genç çökel istifi, aktif yapısal unsurları vasıtasıyla yakın bölgesinin sismojenik davranışının incelenmesi", Turkish National Geodetic and Geophysical Union, Proje Yürütücüsü: Prof. Dr. Levent GÜLEN
2	Kıbrıs ve Civar Bölgelerindeki Deprem Tehlikesinin Tespit Edilmesi TÜBİTAK-109Y346 Danışman: Prof. Dr. Levent GÜLEN, Araştırmacı: Araş.Gör. Hilal DOMAÇ

### ✓ SAU-BAP Projects

1	Horasan, G., Yıldırım, E., Budakoğlu, E., Küyük, H.S., Kırtel, O., Akbaş, E., "Sakarya Üniversitesi Esentepe Kampüsü ve yakın çevresinin yerel zemin özelliklerinin belirlenmesi" Proje No:2010-01-14-004, Başlama Tarihi: Jul 1 2010, Bitiş Tarihi: 2013, Toplam Bütçe:24000.
2	Hakan YAKUT, Filiz ERTUĞRAL, Zemin ZENGİNERLER, Emre TABAR, Eray YILDIRIM, "Kuzey Anadolu Fay Hattının Geçtiği Sapanca ve Çevresindeki Radon Konsantrasyonunun Belirlenmesi ve Bölgedeki Tektonik Hareketlerle İlişkilendirilmesi" Proje No: 2012-02-02-007, Başlama Tarihi: May 15, Bitiş Tarihi: 2014, Toplam Bütçe:22000.
3	Mustafa KUTANIŞ, Murat UTKUCU, Kemal BEYEN, İhsan Engin BAL, Ahmet Turan ÖZCERİT "Sakarya'da önemli Yapıların Bir Deprem Sonrası Yapı Güvenliğinin Yapı Tanılama Yöntemleriyle Belirlenmesi" ,, Proje No: , Başlama Tarihi: Oca 2 2012 12:00:00:000ÖÖ, Bitiş Tarihi: Oca 2 2014 12:00:00:000ÖÖ, Toplam Bütçe:45000
4	Murat UTKUCU, Doğan KALAFAT, Hilal YALÇIN "Sakarya ve yakın çevresi için depremsellik parametrelerinin uzaysal dağılımı, deprem tehlikesi ve güncel bir deprem kataloğunun oluşturulması" ,, Proje No: , Başlama Tarihi: Oca 2 2012 12:00:00:000ÖÖ, Bitiş Tarihi: Tem 2 2013 12:00:00:000ÖÖ, Toplam Bütçe:15000

5	Levent GÜLEN, Hüseyin KALKAN, Berksoy YILMAZ, Yiğit İNCE "Sakarya İlinde Sismik Risk Analizi ve Türkiye'de Deprem Yapay-Patlama Ayrımı" ,, Proje No: , Başlama Tarihi: Oca 2 2012 12:00:00:000ÖÖ, Bitiş Tarihi: Oca 2 2014 12:00:00:000ÖÖ, Toplam Bütçe:20000
6	Gülen, L., Taşkın, H. ,Kubat, C "SAKARYA ACİL VE AFET KOORDİNASYON MERKEZİ (SAKOM) TASARIMI PROJESİ" ,, Proje No: , Başlama Tarihi: Eki 5 2011 12:00:00:000ÖÖ, Bitiş Tarihi: May 30 2012 12:00:00:000ÖÖ, Toplam Bütçe.
7	Levent GÜLEN, Yiğit İNCE "Deprem Mekanizma Çözümleri ve Uygulamaları" ,, Proje No: , Başlama Tarihi: Şub 20 2012 12:00:00:000ÖÖ, Bitiş Tarihi:, Toplam Bütçe:3000
8	Levent GÜLEN, Hilal YALÇIN "Türkiye ve Kafkasların depremselliğinin ve deprem tehlikesinin incelenmesi" ,, Proje No: 2011-50-01-035, Başlama Tarihi: Mar 29 2011 12:00:00:000ÖÖ, Bitiş Tarihi: Oca 1 1901 12:00:00:000ÖÖ, Toplam Bütçe: 3000
9	Mehmet Dinçer Köksal, Zeki Özcan, Burhan BARAKLI, Murat Utkucu, Özdemir Çetin, Oktay Gökçe, Esen Arpat, Ertan Pekşen, Peter Maeckel "Karlova Kavşağı'nın Fiziksel ve Matematiksel Modellenmesi", Proje No: , Başlama Tarihi: Oca 2 2012 12:00:00:000ÖÖ, Bitiş Tarihi: Ocak 2 2014 12:00:00:000ÖÖ, Toplam Bütçe:65000.
10	Can Karavul, Kian Pakzad, Sebastian Teuwsen, Jurgen Schultz, Fikret Kurnaz "Maden Sahalarının Hyperspectral Görüntülerle Araştırılması" ,, Proje No: 2013-01-14-001, Başlama Tarihi: Ara 31 2013 12:00:00:000ÖÖ, Bitiş Tarihi: Eki 31 2014 12:00:00:000ÖÖ, Toplam Bütçe: 7240

6	Project No: 2010-01-14-003. Sakarya Nehri ile Çark Deresi Arasındaki Bölgenin Sel ve Taşkın Tehlikesinin Belirlenmesi ve Risk Azaltma Sürecinin Tasarlanması, Coordinator: Dr. Mehmet Dinçer KÖKSAL, Researchers: Oktay GÖKÇE, Turgut ÖZTAŞ, Oya ARAPOĞLU, Continues.
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## PUBLICATIONS

### ✓ International Papers (SCI / SSCI )

1	Kuyuk, H.S., Yildirim, E., Dogan, E., Horasan, G., "Clustering Seismic Activities Using Linear and Nonlinear Discriminant Analysis", Journal of Earth Science, 25, 140-145, ISSN:1674-487X ,DOI: 10.1007/s12583-014-0406-x, FEB ,2014.
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<b>2</b>	Kalafat, D., Horasan, G., "A seismological view to Gökova region at Southwestern Turkey", International Journal of the Physical Sciences, Vol.7(30), 5143-5153, DOI: 10.5897/IJPS12.277, AUG, 2012.
<b>3</b>	Kuyuk, H. S., Yildirim, E., Dogan, E., Horasan, G., "Application of k-means and Gaussian mixture model for classification of seismic activities in Istanbul" ,Nonlinear Processes in Geophysics ,Vol. 19 ,pp. 411-419, ISSN:1023-5809 ,DOI: 10.5194/npg-19-411-2012 , 2012.
<b>4</b>	Ogutcu, Z, Horasan, G., Kalafat, D., "Investigation of microseismic activity sources in Konya and its vicinity, central Turkey", Natural Hazards ,Vol. 58 ,pp. 497-509, ISSN:0921-030X ,DOI: 10.1007/s11069-010-9683-6 , JUL , 2011.
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✓ **National Abstracts**

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2	Yalçın, H., Gülen, L., Çağnan, Z., Kalafat, D., 2012. Kıbrıs ve Yakın Çevresinin Depremselliği, TMMOB Jeoloji Mühendisleri Odası 65. Jeoloji Kurultayı, Ankara, 4-5
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16	Utkucu, M., Budakoğlu, E. Ve Gülen, L., "8 Mart 2010 Başyurt (Karakoçan) Depremi (Mw=6.0) Telesismik Kaynak Özellikleri: Sismotektonik Çıkarımlar" ,1. Türkiye Deprem Mühendisliği ve Sismoloji Konferansı, 11-14 Ekim,2011,ODTÜ – ANKARA
17	Yalçın, H., Kutanis, M., Özbayraktar, G., Bursa Şehri Yerel Tasarım Spektrumunun Olasılıksal Sismik Tehlike Analizi İle Elde Edilmesi, 2. Türkiye Deprem Mühendisliği ve Sismoloji Konferansı, 25-27 Eylül 2013,MKÜ, HATAY. (083 No’lu Bildiri)
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19	Ali SİLAHTAR ve Mehmet Zakir KANBUR, Zemin Sınıfı ve Tabakalaşmanın Remi(Kırılma-Mikrokırınım)Tekniği ile Beirlenmesi: Isparta, Çünür Örneği, 2. Türkiye Deprem Mühendisliği ve Sismoloji Konferansı 25-27 Eylül 2013 – MKÜ – HATAY
20	Ali SİLAHTAR ve Mehmet Zakir KANBUR,"Isparta Gölcük Bölgesindeki Sığ derinlikteki Jeolojik Birimlerin MASW Tekniği İle İncelenmesi" ,Türkiye 20. Uluslararası Jeofizik Kongre ve Sergisi, 25-27 Kasım,2013,Antalya.

## 1. KOCAELI UNIVERSITY FACULTY OF ENGINEERING DEPARTMENT OF GEOPHYSICS

<http://jeofizik.kocaeli.edu.tr>



The department of geophysical engineering was founded in 1979 under the Kocaeli State architecture-engineering academy. Education started in 1980 in our department. In 1982, the department joined the engineering faculty of Yıldız University. The first student group graduated from the department in 1984. With the establishment of Kocaeli University in 1992, the department became a part of the engineering faculty. Evening program (night schedule) started in 1992. Totally 582 undergraduate students are currently going on their education in our department. The department has greatly been developed with respect to the quality of our academic staff, education, and research facilities since 1979. In Earth and Space Sciences Research Center (YUBAM), our academic personnel successfully continue their research in an effective manner about earthquake, seismology etc. The total number of academic staff working in our department is now 20, including 4 professors, 8 assistant professors, 8 research assistants, and 1 specialist.

Seismic risk of Istanbul and its surrounding area has increased right after the 1999 earthquakes and many speculations have been published in the media about forthcoming events. In order to have enough information about forthcoming earthquakes, a seismic network should be installed and operated continuously via online communication. Researchers at the Research Center of Earth and Space Sciences of Kocaeli University (YUBAM), in cooperation with the scientists from GFZ (GeoForschungZentrum), installed a local seismic network consisting of 25 seismic stations to monitor micro-earthquake activities of the mid-Marmara region and collect information for the next probable large earthquake in this region.

The network which is called ARNET is the densest local network with the highest number of seismic stations in Turkey and covers the districts Yalova-Armutlu-Gemlik and its surrounding areas. It is also the biggest seismic network operated by universities in Turkey with its 25 seismic stations. The map below shows the distribution of ARNET seismic stations. This network was initially set up as a 10-station local network in September 2005 and the number of the stations reached 25 during the years 2006 and 2007. Recently, 15 stations of this network have been connected to the data centre on Umuttepe Campus of Kocaeli University via online communication systems and micro-earthquake activities occurring in the Marmara Region have started to be recorded at our data centre.

The network has many specifications with the most dense and largest number of seismic stations, and one of the stations located in 25 different sites has a borehole seismometer at 100 m depth, 15 broadband seismometers and 10 short period seismometers. In addition, six accelerometers have been installed nearby faults and densely-populated areas in order to monitor acceleration of mid-size and large earthquakes. Since the region being monitored is characterized by geothermal activity and higher tectonic deformation, we have also installed geochemical sensors to the cold and hot water well stations for pressure changes, conductivity, temperature changes and leveling in order to understand the relation between

micro-earthquake activities with hydrothermal potential. This observation will enable us to catch some geochemical precursory phenomena noticed prior to some large earthquakes during earthquake prediction studies. These observations will enable us to study possible interactions between earthquakes and the fluids with special focus on earthquake-related pore-pressure variations in geothermal systems. These observations are conducted at 22 different locations of the study area and Bursa city. At each site, different kinds of geochemical parameters are being monitored. Geochemical observations are conducted together with the Kandilli Observatory and Earthquake Research Institute.

Offline and online data is recorded with the updated software at our center (YUBAM), and data processing is automatically and manually realized by our researchers and students. The data obtained by ARNET is used for education and research purposes and conducting different kinds of researches on Seismology. The information and some of the results obtained from ARNET data has been submitted and shared in several international symposiums, workshops and conferences. At present, the data of the network is under process in different scientific studies. Among some of these studies are 3-dimensional seismic tomography, local stress distribution analysis, recognition of seismicity patterns, moment tensor analysis and accurate seismic event location techniques.



Figure 1. Seismic Network of Kocaeli University.

## Working Groups

- Earthquake Working Group
- Disaster Working Group
- Applied Geophysics and Soil Working Group
- Remote Sensing and Geographical Information System Working Group

## PROJECTS

- Seismic Microzonation of İzmit and Surrounding of İzmit based on Global Information System(GIS)...
- Determining the Fault and Lineament Structure of İzmit and Surrounding of İzmit by Using Satellite Data...
- Earthquake activity of Yalova and Armutlu Region...

## PUBLICATIONS

### SCI PUBLICATIONS

- 1- **Tunç, B.**, D. Çaka, T. S. Irmak, H. Woith, S. Tunç, Ş. Barış, M. F. Özer, B.-G. Lühr, E. Gunther, H. Grosser, J. Zschau (2011), The Armutlu Network: an investigation into the seismotectonic setting of Armutlu-Yalova-Gemlik and the surrounding regions, *Annals of Geophysics*, 54, 1, 2011; doi:10.4401/ag-4877.
- 2- **Ulutaş, E.**, Coruk, Ö., and Karakas, A. 2011. A study of residuals for strong ground motions in Adapazarı Basin, Nw Turkey, by Ground Motion Prediction Equations (GMPEs), *Stud. Geophys. Geod.*, 55 , 213-240.
- 3- **Ergin ULUTAŞ**, Comparison of the seafloor displacement from uniform and non-uniform slipmodels on tsunami simulation of the 2011 Tohoku-Oki earthquake- *Journal of Asian Earth sciences* 52 (2013) 568-585
- 4- Yoshimori Honkura, Naoto Oshiman, Masaki Matsushima, **Şerif Barış**, Mustafa Kemal Tunçer, Sabri Bülent Tank, Cengiz Çelik&Elif Tolak Çiftçi, Rapid changes in the electrical state of the 1999 İzmit earthquake rupture zone.
- 5- J. Kinscher, F. Krüger, H. Woith, B.G. Lühr, E. Hintersberger, T.S.Irmak, **S.Baris**, Seismotectonics of the Armutlu peninsula ( Marmara Sea, NW Turkey) from geological field observation and regional moment tensor inversion. *Tectonophysics* 608 (2013) 980-995.
- 6- **Ulutas, E.**, 2012. Comparison of the seafloor displacement from uniform and non-uniform slip models on tsunami simulation of the 2011 Tohoku–Oki earthquake. *Journal of Asian Earth Sciences*, <http://dx.doi.org/10.1016/j.jseaes.2012.11.007>.
- 7- **Ulutas, E.**, Inan, A., Annunziato, A., 2012. Web-based tsunami early warning system: a case study of the 2010 Kepulauan Mentawai earthquake and tsunami. *Natural Hazards and Earth System Sciences* 12, 1855–1871, <http://dx.doi.org/10.5194/nhess-12-1855-2012>.
- 8- Oruç, B., 2013. Structural Interpretation of the Erzurum Basin, eastern Turkey, using curvature gravity gradient tensor and gravity inversion of basement relief. v.88, p.105-113. (Available online 5 November 2012).
- 9- **Irmak, T.S.**, Bülent Doğan and Ahmet Karakaş, 2012, Source mechanism of the 23 October 2011 Van (Turkey) Earthquake ( $M_w=7.1$ ) and aftershocks with its tectonic implications, *Earth, Planets and Space*, doi:10.5047/eps.2012.05.002.
- 10- Sertçelik, F., 2012. Estimation of Coda Wave Attenuation in the East Anatolia Fault Zone, Turkey, *Pure and Applied Geophysics Volume* 169,7, pp 1189-1204.
- 11- Köseoğlu, A., N.M. Özel, **Ş. Barış**, S.B.Üçer, L. Ottemöller, Spectral determination of source parameters in the Marmara Region.

### ABSTRACTS

- 1- **Ulutaş, E.**, 2012. The 2011 Off the Pacific coasts of Tohoku-Oki earthquake and tsunami: Influence of the source characteristics on the maximum tsunami heights, One Year after 2011 Great East Japan Earthquake - International Symposium on Engineering Lessons Learned from the Giant Earthquake, March 3-4, Tokyo, Japan, Proceedings book, 2012-03.
- 2- **Ulutaş, E.**, Coruk, Ö., Karakaş, A., 2012. Determination of soil amplification and predominant period in Düzce basin, Istanbul 2012 International Geophysical Conference and Oil & GasExhibition, September 17-19, Istanbul, Turkey, Proceedings CD, ID:195.
- 3- Ulutaş, E., The 27 February 2010 Maule, Chile Tsunami: Fault Rupture Area, InitialHeight and Propagation, 25-27 November 2013 – Antalya
- 4- Oruç, B., David Gomez-Ortiz, **Fadime Sertçelik**- Estimation of Effective Elastic Thickness of Litosphere from Litosphere from Bouguer Coherence Analysis of Eastern Anatolian and Surrounding Region- The 20 th International Geophysical Congress& Exhibition of Turkey,25-27 November 2013-Antalya.
- 5- Güleröğlu, M., **Fadime Sertçelik**- Frequency Dependent Attenuation of S and Coda Waves in Van surrounding- The 20 th International Geophysical Congress& Exhibition of Turkey,25-27 November 2013-Antalya
- 6- **Yavuz, E.**, Emrah Budakoğlu, Murat Utkucu 2013, 23 Ekim 2011 Van depreminin ( $M_w=7.1$ ) *P* Dalgası İlk Hareket Verilerinden Bulunan Odak Mekanizma Çözümü 25-27 Kasım 2013- Antalya
- 7- **Livaoglu, H.**, T. Serkan IRMAK, Mithat Fırat ÖZER, i. Talih GÜVEN, Mikrotremor Yöntemi ile Kocaeli-Değirmendere Hakim Frekans-Sediman Kalınlığı Ampirik İlişkisi: İlk Sonuçlar 25-27 Kasım 2013 – Antalya
- 8- Tunç, B., Tunç, S., **Çaka, D.**, 2012. “Practical Local Magnitude Calculation for Local Network”, AmericanGeologicalUnion (AGU), 3-9 Aralık, San Francisco, USA.
- 9- Tunç, S., Tunç, B., **Çaka, D.**, Ada, S., 2012. Rademacher, H., “Does Broad-Band Seismometer Clip?”, AmericanGeologicalUnion (AGU), 3-9 Aralık, San Francisco, USA.
- 10- **Tunç, B.**, D. Çaka, S. Tunc, T. S. Irmak, H. Woith, Ş. Barış, M. F. Özer, B.-G. Lühr, (2011), Three Dimensional Velocity Structure and Tectonic Features of Armutlu Peninsula, AGU Fall Meeting 2011, 05-09 December 2011, San Francisco, California, USA.
- 11- **Tunc B.**, D. Çaka, S. Tunc, H. Woith, Ş. Barış, B.-G. Lühr, M. F. Özer, T. S. Irmak, E. Günther (2011), Three Dimensional Velocity Structure of the Armutlu Peninsula, EGU General Assembly 2011, 03-08 April 2011, Vienna.
- 12- **Yavuz, E.**, G. Altun, G. Horasan, Sakarya Üniversitesi deprem kayıt istasyonuna ait süreye bağlı büyüklük hesabı. 2013 Türkiye Deprem mühendisliği ve Sismoloji konferansı 25-27 Eylül 2013 MKÜ – HATAY
- 13- **Irmak, T.S.**, Bülent Doğan ve Ahmet Karakaş, 2012, 23 Ekim 2011 Van Depremi ( $M_w=7.1$ ) ve Artçıların Kaynak ve Yırtılma Özellikleri ve Tektonik Anlamı, Aktif Tektonik Grubu 16. Çalıştayı, 18-19 Ekim İstanbul.
- 14- Doğan, B., **T.Serkan Irmak** ve Ahmet Karakaş, 2012, 10 Haziran 2012 Fethiye (Oniki Adalar) Depremi ve Artçıların Kaynak ve Yırtılma Özellikleri ve Tektonik Anlamı, Aktif Tektonik Grubu 16. Çalıştayı, 18-19 Ekim İstanbul.
- 15- Şahin, Y.E., ve **T.Serkan Irmak**, 2012, Denizli Grabeninin Sismotektoniği, Aktif Tektonik Grubu 16. Çalıştayı, 18-19 Ekim İstanbul
- 16- **Tunç, B.**, D. Çaka, S. Irmak, H. Woith, Ş. Barış, M. F., Özer, B. Lühr, E. Günther, H. Grosser, J. Zschau (2011), Armutlu Sismik Ağı (ARNET) ve Armutlu-Yalova-Gemlik çevresinin tektonik özellikleri, 1. Türkiye Deprem Mühendisliği ve Sismoloji Konferansı, 11-14 Ekim 2011 – ODTÜ, Ankara.
- 17- **Irmak T. Serkan**, Tunç, B., D. Çaka, S. Tunç, B. B. Akşahin, H. Woith, Ş. Barış, M. F., Özer, B. Lühr, E. Günther, J. Zschau (2011), Armutlu Sismik Ağı Geniş Band Gürültü Analizi, 1. Türkiye Deprem Mühendisliği ve Sismoloji Konferansı, 11-14 Ekim 2011 – ODTÜ, Ankara



- 18- **Tunç, B.**, D. Çaka, S. Irmak, H. Woith, S. Tunç, Ş. Barış, M. F., Özer, B. Lühr, E. Günther, H. Grosser, J. Zschau (2011), Armutlu Deprem Ağı (ARNET) ve Doğu Marmara'nın Güncel Depremselliği, 2011 Kocaeli Kent Sempozyumu, 06-08 Mayıs 2011 – Kocaeli.
- 19- **IRMAK T. Serkan**, B. Tunç, D. Çaka, H. Woith, S. Tunç, Ş. Barış, M. F., Özer, B. Lühr, E. Günther, H. Grosser, J. Zschau (2011), Kocaeli ve Çevresinin Güncel Deprem Aktivitesi, 2011 Kocaeli Kent Sempozyumu, 06-08 Mayıs 2011 – Kocaeli.
- 20- Yalçın H., Çaka, D., **Tunç, B.**, Woith, H., Lühr, B., **Barış, Ş.** Çeşitli sismik ağ verileri kullanılarak Marmara bölgesi ve civarının güncel depremsellik durumu.- Aktif Tektonik Araştırma Grubu Çalıştayı ATAG 18/5-7 Kasım 2014.
- 21- **Ergin Ulutaş, Türker Yas**, Tuba Sönmez - Tsunami Simulation of the April 01, 2014 Chile Earthquake due to Preliminary Results of Point Source and Finite-Fault Source Models.
- 22- Elif Yeşim Kösten, Ahmet Kıvanç Kutluca, İsmail Talih Güven, Duygu Öztekin, Kevser Dağdelen, **Hamdullah Livaoğlu**, Tahir Serkan Irmak, Mithat Fırat Özer, Kentsel Dönüşüm Sürecinde “Kentsel Afet Risk Yönetimi’ne” Dair Kocaeli- Gölcük-Değirmendere Beldesi Üzerinden “Disiplinler Arası” Bir Yaklaşım.
- 23- Woith, Heiko; Wang, Rongjiang; Caka Deniz, T. Serkan; Tunc Berna; Luehr, Birger-G.; **Baris Serif**, EGU General Assembly 2014, held 27 April – 2 May, 2014 in Vienna, Austria, id.9586. Seismically induced pressure transients at geothermal reservoirs in the eastern Marmara region.
- 24- Sunbul, Fatih; Nalbant, Suleyman; **Baris Serif**; Steacy Sandy; McCloskey, John EGU General Assembly 2014, held 27 April – 2 May, 2014 in Vienna, Austria, id. 15342, Updated seismic hazard on East Anatolian Fault Zone, Turkey.

## SEMINARS, WORKSHOP AND MEETINGS

- 1- *Oruç. B*, **EFC 2011** Earthquake Forecasting Conference. Istanbul, Turkey (September 19-21, 2011).
- 2- **Ulutaş, E.**, 2011. Pre-defined earthquake source mechanism parameters for Tsunami Early Warning in Mediterranean Region, JRC-KRDAE Joint Tsunami Workshop, Bogazici University, Kandilli Observatory and Earthquake Research Institute, February 03, 2011, Istanbul, Turkey.
- 3- **Barış, Ş.**, Advanced Studies Institute on Seismological Research, Kuwait City, Kuwait, January 19-22, 2013
- 4- **Barış, Ş.**, Managing Waveform Data and Related Metadata for Seismic Networks, Kuwait City, Kuwait, January 14-18, 2013.

## PROJECSTS

- 1- Seventh Framework Programme Cooperation Environment, Project Number: FP7-ENV-2012, 308417, Marmara Supersite. 2012-2015.
- 2- Continuous monitoring microearthquake activity and interaction of hydrothermal activity and seismic activity in and around Yalova-Armutlu Region, Eastern Marmara Region-Turkey. (2006-2014)
- 3- Armutlu Yarımadası ve Çevresinin 3 Boyutlu Hız Yapısının Tomografi Yöntemi ile Belirlenmesi, Kocaeli Üniversitesi BAP Projesi, Proje No: 2011/005, (2011-2013).

- 4- Van ili ve çevresindeki aktif fayların geometrisinin, deformasyon biçimi ve kaynağının belirlenerek, bölgenin sismotektonik modelinin oluşturulması. Program Kodu: 1002 Proje No: 113Y303. (2012-2014)

**m. KARADENİZ TEKNİK ÜNİVERSİTESİ FAKÜLTESİ MÜHÜR FAKÜLTESİ  
DEPARTMENT OF GEOPHYSICS**

<http://www.muhsak.ktu.edu.tr/jeofizik>



Department of Geophysics of the Karadeniz Teknik University was established in 1970 under the Faculty of Engineering. Presently, academic staff of the department comprises 15 lecturer (as Professor, Assistant Professor and Associate Assistant Professor) and 6 research assistants.

**Working Groups**

- Applied Geophysics
- Seismology
- Physics Of The Earth's Interior

**n. KAHRAMANMARAŞ SÜTÇÜ İMAM UNIVERSITY FACULTY OF  
ENGINEERING DEPARTMENT OF GEOLOGY**

<http://www.ksu.edu.tr>



Kahramanmaraş region, North and East Anatolian fault system which were formed as simply described above are the principal resources of Turkey's seismic activity. Therefore, in between 2005-2008 years, an individual project supported by TÜBİTAK was carried out at Kahramanmaraş Sütçü İmam University. In this project, it is aimed to monitor geochemical parameters of spring waters as well as soil radon gas concentrations continuously in Gölbaşı-Türkoğlu and Türkoğlu-Antakya segments of Eastern Anatolian Fault Zone which are serious earthquake sources of Kahramanmaraş city and its surrounding areas. In this purpose, three stations for soil radon gas and three stations for spring water in total six stations were installed to collect some measurable data to examine the relationship between those measured data and the regional seismicity.

After 2007, a micro-seismology network that continuously monitor seismic activity along all the East Anatolian Fault System (DAFS) including Kahramanmaraş and its surroundings has been installed under the scope of TURDEP Project by the Scientific and Technological Research Council of Turkey-Marmara Research Centre (TÜBİTAK-MAM) and the TR Ministry of Public Works and Settlements General Directorate of Disaster Affairs (GDDA). With this network all of the quakes greater than 1 ( $M_L$ ) can be recorded in the region. Also, a large number of radon gas, GPS and the borehole tilt/strain measurement stations was established along the East Anatolian Fault in this project. All stations located in the area between Sürgü (Malatya) and Reyhanlı (Antakya) districts, has been monitoring under the responsibility of Kahramanmaraş Sütçü İmam University.

## o. GENERAL DIRECTORATE OF MINERAL RESEARCH AND EXPLORATION (MTA)

<http://www.mta.gov.tr>



### . General Directorate of MTA

General Directorate of Mineral Research and Exploration (MTA), which established in 22 June 1935 (Law No 2804), is a Public Corporation with the aim of conducting scientific and technological research on geology and mineral exploration. MTA corresponds to geological survey corporations in the Developed Countries with its task and properties of the researches. MTA, which is an institution tasked with making geological maps and solving the geological problems of Turkey, engages in scientific research related to earthquake and other natural disasters with geological origin since its establishment. MTA constitutes the basic data source for both reduce disaster losses before the earthquake and post-disaster planning and practices in the country with 80 years experience and knowledge of the archive is based on the geological data base and knowledge on active faults.

### 2. Ongoing Studies by the MTA Today

After the 1999 earthquakes, new projects have been implemented by the General Directorate of MTA with the aim of overcoming deficiencies of geological information infrastructure and active fault, also reducing the damage of the earthquake.

○ **Project of Updating the Active Fault Map of Turkey and the Active Fault Data Base Establishment:** The aim of the project, which launched in 2004 and completed in 2011, is updating the Active Fault Map of Turkey, which was published in 1992 with the purpose of more detailed earthquake hazard analysis in the light of present-day knowledge. Active faults on the lands of Turkey have been mapped in scale of 1:25.000 and created active fault data base under the project. Active fault maps have been produced in the project 1:250.000 and 1:1.000.000 scale map with explanatory book for users and publication of 1:250.000 scale maps also completed.

- **Projects of Geological Atlas of the Large Fault Zones:** These projects have been enacted by MTA in order to produce the geological maps of the major fault systems in Turkey. Within the scope of this research Geological Atlas of the North Anatolian Fault and East Anatolian Fault, which are the country's two largest strike-slip fault systems, were completed and published. Preparation of geological atlas of the Ecemiş fault is being carried out between the years 2009 and 2011.
- **Landslide Inventory Maps of Turkey:** In our country, after the earthquake landslide is a natural disaster causes the most life and property lose. Landslide areas also characterized as most effected weak grounds by earthquakes. Project of Landslide Inventory Maps of Turkey, which

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\* This report has been prepared in accordance with the decisions of TUSA-KDK 1 of 2011 meeting.

initiated to determine landslides across the country and to demonstrate the potential risk of it for use in planning and applications, was completed in 2007. Landslide survey was carried out on the 5547 pieces of 1/25.000 scale sheets and digitized map of landslide units in 2923 sheets under the projects. 1:500.000 scale 18 pieces Landslide Inventory Map of Turkey were published and offered to users at the end of 2009.

- **Determining Potential Land Use Studies:** In these studies, basic earth science data and properties of natural disaster are investigated to take advantage of regional land use planning. For this purpose, in the region researches are being carried out on topics such as geology, hydrogeology-hydrology, geomorphology, general engineering geology, seismicity, mass movements, determination of flood areas to benefit from planning of land use In this context, these studies have been completed for 49 cities in Turkey.

- **Marine Geology and Geophysics Researches:** MTA Sismik-1 Research Vessel, assumed an important role, was made earth science studies for different purposes in all the seas and territorial waters. In this context, projects are prepared with local and foreign universities. Thus, recognition of the seas surrounding the three sides of our country, determination of features and to determine the economically important natural resources are intended. MTA Sismik-1 Research Vessel, to be completed lifetime in 2003, was donated to Istanbul Technical University Faculty of Maritime for use maritime training activities. Under the General Directorate of MTA, the marine seismic surveys carried out in rented boats, and small vessels between the years 2003-2010. Marine research will continue with the MTA-Selen Boats, construction was completed in 2011. By 2015, planned to give a new seismic research vessel, MTA will continue to do research on the shallow and deep seas.

- **Investigation of Crustal Structure of Anatolia Northwest with Geophysical Methods:** Between 2006-2010, with MTA's proposal and support of Ankara University and Cumhuriyet University, "Investigation of Crustal Structure of Northwest Anatolia with Geophysical Methods" project was carried out. With this

aim 1) from gravity studies which done simultaneously together with MT (magneto telluric) measurements studies, adding detailed density distribution map of the region 2) with this data, creating geoelectric models and geodensity models, 3) carried out by the MTA, increase information in the working area of Turkey Regional Gravity Maps project, 4) providing information about geometry of deep faults at the updating “Updating the Active Fault Map of Turkey project” conducted by MTA Department of Geology, 5) by providing lacking information of deep crust structure at the earthquake studies for the researcher, in the international science area increase the competition.

**p. TÜBİTAK MAM EARTH AND MARINE SCIENCES INSTITUTE**

<http://www.mam.gov.tr/english/YDBE>



Earth and Marine Sciences Institute were first established in the year 1983 as Earth Sciences Division of Basic Sciences Research Institute. During the period from its foundation until 1996, it acquired experience and know-how in Earth Sciences and a strong infrastructure was built for measurement and evaluation. From 1996 until today, when it was directly connected to TUBITAK MRC Directorate, it defined its mission and vision in parallel to reorganization of Marmara Research Institute and carried out its studies. In the year 1998, it acquired the status of being a research institute connected to TUBITAK MRC Directorate.

Having the vision of being a Center of Excellence in research on active tectonics and underground resources areas countrywide and in our region and the mission of carrying out applied research in active tectonics and underground resources

focusing on social benefit by multidisciplinary approaches based on modeling and measurement and dissemination of information acquired by these researches. It inclined on the earth sciences problems awaiting solutions in the light of the progress in earth sciences in the world.

Emphasizing on being a customer oriented institute, its studies were concentrated on three different areas, namely Earthquake Processes, Geophysical Processes and Geochemical Processes. Its name was simplified to become Earth and Marine Sciences Institute at the start of year 2005.

## VISION

To become "A Center of Excellence" carrying out researches in the areas of active tectonics and the underground resources in Turkey and in the Region

## MISSION

To accomplish social benefit focused applied researches by multidisciplinary approaches based on measurement, monitoring and modeling in the areas of active tectonics and the underground resources and to provide dissemination of acquired know-how

## TARGETS

- To let information acquired through researches oriented toward geologic originating disasters to be used as a basis for disaster preparation planning in order to increase social welfare
- To raise public awareness and authorities on the geological processes related to Medical Geology by conducting multi-disciplinary pioneering researches
- To carry out researches in cooperation with the implementing organizations, on reevaluation of the petroleum and natural gas regions; in order to develop the limited hydrocarbon resources in Turkey
- To increase the number of experienced researchers in Earth Sciences areas where the Institute determines an R&D gap in order to accomplish social benefit focused studies at minimum financial cost to the public

## QUALITY POLICY

EMSI conforms to TUBITAK-MRC' s quality and environment policy, as formalized in its EN ISO 9001-2000 Quality Management System and 14000:2004 Environment Management certifications. As a consequence, EMSI ensures maximum benefit to all its stakeholders within Turkey and abroad, competing in the international arena as a pioneer research and technology institute performing applied research based on measurement, computer aided modeling and remote sensing with the target of sustainable progress at information, science and technology with its human resources.

**Earthquake Processes:**

- Earthquake seismology
- Seismic micro-zonation
- Crustal deformation and structure
- Earthquake risk studies
- Active tectonics

**Geophysical Processes**

- Seismic, gravity-magnetic, electric-electromagnetic data acquisition and processing
- Marine geophysics and sea bottom characterization techniques
- Geodetic applications

**Geologic and Geochemical Processes**

- Bio-geochemical and organic geochemical studies oriented towards environment and petroleum studies
- Petroleum, earth gas and coal gas research
- Hydro-geochemical studies
- Quantitative sedimentary basin analysis and modeling
- Medical geology application

**Techniques Applied**

- Space Geodesy - (GPS, InSAR)
- Remote Sensing
- Geographic Information Systems (GIS) Applications
- Inner earth Imaging Systems
- Deformation Monitoring Methods
- Seismic Modeling
- Tectonic and Geologic Mapping
- Well logs
- Organic Geochemistry and Organic Petrology
- Basin Modeling

**LABORATORIES**

- Environmental and Petroleum Geochemistry Laboratory (EPGL)
- Active Tectonics Research Laboratory

**COOPERATIONS**International

MIT, USA

Univ. of California, Berkeley, USA

Darmstadt University, Germany

CNRS, IPGP, France

Forschungszentrum Jülich, Germany

GEOMAR (Kiel Univ.), Germany



NATO, SACLANTCEN, Italy  
Academy of Sciences of Ukraine  
GeoEcomar (Romania)

#### National

General Directorate of Disasters Affairs  
General Directorate of Mineral Research & Exploration  
Turkish Coal Enterprises  
Turkish Petroleum Corporation  
Istanbul Metropolitan Municipality  
Kocaeli Metropolitan Municipality  
Turkish Navy  
General Commander of Mapping  
Boğaziçi University  
Cumhuriyet University  
Çukurova University  
Dicle University  
Dokuz Eylül University  
Ege University  
Eskişehir Osmangazi University  
Fırat University  
Hacettepe University  
İnönü University  
İstanbul Technical University  
Süleyman Demirel University  
Kahramanmaraş Sütçü İmam University  
Yıldız Technical University

## **PROJECTS**

- European Plate Observing System (EPOS)

Duration: 08.11.2010 – 31.12.2014

- Site Classification and Risk Evaluation for The Bursa Province

Duration: 01.01.2011 – 31.12.2013

- Processing Russian and European Earth Observations for Earthquake Precursors Studies (PRE-EARTHQUAKES)

Duration: 01.01.2011 – 31.12.2012

- SCHOOL SEISMOLOGY PROJECT (SİSMOKUL)

Duration: 18.08.2010 – 17.08.2012

- Determination of Underground Coal By Applying Integrated Seismic Methods And Investigation of Coalbed Gas Potential of Soma Tertiary Basin

Duration: 01.03.2009 – 31.08.2012

•Investigation of Possible Active Faults in Istanbul Land Area and Development of Landslide Determination and Monitoring Methodologies by Multidisciplinary Researches in Istanbul Metropolitan Area

Duration: 01.06.2009-30.05.2012

•National 1MV Accelerated Mass Spectroscopy (AMS) Laboratory

Duration: 01.01.2009 - 31.12.2012

**r. SİVAS CUMHURİYET UNIVERSITY FACULTY OF ENGINEERING  
DEPARTMENT OF GEOPHYSICS**

<http://www.cumhuriyet.edu.tr>



**s. HACETTEPE UNIVERSITY FACULTY OF ENGINEERING  
DEPARTMENT OF GEOLOGY**

<http://www.hacettepe.edu.tr/>



**t. İSTANBUL TECNİK UNİVERSİTY FACULTY OF ENGINEERING  
DEPARTMENT OF GEOPHYSICS**

<http://www.geop.itu.edu.tr>



### **Research Labs**

Prof.Dr. Nezihi CANITEZ Geophysical Data Processing Laboratory  
Applied Geophysics Laboratory  
Palaeomagnetism Laboratory  
Seismology Laboratory  
Computational Geophysics Laboratory

### **u. MIDDLE EAST TECHNICAL UNIVERSITY DISASTER MANAGEMENT IMPLEMENTATION AND RESEARCH CENTER**

<http://www.dmc.metu.edu.tr>



The Center was created in November 1997 under the UNDP cost-sharing project "Improvement of Turkey's Disaster Management System".

#### **Objectives:**

To provide consultancy and project support to domestic and international institutions with a multidisciplinary approach for mitigation of natural and manmade disasters.

To organise seminars, training courses, in-service training to officials or to community within the framework of disaster management.

Arrange research, implementation and improvement activities about disaster management.

Organise or assist to organise scientific and professional meetings about disaster management.

NATO Science for Peace Programme, Seismic Arrays in Turkey SfP977484 Science for Peace Programme, SfP977484: National Seismic Arrays in Turkey and

TUBITAK ICTAG1578: Construction of Strong Ground Motion Recording Arrays in Local Areas

Our Center has constructed three strong ground motion arrays in cooperation with General Directorate of Disaster Affairs Earthquake Research Department. A total of 38 ETNA type devices were installed with the support of NATO and TUBITAK.

## **RESEARCH**

Current :

- "Strengthening citizen participation in disaster management. Pilot project in Bursa".
- "A feasibility assessment of the amendments required in the existing disaster legislation concerning necessary changes."
- "Prepare pilot regional plans for disaster management."
- Estimation of Potential Seismic Losses in Erzincan (Turkey), Turkish Geophysical and Geodesy Union (TUJJB) Project, 2012- cont.

Completed :

- A round table meeting in December 1998 and December 1999.
- Turkish-Japanese international workshop on "Recent Earthquakes and Disaster Management in March 1999."
- Training of GDDA personnel in data management and access application.
- A seminar for the instructors in Civil Defence College about "Training of fire brigades in light search and rescue operation" by Joe Bishop.
- A seminar on citizen participation and social awareness by Joe Bishop.
- A seminar to the related agency personnel about the GIS Applications in Disaster Management in June 1999.
- Earthquake Symposium in March 2000.
- The Third Global Disaster Information Network Conference in April 2000.
- Earthquake Model of the Middle East- EMME Project, 2010- 2014.
- NERA (Network of European Research Infrastructures for Earthquake Risk Assessment and Mitigation, European Union Project, 2010- 2014.

## PUBLICATIONS

- A regional near-surface high frequency spectral attenuation ( $\kappa$ ) model for Northwestern Turkey, A. Askan, F.N. Sisman, O. Pekcan (2014). Soil Dynamics and Earthquake Engineering, 65, 113–125. doi: 10.1016/j.soildyn.2014.06.007
- Relationships between Felt Intensity and Recorded Ground-Motion Parameters for Turkey, M.Bilal and A. Askan (2014). Bulletin of the Seismological Society of America, 104 (1), 484–496, doi: 10.1785/0120130093.
- An alternative approach to the ground motion prediction problem by a non-parametric adaptive regression method, F. Yerlikaya-Özkurt, A.Askan and G.-W. Weber (2014). Engineering Optimization, 46 (12), 1651–1668, doi:10.1080/0305215X.2013.858141.
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**TURKISH NATIONAL UNION  
of  
GEODESY and GEOPHYSICS**

**NATIONAL REPORT  
VOLCANOLOGY AND CHEMISTRY OF THE EARTH'S INTERIOR  
COMMISSION OF  
TURKEY FOR 2011 - 2015**

**to be presented at the  
XXVI. GENERAL ASSEMBLY  
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22 JUNE - 02 JULY, 2015**

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**The Report of  
COMMISSION of VOLCANOLOGY and CHEMISTRY  
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**Prepared by : TAVCEI (TUVAK)**

**to be presented at the  
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2015**



## INTRODUCTION

The Turkish National Commission for Volcanology and Chemistry of the Earth's Interior (TAVCEI) had continued his work in the period between 2011-2014 on the coordination of the scientific studies on magmatology and geochemistry in Turkey.

The commission is sponsored and supported by the General Directorate of Mineral Research and Exploration (MTA), which corresponds to the Geological Survey in many countries. MTA not only provides the secretarial support but also the web-page of the Commission. The scientific efforts of the Commission are flanked by a considerable number of scientists from the Geology Departments of the leading Universities such as İstanbul Univ., İstanbul Technical Univ., Black Sea Univ., Selçuk Univ., Middle East Technical Univ., Hacettepe Univ., 9 Eylül Univ., Çukurova Univ. etc. From these about 100 scientists are actively involved in the sub-commissions and committees. A group of graduate students and young scientists are also implicated in the activities.

The goals of the Commission are;

- 1- to organize courses, summer-schools, work-shops, symposia and congresses on related topics,
- 2- to inform the public on the volcanogenic hazards
- 3- to provide basic knowledge on the igneous processes in the Earth's interior within the framework of popular science.
- 4- to coordinate the multi-disciplinary studies

The Sub-Commissions and Working Groups of TAVCEI are structured according to the popular issues in the country and include:

- 1- SC of Volcanology and Geothermal Energy
- 2- SC of Geochemistry
  - a- WG on Granitoids
  - b- WG on Ophiolites
  - c- WG on Alkaline magmatism
- 3- Isotope Geochemistry and Geochronology
  - a- WG for Data Bank of radiometric ages of plutonic rocks
  - b- WG for Data Bank of radiometric ages of volcanic rocks
- 4- Pyroclastic Deposits
- 5- Igneous Mineral Deposits
- 6- Data Bank on Geochemistry
- 7- Geological Heritage and Natural Monuments of igneous origin
- 8- Igneous Terminology in Turkish
- 9- WG for TAVCEI-Bulleten
- 10- WG for Documentation

In the following the Commission reports its activities and a list of related publications in the 2011-2014 interval.

Further activities of the TAVCEI can be seen on the following web-address of the Commission: **<http://www.mta.gov.tr/tuvak>**

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