TURKISH NATIONAL UNION OF GEODESY AND GEOPHYSICS

2007 – 2011 TERM REPORT
OF
TURKISH NATIONAL GEODESY COMMISSION

GENERAL COMMAND OF MAPPING
ANKARA
2011

Turkish National Geodesy Commission

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1. Introduction

Directing and promoting the scientific studies at 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. Although this resource is not used effectively now the studies for availing better conditions are carried on.

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 event 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 Mw >= 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.

TNGC's being successful and attaining its goals in the following term and its being a scientific community which will be found appropriate by the Turkish scientists of Geodesy and in which they would be active is our best wish.

2. 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.

3. 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 and strategies for next term activities

a. Reference Coordinate Systems Working Group

(1) Turkish National Fundamental GPS Network

Turkish National Fundamental GPS Network (TNFGN – TUTGA) has been established in 2001 (Figure 3.1) and some of the stations have been re-surveyed due to the earthquakes happened in 1999 with ongoing efforts of periodic observations since then. Definition of a national reference system called TUREF (Turkish National Reference Frame) is still in progress in coordination with the Turkish National Permanent GPS Network. Positional accuracies of the stations are about 1-3 cm whereas the relative accuracies are within the range of 0.1 - 0.01 ppm. Besides, the network has been connected to the Turkish Horizontal and Vertical Control Networks through overlapping stations and time-dependent coordinates of all stations are being computed in the context of the maintenance of the network with repeated GPS observations. Also appropriate models for coordinate transformation from ED-50 system into the WGS84 have been defined in the context of TUTGA. Detailed information about TUTGA can be found at official web of General Command of Mapping. Combining permanent and survey-type GPS measurements is still an on-going effort. Significant progress has been made and preliminary results were obtained.

The total number stations are about 682 and for each station 3D Coordinates and their associated velocities have been computed in ITRF2005.0 (Reference Epoch: 1998.0). Positional accuracy of the stations is about 1-3 cm whereas the relative accuracies are in the range of 0.01 ppm. Also, the network has been connected to the Turkish Conventional Horizontal and Vertical Control Networks through some points and time-dependent coordinates of all the stations are being computed in the context of the maintenance of the network with periodic GPS observations.

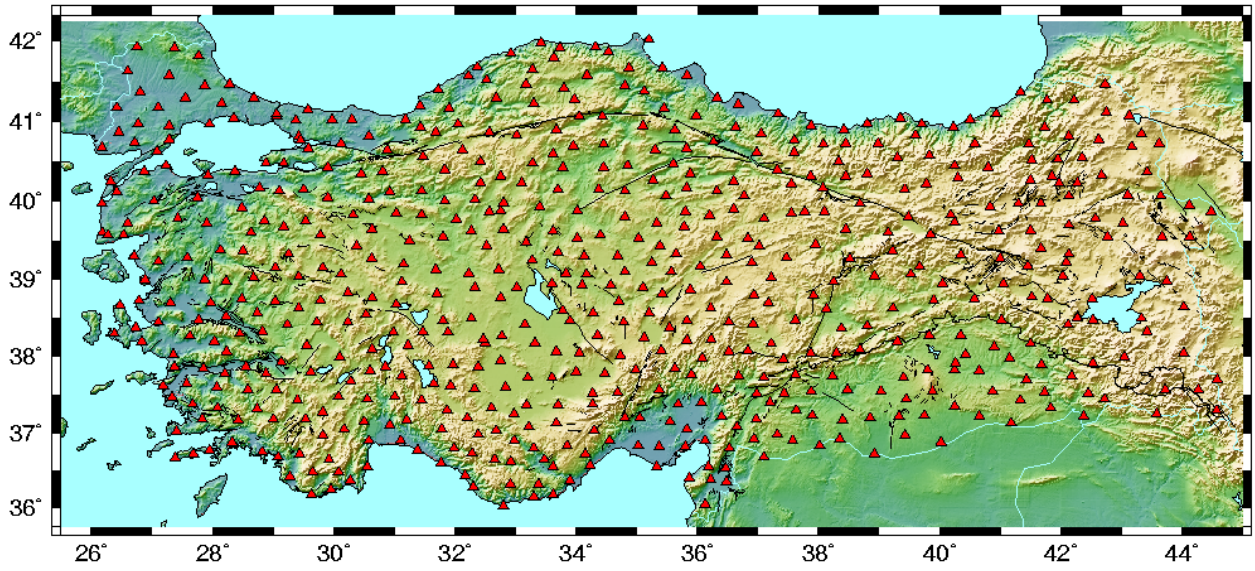

Figure 3.1. Distribution of TNFGN stations

Considering the on-going tectonic feature of the region, second period surveys of the great majority of the points have been completed in 2001, 2002 and 2003 and velocities have been estimated. Also appropriate models for coordinate transformation from ED-50 system into the WGS84 have defined in the context of TNFGN. Detailed information about TNFGN can be found in www.hgk.msb.gov.tr under the name TUTGA in Turkish.

The Turkish national reference system called TUREF (Turkish National Reference Frame) was defined so as to concide with ITRF-96 at epoch 2005.0 to provide backward compatibility. Positional accuracies of the stations are about 1-3 cm whereas the relative accuracies are within the range of 0.1 - 0.01 ppm. Besides, the network has been connected to the Turkish Horizontal and Vertical Control Networks through overlapping stations and time-dependent coordinates of all stations are being computed in the context of the maintenance of the network with repeated GPS observations. Also appropriate models for coordinate transformation from ED-50 system into the WGS84 have been defined in the context of TUTGA. Detailed information about TUTGA can be found at official web site of General Command of Mapping. Combining permanent and survey-type GPS measurements is still an on-going effort. Significant progress has been made and preliminary results were obtained.

(2) Turkish National Permanent GPS Network and Turkish National Permanent RTK Network

The Turkish Permanent GPS Network (TNPGN) is still growing up with the addition of new stations (Figure 3.2). The number of the sites forming TUSAGA is 25 as of 2010. Other than that of those stations, the data from 10 stations around Marmara Sea, established under a private project with TUBITAK Marmara Research Center (TUBITAK – MAM) is being utilized by scientific community. The time-series analyses of TNPGN stations are performed at General Command of Mapping on a daily basis. Collaborate works in and abroad Turkey for geodetic, geodynamic and engineering surveying purposes are increasingly contributing to the development of the static network. Furthermore, TNPGN stations are going to be utilized as geodetic control and for monitoring the crustal movements in geodynamical activities within their continuous data collection and analyses cycle.

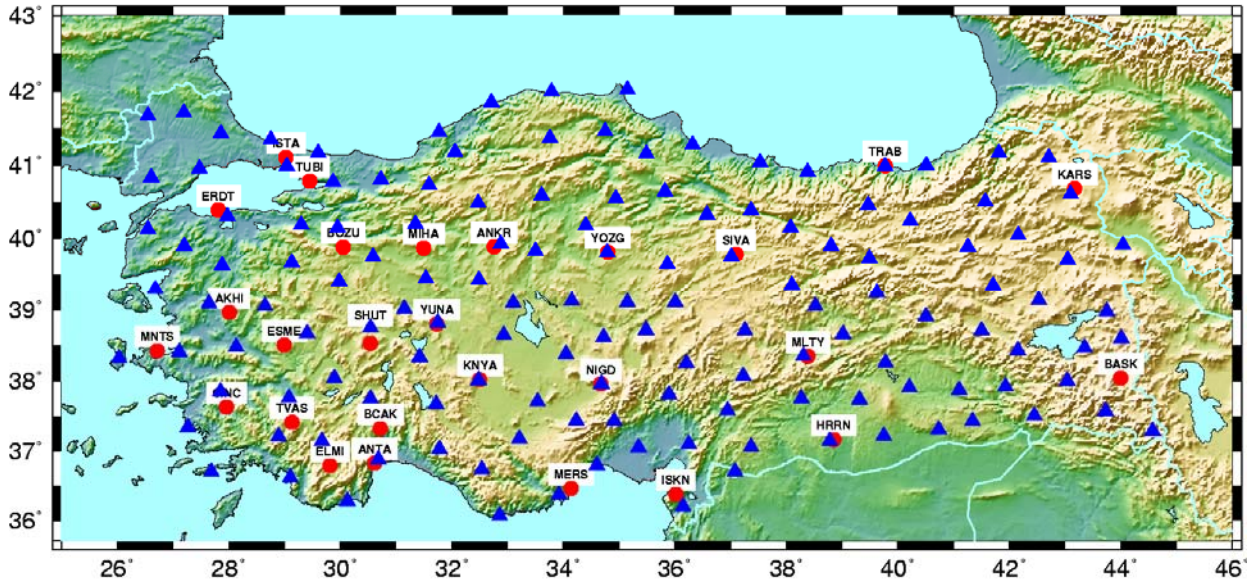

Figure 3.2. Distribution of TUSAGA and TUSAGA-Active stations (as of Jun 2008). Red Circles TPGN sites-25; BlueTriangles: TPGN-ACTIVE stations(144).

Although TUSAGA was preliminarily conceived as a static continuous network, intensive cadastral activities have led to establishing a RTK network which is supposed to cover the whole country. A RTK Network of 144 sites is financed by Turkish National Scientific and Technological Council) and İstanbul Culture University has taken over the responsibility of making the network fully operational by the end of 2008 under the supervision of General Command of Mapping and General Directorate of Registration and Cadastre. While the RTK Network is planned to serve the mapping community, daily GPS data also provides an indispensable tool for earth science community investigating the tectonic and seismic activity of a very active region like Anatolia and surroundings. The feasibility of TUSAGA for DGPS operations and a homogeneously distributed high-precision GPS network enable civilian end users to work at ease in variety of applications ranging from large-scale mapping, GIS and cadastral applications.

Particularly for the applications ranging from large-scale mapping, GIS and cadastral surveys, new project under the name TUSAGA-Active has been completed collaboratively with governmental institution and funded by TÜBİTAK. The stations serves as real-time kinematic basis enabling all users to get differentially corrected positional information as well as updated geoid and datum transformation parameters.

Additionally, more than half of the GPS stations were installed in meteorological parks of General Directorate of State Meteorology. Real-time derivation of Precipitable water (PW) data from TUSAGA provides an important input for short–term weather forecasting and the assimilation studies are on the way. GPS-Derived PW provides a spatial and temporal resolution of 80 km and 1 hour versus those provided by radiosonde stations 500 km and 12 hours. The Figure 3.3 show the consistency of PW estimates from GPS and radiosonde. The variability of PW during the disastrous flood event between 22-28 Ekim 2008 was also observed through TUSAGA network as shown in Figure 3.4.

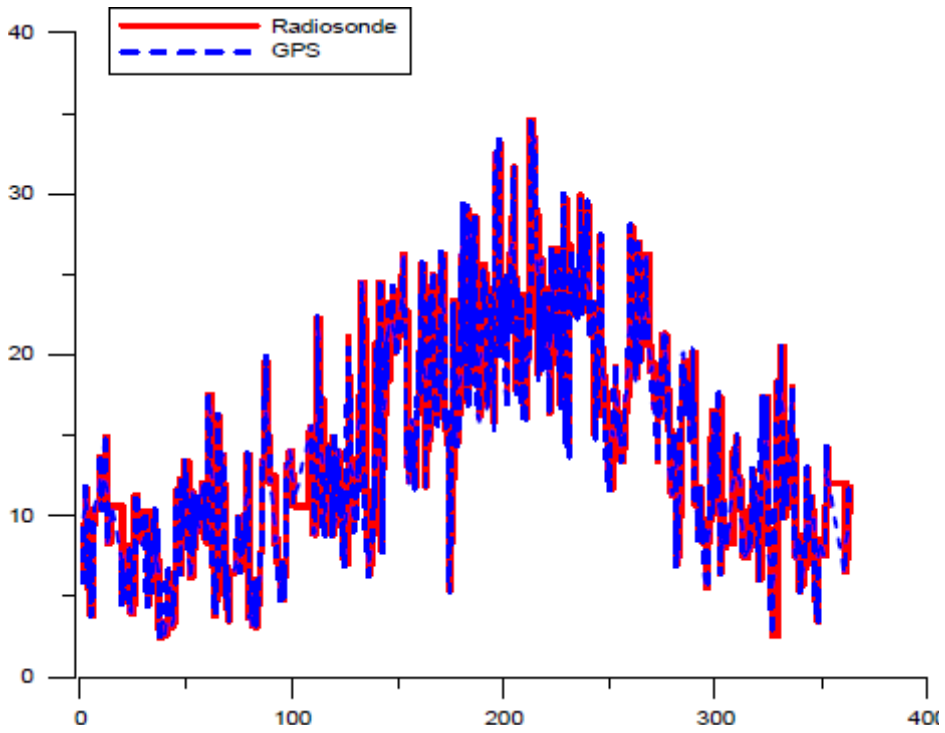

Figure 3.3. GPS-Derived PW estimates and radiosonde observations

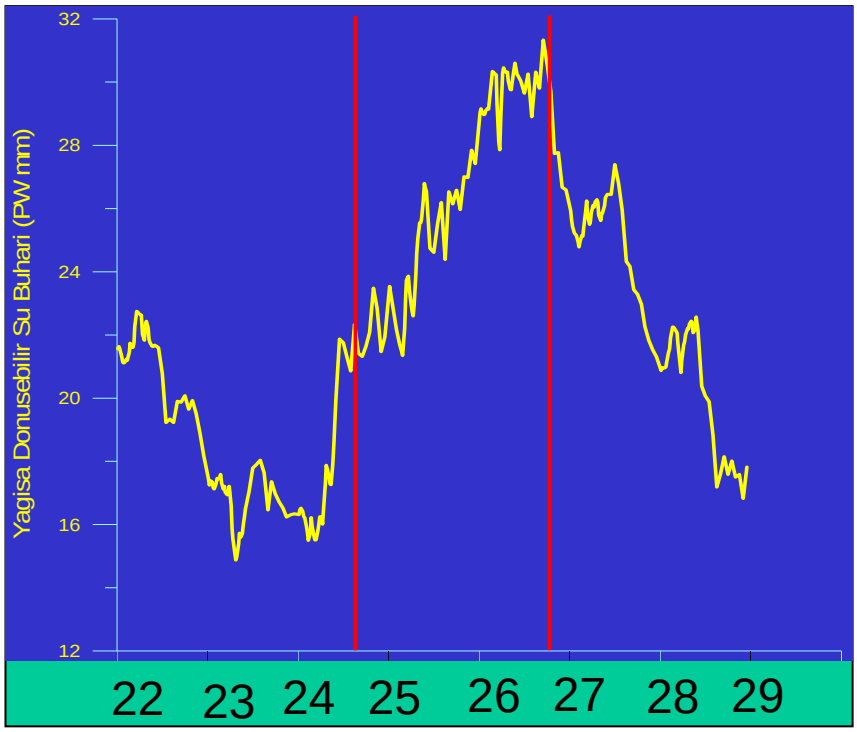

Figure 3.4. 22-28 October 2008 flood event as detected by GPS PW estimates

Another project was also initiated about the real-time determination of Total Electron Content. The project was formed with collaboration with Hacettepe and Bilkent Universities. The project consists of real-time determination of Total Electron Content and formation of a real-time ionospheric tomography. An example of two-dimensional gridded vertical total electron content values are shown in Figure 3.5.

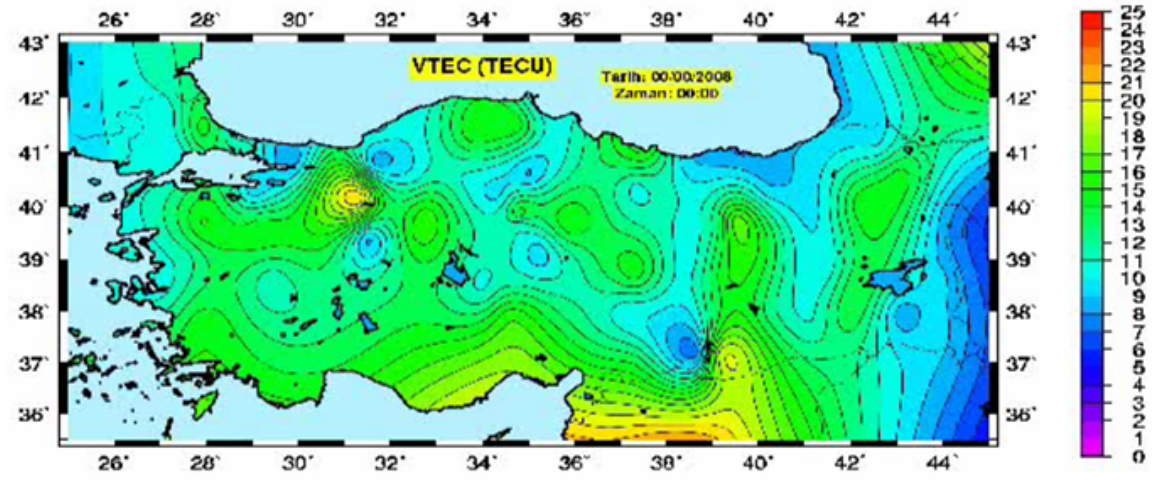

Figure 3.5. Vertical total electron content values at a specific epoch

System operations and computations of coordinate correction parameters are being held in control center established in General Command of Mapping. GNSS data collected at all stations are transferred to the control center via ADSL and GPRS/EDGE and correction parameters are transferred to the users in the filed after computed in these centers. RTK correction parameters which are in current RTCM and CMR+ communication formats are transferred to the rovers via GPRS and NTRIP. Within the Project, at present, transformation parameters which will be used for ED50/WGS-84 datum transformation are being computed.

For this purpose, GPS observations are being held at approximately 6000 ED50 points through Turkey.

GPS data collected at each site are processed via GAMIT/GLOBK V10.35 software in daily basis and coordinate time series are created. After that, these time series are examined for daily positional variations which can be caused by deformations including plate tectonics, earth's crust or other reasons.

(3) Turkish National Vertical Control Network (TUDKA)

Turkish National Vertical Control Network (TNVCN-99) was established with the adjustment of 243 lines of 25680 points with total length of 29316 km. This network includes 151 first and 41 second order lines measured between 1970 and 1993, and 7 first and 44 second order lines measured before 1970 (Figure 3.6). Vertical datum for TNVCN-99 is defined with arithmetic mean of instantaneous sea level measurements recorded at Antalya tide gauge between 1936 and 1971. In the adjustment, geopotential numbers were used as observations and geopotential numbers, Helmert orthometric heights and Molodensky normal heights at all points were calculated. Gravity values in modified Potsdam datum were used in calculating geopotential numbers. The adjustment results in precision of point heights varying from 0.3 cm to 9 cm depending on the distance from the datum point. Differences between TNVCN-99 Helmert orthometric heights and currently used Normal orthometric heights were found to be between –14 cm and +36.9 cm and mean value of it was found as +9.5 cm with standard deviation of ±8.4 cm. Correction value between two height systems at any point given with position can be calculated. Right after 17 August 1999 İzmit earthquake, in November 1999, in order to determine the vertical displacements in TNVCN-99, levelling line of 110 km re-measured in the region; Hersek – Karamürsel – Gölcük – İzmit – Adapazarı - Arifiye and Doğançay.

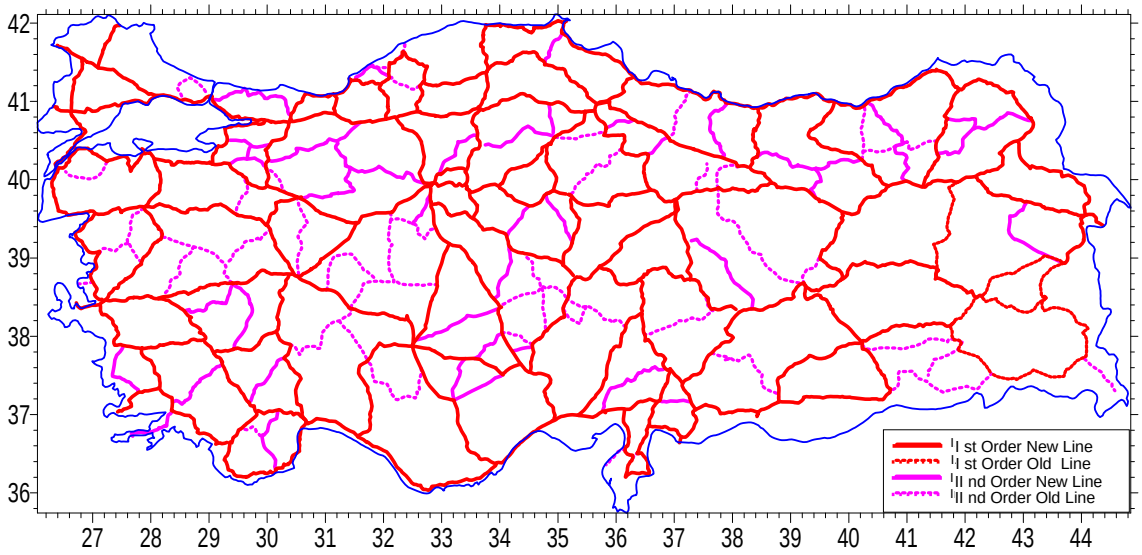

Figure 3.6. Turkish National Vertical Control Network (TNVCN)

(4) Turkish Sea Level Monitoring System (TUDES)

Many coastal countries deploy and operate tide gauges along their coasts to meet sea level related practical and scientific needs. Sea level observation stations (tide gauges) in

Turkey are established and operated by General Command of Mapping in order to determine the geodetic vertical datum precisely that is indispensible for mapping activities and meet the sea level data needs of scientific and engineering communities. Sea level observations have been carrying 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 Sytem (TUDES) has been established. At the present TUDES consists of one data center and 19 digital and automatic tide gauge stations shown in Figure 3.7.

- A data center located at Ankara,
- Iskenderun, Erdemli, Taşucu , Bozyazı and Antalya tide gauges at the Eastern Mediterranean Sea,
- Girne and Gazi Magusa tide gauges at Turkish Republic of Northern Cyprus,
- Aksaz, Bodrum, Menteş and Gökçeada tide gauges at the Aegean Sea,
- Erdek, Marmara Ereğlisi and Yalova tide gauges at the Sea of Marmara,
- İğneada, Şile, Amasra, Sinop and Trabzon tide gauges at the Black Sea.

Through TUDES project, General Command of Mapping aims to;

- Determine and improve vertical reference surfaces for heights and depths used in topographic, nautical and aeronautical charts,
- Connect the vertical datums of Anatolia, Thrace, Turkish Republic of Northern Cyprus and the other Turkish islands,
- Test the Turkish Geoid at tide gauges,
- Monitor sea level variations in time and space domain from tide gauge, satellite altimetry, GRACE, atmospheric and oceanographic data,
- Find out tidal characteristics and produce accurate tide information,
- Provide sea level data for natural hazards such as earthquake, tsunami, storm surges, and climate change studies.

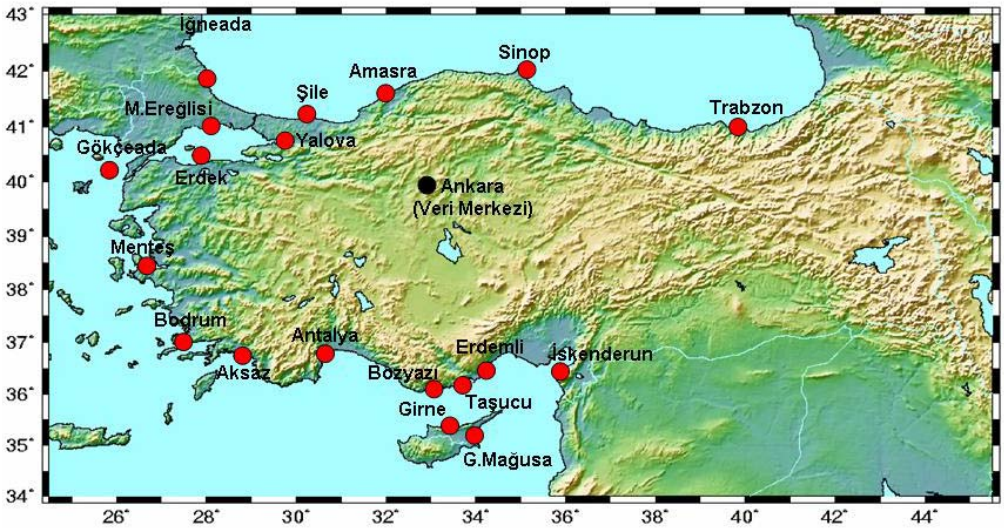

Figure 3.7. Locations of the existing tide gauge stations of TUDES

Sea level, atmospheric pressure, air temperature, relative humidity, wind speed and direction are measured with high accuracy at TUDES tide gauges and stored in dataloggers every 15 minutes interval and also hourly. Data stored in dataloggers at tide gauges are

transmitted to data center via GPRS. Collecting data from TUDES gauges, quality control and analysis processes 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 (land subsidence or land uplift). Periodic geodetic measurements such as GPS, continuous GPS, and precise leveling are carried out at all TUDES 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.

Since sea level changes are the main indicators of global climate change due to global warming, sea level data has gained importance in the climate change, oceanographic and meteorological studies for the investigation of the causes and the impact of climate change. In addition, tide gauge sea level data are used as complementary dataset to seismic and geophysical measurements for the tsunami early warning systems. General Command of Mapping takes part in;

- "Integrated Meteorology/Oceanography Network of Excellence (MOMA) Project" supported by The Scientific and Technological Research Council of Turkey (TUBITAK)
- Close collaboration with Bogazici University Kandilli Observatory and Earthquake Research Institute for "Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS) Project" ,
- "European Sea Level Service (ESEAS)".

b. Gravity Field Working Group

(1) Turkish Geoid-2009 (TG-09)

Turkish regional geoid models have been developed by employing a reference earth gravitational model, surface gravity observations and digital terrain models. The gravimetric geoid models provide a ready transformation from ellipsoidal heights to the orthometric heights through the use of GPS/leveling geoid heights determined through the national geodetic networks.

The recent gravimetric models for Turkish territory were computed depending on OSU91 (TG-91) and EGM96 (TG-03) earth gravitational models. The release of the Earth Gravitational Model 2008 (EGM08), the collection of new surface gravity observations (~266000), the advanced satellite altimetry-derived gravity over the sea (DNSC08), the availability of the high resolution digital terrain model (90m) and a larger number of GPS/leveling stations (~2700) have encouraged us to compute a new geoid model for Turkey. We used the 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 (TQG-09). Since the Helmert orthometric height system is adopted in Turkey, the quasi-geoid model (TQG-09) was then converted to the geoid model (TG-09) by making use of Bouguer gravity anomalies and digital terrain model. After all we combined gravimetric geoid model with GPS/leveling geoid heights in order to obtain a hybrid geoid model (THG-09) (or a transformation surface) to be used in GPS positioning applications (Figure 3.8). The RMS of the post-fit residuals after the combination was found to be ± 0.95

cm, which represents the internal precision of the final combination. And 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 ± 8.38 cm. which has not been achieved in Turkey until this study.

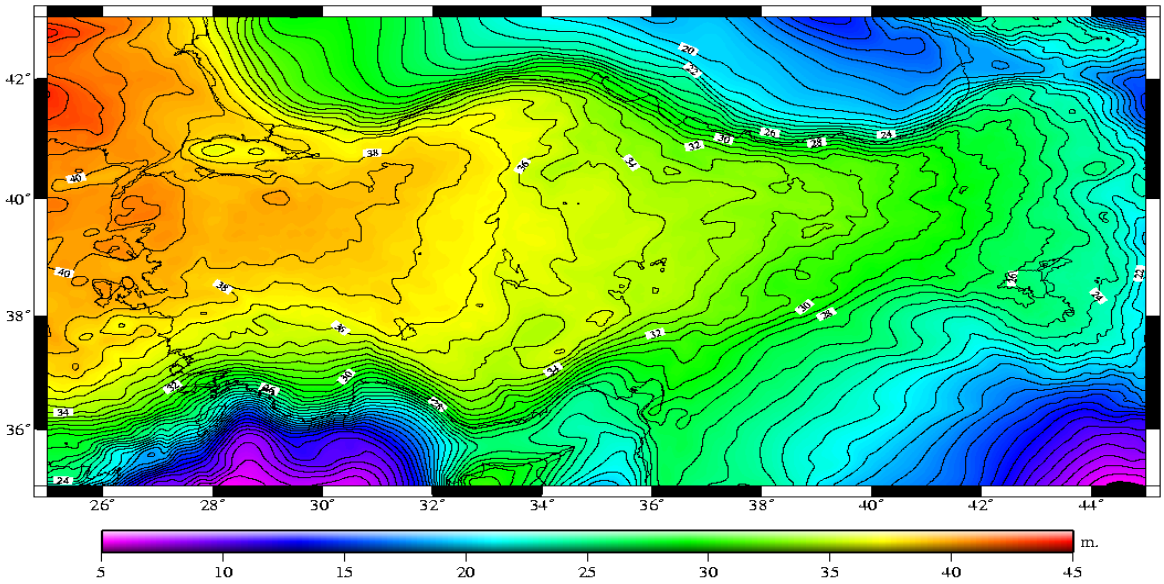

Figure 3.8. Turkish Geoid Model of Turkey (TG-09).

(2) Height Modernization Studies in Turkey

Studies of Turkish National Vertical Control Network (TUDKA) were started in 1935 by the establishment of Antalya tide gauge. By the year 1970, leveling between network points was finished. Between 1985 and 1992 new measurements were performed and adjustments studies were completed and it is named TUDKA-92. In 1999, network was adjusted after including additional leveling measurements.

General Command of Mapping has started a project for height modernization in Turkey. In this context achievement of the 1-cm Turkish geoid model, new, consistent, and precise surface gravity observations, airborne gravity especially in remote areas, vertical velocity field and deformations in the leveling network, more and stable GPS/leveling stations establishment, topographic density model, digital terrain model issues are being investigated.

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 3.9 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.

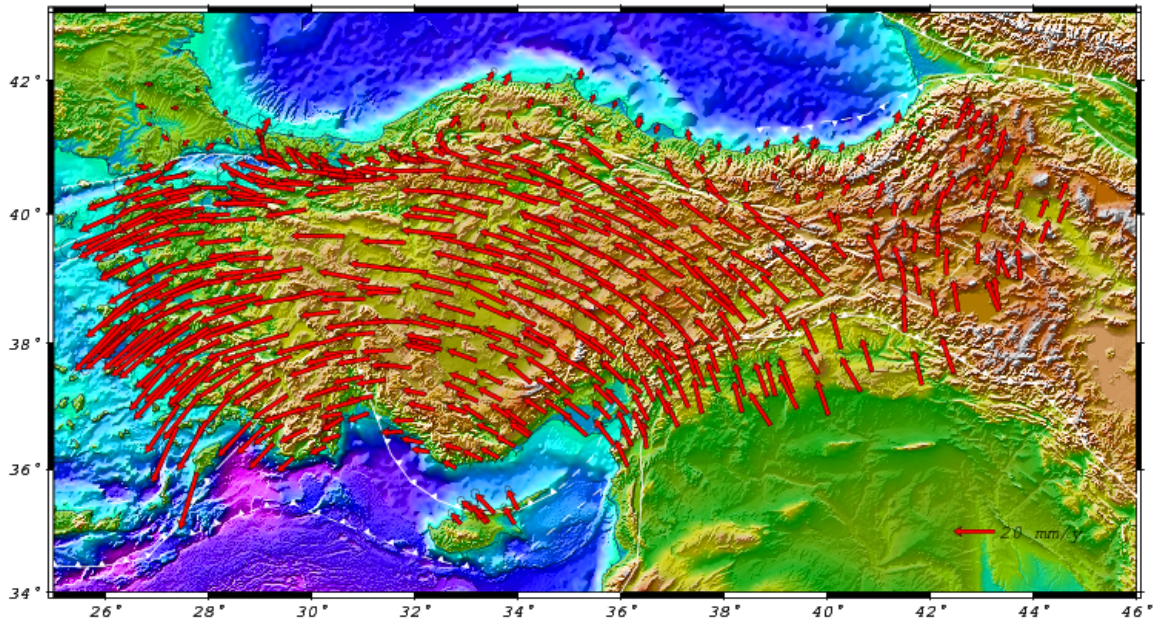

Figure 3.9. Horizontal Velocity Map of Turkey acquired from inter-seismic data before the earthquakes (Eurasia Fixed)

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 3.10 and Figure 3.11, 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. Six such earthquakes have occurred since the establishment of Turkish National Fundamental GPS Network. and survey-mode GPS measurements in collaboration with international earth scientists.

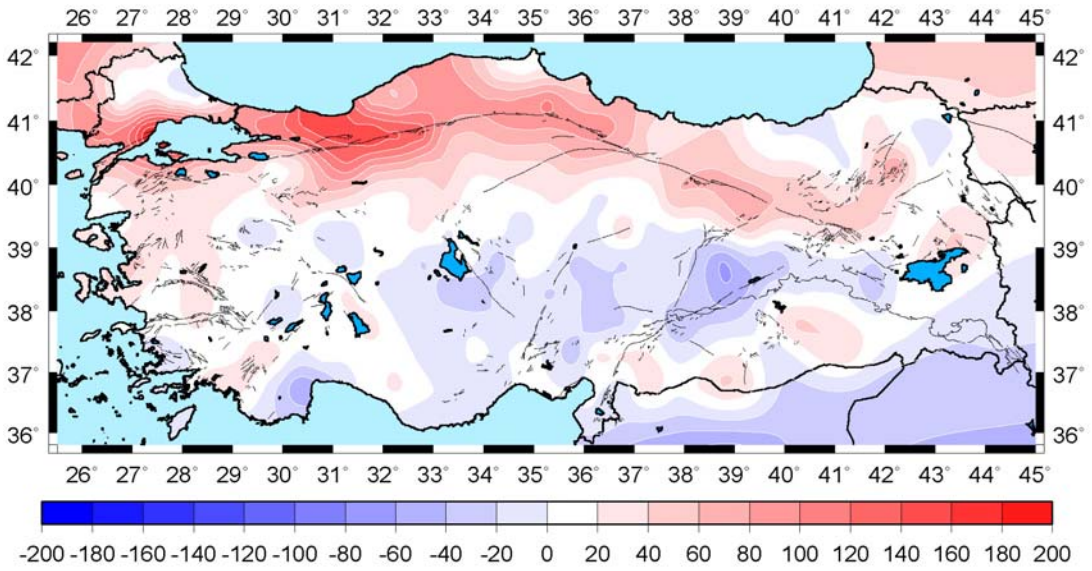

Figure 3.10. Shear strains in nanostrain per year

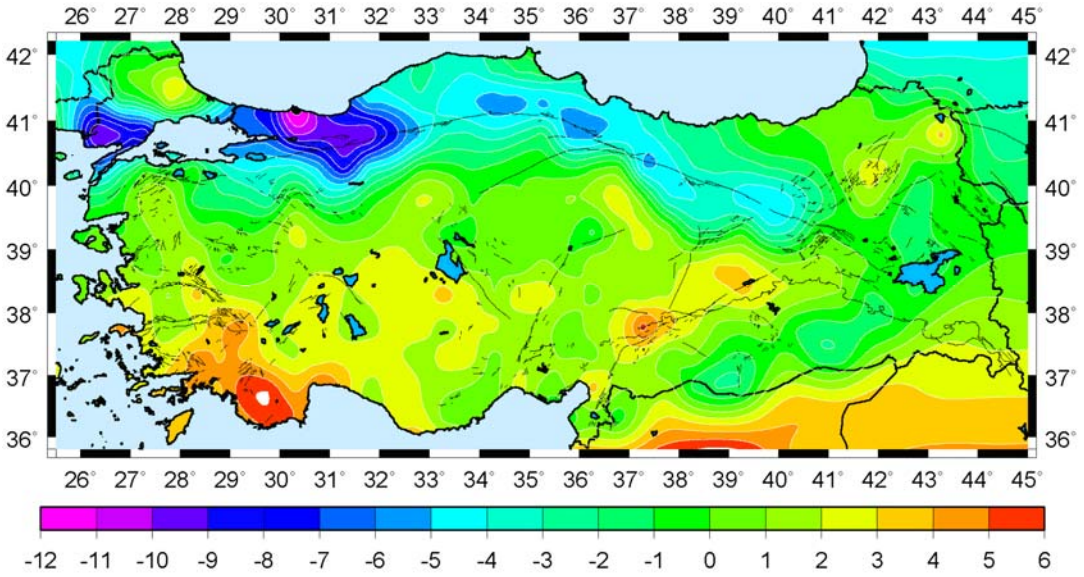

Figure 3.11. Rigid-body rotations in °/Myr

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. TUTGA 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 exploded 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 then modern standards. Therefore new and updated one has been prepared with in last two years, and it is now on the stage of approval. 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.

4. Annual Scientific Meetings

Commission was agreed to organise periodically annual scientific workshops; and then decided to start last year. 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 2007 and 2011 are as follows:

- Geodesy and Atmosphere – Ankara 2007
- Reference Frames – İstanbul 2008
- Deformation Analysis – Konya 2009
- Geodesy in Spatial Planning – İzmir 2010

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.

5. 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.

2007 Issue: 137

- Investigation of Long Term Absolute Sea Level Changes By The Time Series Analysis of Tide Gauge And Continuous GPS Time Series
- Accuracy Assessment of Digital Elevation Models, Produced In Different Scales From Different Sources By Using Various Techniques
- A Case Study Based On Marketing of Spatial Data In Scope of E-Government In Turkey
- The Role of Information Technologies In Effectiveness of State And An Application For Internet Sale
- International Initiatives Related To Spatial Data Infrastructure

2007 Issue: 138

- Derivative Based Parameter Estimation Methods
- Investigation of Sea Level Variations In Marmara Sea By Means of Ers-1, Ers-2 And Topex/Poseidon Satellite Altimetry Observations An Application For Semi-Automatic Extraction of Line Features From Aerial Photographs
- Contour Simplification And Its Automation In The Production of Topographic Maps Internet Gis And Its Usage In Forest Fires
- Spatial Access Methods

2008 Issue: 139

- Evaluation of Global Geopotential Models By Gps-Leveling Data In Turkey
- Adaptation of Turkish Topographic Database At The 1:1.000.000 Scale To European Topographic Database And Publishing On The Internet/Intranet Environment
- Investigation of Sea Level Variations In The Eastern Mediterranean Sea By Using Satellite Altimetry Data
- Efficiency of Methodology In Determination of Earthquake Source Parameters Through Geodetic Measurements

2008 Issue: 140

- ITRF-2005 And Relations Between Previous Reference Frames
- Dem Production From Aerial Photographs And Accuracy Modeling of Dem
- Building Detection From High Resolution Satellite Imagery Using The Genetic Algorithm Approach
- Accuracy Assessment of The Effect of Digital Elevation Models Generated From Different Sources On Orthophoto
- Oem GPS Receiver And A Map-Matching Algorithm

2009 Issue: 141

- Seismicity of Ankara And Source of The 2005-2007 Afşar (Bala-Ankara) Earthquakes
- Accuracy Investigation of The Methods of Determining Orthometric Heights From Ellipsoidal Heights By Using Geoid
- Evaluation of The Production of 1/25.000 Scale Topographic Maps From Spot 5 Stereo Imagery
- Presenting The Data of Permanent GPS Stations On The Internet/Intranet Environment
- Serving of Orthophotos On The Web

2009 Issue: 142

- Clock Error And Tropospheric Delay Parameter Estimation Models of The Very Long Baseline Interferometry Technique
- Global Geodetic Observation System (Ggos) And Earth's Gravity Field: An Investigation Concerning Turkey
- Direct Georeferencing And Orthorectification of Airborne Digital Images
- Digital Spherical Photogrammetry Techniques Recently In Use
- Georeferencing Methods For Terrestrial Laser Scanner Poınt Clouds

2010 Issue: 143

- Georeferencing Methods For Terrestrial Laser Scanner Point Clouds
- L1 Norm Minimization In Geodetic Networks: The Case of Levelling Network
- The Accuracy Assessment of Insar Measurements
- Digital Aerial Camera And Acquisitions For Photogrammetry
- Automation In Selection of Road Features From 1:2500 Scale To 1:100000 Scale
- Free And Open Source Desktop Gis Software Programs: A Comparative And Systematic Evaluation

2010 Issue: 144

- Isostatic Gravity Anomaly Map of Turkey
- Improving Deformation Velocities Via Utilizing Time Series Analysis of Continuous GPS Stations
- Analysis And Interpretation of Temporal Change of Gps Coordinates: A Case Study In İzmir Region
- An Overview of Network Hierarchy, Observation Time Spans And Precision Criteria of In View of The Recent Developments
- Software Design For Self-Calibration of Digital Cameras
- Camera Mounting To The Terrestrial Laser Scanners And Estimation of The Camera Position with Respect To The Scanner Reference Frame
- Investigation of The Effects of Kernel Functions In Satellite Image Classification Using Support Vector Machines

2011 Issue: 145

- Computation of The Actual Coordinates And Velocities of Turkish National Fundamental GPS Network
- Data Quality Control & Management System of Turkish Sea Level Monitoring Network
- A Calculation Model For Fisheye Lens Distortion Used In The Camera Cluster
- A New Approach On The Usage of Internet-Based Gis For Civil And Military Applications In
- Emergency
- Analysis of The Prediction Method Used In Environmental Noise Mapping From Gis Data