

**TURKISH NATIONAL UNION OF GEODESY AND GEOPHYSICS (TNUGG)**

**THE REPORT OF TURKISH NATIONAL  
HYDROLOGY COMMISSION**

**(2003 – 2006)**

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

ANKARA

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## **CONTENTS**

### **A. INTRODUCTION**

### **B. HYDROLOGICAL ACTIVITIES IN TURKEY**

- B.1 Ongoing projects
- B.2 Other initiatives
- B.3 Educational and training courses
- B.4 Organization of specific courses / seminar
- B.5 National / local scientific and technical meetings
- B.6 TEFER (Turkey Earthquake and Flood Emergency Recovery) Project
- B.7 Flow measuring stations
- B.8 Snow observation
- B.9 Institutional relations/cooperation
- B.10 Completed and ongoing scientific projects
- B.11 Activities foreseen for the future

### **C. PUBLICATIONS PUBLISHED BY NATIONAL / INTERNATIONAL INSTITUTES, JOURNALS, PROCEEDINGS**

- C.1 International Publications
  - C.1.1 International Journals
  - C.1.2 International Proceedings / Symposium / Conference Proceedings
- C.2 National Publications
  - C.2.1 Publications
  - C.2.2 National Journals
  - C.2.3 National Proceedings / Symposium / Conference Proceedings

# **THE NATIONAL REPORT OF TURKISH NATIONAL HYDROLOGY COMMISSION**

## **A. INTRODUCTION**

Among the hydrology related organizations in Turkey are the General Directorates of the State Hydraulic Works (DSI), Electrical Power Resources Survey and Development Administration (EIE), State Meteorological Affairs (DMI) and the universities namely Middle East Technical University (METU) and Hacettepe University, Gazi University, Istanbul Technical University (ITU), all who are major contributing members of Turkish hydrological community.

In Turkey, General Directorate of State Hydraulic Works (DSI) is actively engaged in coordinating all hydrology-related organizations including private sector, newly emerging institutions, water-related establishments and universities.

During the last four years, it can be generally stated that the educational and technological capacities of the hydrometeorological services, and organizational abilities as well 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.

## **B. HYDROLOGICAL ACTIVITIES IN TURKEY**

Turkish involvement in the international regional projects has been rather limited. However, the support to the international postgraduate hydrological course of UNESCO “*Sediment Transport Technology*”, preferably for the specialists from the developing countries, is the main activity organized by DSI in this framework.

As a concrete improvement, it can be stated herewith that a forum page, with the e-mail address of [hidroloji@yahogroups.com](mailto:hidroloji@yahogroups.com), linked to the DSI's Web Site (<http://www.dsi.gov.tr>) to inform and to discuss the related issues of hydrology has been found quite effective. This report, with the extra information with respect to the IAHS activities in the Country and other details, can be available in the related page of above given Web address.

Meanwhile, in order for dealing with the IAHS related issues, in coordination with the other international hydrological relations, a special section entitled as Section of International Hydrological Affairs has been established in State Hydraulic Works (DSI).

Moreover, there has been some improvements regarding to Hydrologic Archive established in DSI. In this regard, all available hydrological documents, including IAHS publications are stored in an archive, and introduced to the hydrological community in the Internet environment.

## **B.1 Ongoing projects:**

The following projects are currently being studied by DSI;

- Determination of wetlands-groundwater interaction at Develi-Yeşilhisar-Yahyalı Closed Basin in Kayseri, by using hydrology, hydrogeology and environmental isotopes.
- Investigation of Water Resources In The Eskisehir Region By Means of Natural Radioactivity and Hydrogeochemistry

## **B.2 Other initiatives**

The celebration of World Day of Water, March 22<sup>nd</sup>, with the themes of 2007, “Coping with Water Scarcity”

2006, “Water and Culture”

2005, “Water for Life”

2004, “Water and Disasters”

2003, “Water for Future”

has been celebrated in Turkey with a series of activities carried out to increase public awareness of water in the country. In order to promote extensive public awareness in water use and the role of water for development, the day was a great opportunity to raise the discussion on this matter and make it known as much as possible.

Some brief information giving on the manner in which World Water Day 2007, with the theme of “Coping with Water Scarcity” was celebrated by DSI. For the purpose of celebrating World Day of Water, General Directorate of State Hydraulic Works (DSI) arranged a number of activities such as competition of composition, picture, photo and placard, celebration of the day and exhibition display.

## **B.3 International training courses**

Turkey is among the countries to respond to the UNESCO call in 1970’s for the promotion of hydrological training on an international extent. For this purpose, the Department of Technical Research and Quality Control of DSI has announced her first UNESCO sponsored International Post-Graduate Course on Hydrology as early as 1970s. Since then, DSI has been organizing a one month-long training course on the issue of sediment technology. In this course, the lectures on both theory and experiments are given to the participators.

## **B.4 National / Local Scientific and Technical Meetings, Seminars and Courses**

The General Directorates of DSI and EIE, and some of the Universities have organised some local courses on the subject of operational hydrology. Most of them are related to the various hydrology-related practices including snow measurement, gauging of water level, project hydrology and hydrological evaluation of the major basins. Also, the important activities as a part of the hydrological program carried out by different institutions in Turkey, in the period of 2003-2006 are listed as following.

- A World Water Day Panel on “The Effect of Climate Change on Water Resources” Water Foundation, 22 Mart 2005
- “International Workshop on Applications of Wavelets to Real World Problems” 17-18 July 2005, Istanbul Commercial University
- Seminar Entitled “Why Climate Change?” Turkish Chamber of Engineers

- Seminar on “Watershed Model on Euphrates and Tigris And Its Applications”
- Seminar on Hydrometry, 05-09.09.2005
- Seminar on Engineering Hydrology, 12-21.09.2005, DSI Aydin
- Hydrology Seminar, 12-16.09.2005
- International Symposium on Water and Land Management for Sustainable Irrigated Agriculture, 4-8.04.2006
- Seminar on “Water Information System” 15.12.2005
- 3<sup>rd</sup> International Advanced Course on “Water Resources Data Analysis - Data Processing, Interpreting and Design” 11-20.07.2005
- Course on Dam Planning and Design, 6-10.03.2006
- Seminar on “Data Processing and Desing In Hydrology“ 3-7.04.2006
- Flood Estimation and Planning Course, 8-12.05.2006
- National Congress on “Water Politics” 21-22 Mart 2006
- Second National Symposium on “Water Engineering“ 21-24.09.2005
- Second National Symposium on Isotop Technics In Hydrology” 20-23.09.2005
- Symposium on “Legistrative and Institutional Aspects of National Water Management” 21 Mart 2005
- International Symposium on “Water For Development” DSI 7-11 September 2005, Istanbul
- EMWIS Promotion Seminar on “Water Information System” 15.12.2005

#### **B.6 TEFER (Turkey Earthquake and Flood Emergency Recovery) Project:**

The effects of the floods combined with the landslides experienced by Turkey on May 21, 1998, caused deaths, suffering and extensive damage to both public and private property and costly social and economic disruption for a time after disaster in the West Black Sea Region. The floods occurred in daytime and resulted in the minimum loss of lives.

In response to these floods, The Government of Turkey with assistance from the World Bank has identified a work programme to develop flood management and to reduce or eliminate long-term risk and damage to people and their property from natural hazards and their effects and to repair, rehabilitate and to reconstruct various structures and infrastructure components lost or damaged in these floods and to carry out some technical training and studies.

The project will provide technical assistance to perform hydrometric network review and design and automated weather and hydrometric system design. In addition, the project will support the installation of about 129 automatic real-time hydrometric, 206 automatic real-time meteorological and 3 Doppler radar stations so that real-time data will be available in order to run the operational flood forecasting models.

#### **B.7 Flow Measuring Stations**

During 1999-2002 in Turkey, some improvements have been achieved regarding the hydro-meteorological observing stations. To the most of the hydrometric observing stations, the electronic gauges have been installed. This improvement improved the station conditions, removing the observation errors and failures. Additionally, the measurements now are conducted in a more sensitive way and the observed data are transferred by modern telemetry technology. Using the modem facilities, it is now possible also to read, evaluate and store the real time data at the office. We plan on increasing the number of electronic gauges in basins.

## **B.8 Snow Observation**

Seasonal snow-melt runoff estimates are extremely important in mountainous regions with semi-arid climatic conditions, like eastern part of Turkey. For that reason, automated snow and meteorological stations are established at higher altitudes since 1996, in the upper Euphrates River from the jointly research project sponsored by the State Planning Organization. It is still ongoing research in order to run near real time operational melt model to forecast runoff (rate / volume) melting from snow and rain on snow during early spring season.

Knowing the seasonal discharge volume in advance increases the flexibility in planning and operational of water resources systems as well as various water management decisions. For that purpose, RS techniques to trace the snow cover areas are used in the project.

Broad area observation systems are capable of monitoring macro-scale atmospheric and terrestrial features at varying spatial and temporal resolutions. Spatial and temporal requirements are important factors governing choice of satellite retrieval method.

During the last decade, besides to the classic snow observations, new technologies in snow studies have been imported by Turkey to improve the classical methods in use. Starting from 1998, the model studies using the available snow network observations have been applied. Application of remote sensing techniques in snow monitoring was initiated in 1996, through the NATO SfS fund support in the east part of Turkey. In the scope of these studies utilizing the Snow Runoff Model has started the project for estimation of snow-water equivalent potential of Karasu basin followed by other models as SLURP, HBV and others. In that study, remotely sensed snow cover data obtained by the NOAA (AVHRR) system were used to estimate the runoff from snowmelt. One of the major contributors of water to the Keban Dam is the Karasu River, which joins the Euphrates River at Keban Dam. Snowmelt from mid March to June contributes 65-70 % of the total annual runoff. NOAA (1x1 km) and MODIS (55 km) resolution images of the region are obtained, processed and combined with GIS in order to monitor time and spatial distribution of snow-covered areas. Real time snow depths are measured and received regularly from the field using snow measuring ground stations using the (Inmarsat Mini M) GSM and telephone line systems. Two satellite-receiving stations (Meteosat and NOAA) are present in DSI

Since the traditional point measurements are not representative enough from the point of “distribution in elevation” and cannot fully meet the necessary data requirements. Satellite remote sensing is expected to be a potential solution to this problem because broad area observation systems are capable of monitoring macro-scale atmospheric and terrestrial features at varying spatial and temporal resolutions. Spatial and temporal requirements are also important factors governing choice of satellite retrieval method.

Starting from 1996 winter, 3 snow pillows were placed at Guzelyayla, Ovacık and Cat through DPT (State Planning Organization) project to collect snow depth and water equivalent data automatically. Two of them had to be closed in 1998 but the rest continues to operate at elevations above 2250 m. It is intended that the data collected at prescribed dates are recorded electronically and the data can be stored and transferred to a central unit in Ankara. Each station is equipped with data logger unit, Snow depth measurement by sound sensors, Snow

pillow, and Air temperature and Pressure sensors. At these stations snow is also measured manually to cross check the data collected and new additional automated stations are being installed by DMI within the same experimental basin at higher altitudes in 2007.

With the data obtained from these stations and other snow courses where snow depth and water equivalent are measured manually by DSI and EIE and density is computed and checked with AWOS records, the following snow parameters are determined: Percentage of spatial snow cover, snow depth, snow water equivalent, snow density, temperature profile of snow pack. Several papers are produced and published at International journals and some of them are presented at national and international symposium and conferences.

### **B.9 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
- JIHP, 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
- UNESCO-IHE Institute for Water Education and/or international / regional / water centers under the auspices of UNESCO
- WMO, World Meteorological Organization

### **B.10 Completed and ongoing scientific projects**

In the period of 2003-2006 at national level, following projects have been completed by General Directorates of DSI, EIE and Universities:

- Determining Snowwater Potential of Eastern Anatolia Region by Using Satellite Technologies, 2<sup>nd</sup> Stage Consulting Facility. DSI, Department of Investigation and Planning, 1998-1999
- The Determination of Gross Alpha and Beta Activity of Drinking Water in Turkey, İZ-977, 2005.
- Investigation of Recharge Conditions of the Aquifer System in Beypazari Trona Field by Using the Environmental Isotopes, İZ-983, 2005

It is kindly informed that the other details, mostly related to the studies done by universities, can be available in the related pages of the Web site of [www.dsi.gov.tr](http://www.dsi.gov.tr) , in which the secretariat works of IAHS are introduced also.

### **B.11 Activities foreseen for the future**

Activities planned until December 2006

- Improvement of functional capabilities of the Bureau of UNESCO/WMO related issues, established in Investigation and Planning Department of DSI in order to serve as focal point also for various international hydrological activities,
- Establishment of a regional training center (to be affiliated to DSI Research Department in Ankara) on “Sediment Technology, Isotope and Erosion” using the existing facilities available in DSI,
- The preparation of a guide book for determining the factor of "degree-day" in estimating the snow-melt water potential, to be prepared by Hydrology Division in DSI, Ankara
- Activities foreseen for 2006-2007
- Organization of 5<sup>th</sup> National Congress of Hydrology, planned by Civil Engineering Department, METU (Middle East Technical University) with invited speakers from Turkey and outside of countries.
- Development of DSI's Water Information System
- Further involvement in FRIEND activities
- Course on hydrological modeling, by Istanbul Technical University, in collaboration with DSI and EIE

In the long term, it is proposed to be more effective in finding a way that the national community, under the leadership of DSI, has a real impact on all hydrologic activities and water related politics in the Country.

## **C. PUBLICATIONS PUBLISHED BY NATIONAL / INTERNATIONAL**

### **INSTITUTES, JOURNALS, PROCEEDINGS**

It can be firstly indicated that the flood yearbooks, prepared by DSI's hydrologists, includes the preliminary information used for strategic and socio-economic planning in the basins. The valuable information in this publication, together with the maps showing the flooded areas at the scale of 1/800 000, will be main input for the studies by European Natural Disasters Training Center (AFEM), established by Turkey in 1988 under the responsibility of the Ministry of Public Works and Settlement.

The other publication would be given in a classified form as following:

#### **C.1 International Publications**

##### **C.1.1 Publications**

- Application of infiltration models to field data from Wadi Tabalah, Saudi Arabia (1995) *IAHS-AISH Publication, (232), Pages 305-315.*
- Analysis of maximum flood events and their probability functions under arid climatic conditions in Saudi Arabia (1991) *National Conference Publication - Institution of Engineers, Australia, 3 (91 pt 22), Pages 761-768.*
- Regional flood discharge analysis southwest region of the kingdom of Saudi Arabia. (1987), *Pages Baton Rouge, U.S.A.: May 14-17, 1986, Dordrecht, The Netherlands, D. Reidel Publishing Co., 1987.*

### C.1.2 International Journal

- Sampling Variances of Regional Flood Quantiles Affected by Intersite Correlation  
*Journal of Hydrology, Vol.291, 42-51, 2004.*
- Comment on “ Applicability of prewhitening to eliminate the influence of serial correlation on the Mann-Kendall test” by Sheng Yue and Chun Yuan Wang  
*Water Resources Research, 40(8), 2004.*
- Trends in the Maximum Mean and Low Flows of Turkish Rivers  
*Journal of Hydrometeorology, Vol. 6, p. 280-290, 2005.*
- Probabilities and return periods of multisite droughts  
*Hydrological Sciences Journal, IAHS, 50(4), 605-615, 2005.*
- Drought impact on water supply system of Istanbul Metropolis  
*Algerian Journal of Technology, p.249-258, 2005.*
- Drought impact on water supply system of Istanbul Metropolis  
De l'eau pour le developpement durable sans le bassin mediterraneen, 21-23 Mai 2005, Alger.
- Spatial and Temporal Changes of Soil Salinity in a Cotton Field Irrigated with Low-quality Water  
*Journal of Hydrology (272):238–249.*
- Assessing Drainage Problem Areas by GIS: A Case Study in the Eastern Mediterranean Region of Turkey  
*Irrigation and Drainage (52):343–353.*
- Effects of Urbanization and Land-use Type on Monthly Extreme Temperatures in a Developing Semi-arid Region, Turkey  
*Journal of Arid Environments 68: 143–158.*
- The impact of water resources development projects on water vapor pressure trends in a semi-arid region, Turkey  
*Climatic Change 82:195–209, DOI:10.1007/s10584-006-9160-0.*
- Point-scale energy and mass balance snowpack simulations in the upper Karasu basin, Turkey  
(2006) *Hydrological Processes, 20 (4), Pages 899-922.*
- Modelling the temporal variation in snow-covered area derived from satellite images for simulating/forecasting of snowmelt runoff in Turkey  
(2005) *Hydrological Sciences Journal, 50 (4), Pages 669-682.*
- Using MODIS snow cover maps in modeling snowmelt runoff process in the eastern part of Turkey  
(2005) *Remote Sensing of Environment, 97 (2), Pages 216-230. Cited 1 time.*
- Determination of soil hydraulic properties using pedotransfer functions in a semi-arid basin, Turkey  
(2004) *Hydrology and Earth System Sciences, 8 (6), Pages 1200-1209.*
- Simulation of event-based snowmelt runoff hydrographs based on snow depletion curves and the degree-day method  
(2003) *Canadian Journal of Remote Sensing, 29 (6), Pages 693-700. Cited 1 time.*

- Monitoring snow-covered areas using NOAA-AVHRR data in the eastern part of Turkey  
(2002) *Hydrological Sciences Journal*, 47 (2), Pages 243-252. Cited 3 times.
- Groundwater recharge estimation from ephemeral streams. Case study: Wadi Tabalah, Saudi Arabia  
(1997) *Hydrological Processes*, 11 (12), Pages 1607-1619. Cited 4 times.
- Estimation of actual evaporation using precipitation and soil moisture records in arid climates  
(1995) *Hydrological Processes*, 9 (7), Pages 729-741. Cited 5 times.
- Estimation of peak discharge using GIUH model in Saudi Arabia  
(1995) *Journal of Water Resources Planning & Management - ASCE*, 121 (4), Pages 287-293. Cited 2 times.
- Transmission losses from ephemeral stream in arid region  
(1994) *Journal of Irrigation & Drainage Engineering - ASCE*, 120 (3), Pages 669-675. Cited 7 times.
- Infiltration-recharge through wadi beds in arid regions  
(1993) *Hydrological Sciences Journal/Journal des Sciences Hydrologiques*, 38 (3), Pages 173-186. Cited 17 times.
- Flood hydrograph estimation for ungaged wadis in Saudi Arabia  
(1993) *Journal of Water Resources Planning & Management - ASCE*, 119 (1), Pages 45-63.
- Rainfall-runoff modeling of a microcatchment in the western region of Saudi Arabia  
(1990) *Hydrology in mountainous regions I*, Pages 655-659.
- Rainfall-runoff modeling of a microcatchment in the western region of Saudi Arabia  
(1990)
- Techniques of artificial recharge from an ephemeral Wadi channel under extreme arid conditions  
(1989), Pages 602-611.
- Water balance approach under extreme arid conditions - a case study of Tabalah Basin, Saudi Arabia  
(1989) *Hydrological Processes*, 3 (2), Pages 107-122. Cited 7 times.
- Techniques of artificial recharge from an ephemeral wadi channel under extreme arid conditions  
(1989)
- Effects of urbanization and the determination of mean areal rainfall of thunderstorms in georgia, U. S. A.  
(1977) *Ky Univ Off Res Eng Serv Bull*, (114), Pages 203-208.
- Characteristics of rainfall cell patterns in the southeast coastal plain areas of the usa, and a computer simulation model of thunderstorm rainfall.  
(1975), Pages 214-221.
- Effects of urbanization and land-use type on monthly extreme temperatures in a developing semi-arid region, Turkey  
*Journal of Arid Environments* 68(2007) 143-158
- The impact of water resources development projects on water vapor pressure trends in semi-arid region, Turkey  
*Climatic Change* (2007) 82:195-209

- Salt accumulation in the root zones of tomato and cotton irrigated with partial root-drying technique  
*Irrigation and Drainage 55:533-544 (2006)*
- Yield response and N-fertiliser recovery of tomato grown under deficit irrigation  
*European Journal of Agronomy 26 (2007) 67-70*

### **C.1.3 International Proceedings / Symposium / Conference**

- Estimation of seasonal runoff using remote sensing satellite data  
(1997) *Remote sensing and geographic information systems for design and operation of water resources systems. Proc. international symposium, Rabat, Morocco, 1997, Pages 103-112.*
- Application of infiltration models to field data from Wadi Tabalah, Saudi Arabia  
(1995) *Application of tracers in arid zone hydrology. Proc. international symposium, Vienna, 1995, 232, Pages 305-315.*
- Global or local trends in hydropower, Proc.  
*EWRA Symposium on Water Resources Management: Risks and Challenges for the 21<sup>st</sup> Century, İzmir, 2-4 Sept. 2004.*
- Application of water balance model to western Saudi Arabia and use of GIS in future  
(1993) *Applications of geographic information systems in hydrology and water resources management. Proc. international conference, Vienna, 1993, Pages 685-693.*
- Assessment of Outliers in Statistical Data Analysis  
*Nato-Advanced Research Workshop on Integrated Technologies for Environmental Monitoring and Information Production, 173-180,10-14, 2003.*
- Describing Study Areas And Progress Achieved  
*QUALIWATER PROJECT {Diagnosis and Control of Salinity and Nitrate Pollution in Mediterranean Irrigated Agriculture (INCO-CT-2005-015031)} TRAINING WORKSHOP, September 19 to 22, ZARAGOZA, SPAIN.*
- Improvement of Operation of Istanbul Water Supply System during 1989-1994 Dry Period  
*BALWOIS (Water Observation and Information System for Balkan Countries) 2006, Ohrid*
- Analysis of Dry Periods of Coruh River Basin  
*BALWOIS (Water Observation and Information System for Balkan Countries) 2006, Ohrid.*
- Management of Water Supply Systems of Metropolises; Istanbul Example  
*NATO –ARW, 26-28 Eylül 2006.*

## **C.2 National Publications**

### **C.2.1 Publications**

As for the official publications related to the observations and assessment of the data, DSI has published the yearbooks of the observed discharge data at the project sites. On the other hand, EIE has published the yearbooks of the observed data for water flows, water levels in the lakes and sedimentation.

- The role of Water Quality in Wetlands : two different wetlands study from western part of Turkey: Izmir Bird paradise and Kucuk Menderes River Wetland

- Monitoring of Performance a Hydrological Model to estimate annual water yield in a small watershed in Meric River Basin
- Future of the Integrated Water Supply System of İstanbul
- Benefits Obtained from Renovation of Omerli Dam
- Reservoir Management Using Artificial Neural Networks
- A Comparison of Three Methods for the Prediction of Future Stream Flow Data
- Improvement of Operation of İstanbul Water Supply System during 1989-1994 Dry Period
- Comparison of Bed Load Formulae in Hydraulic Geometry Using Similarity Principle
- Current Level of Water Erosion Problem and Sediment Control Measures in Turkey
- The Causes of Floods in the Western Blacksea Region, Turkey
- Turkish Emergency Flood and Eartquake Recovery Project (TEFER)
- Southeastern Anatolia Project (GAP) in Turkey as a water resources management
- Seasonal rainfall Intensity and Frequency in Turkey
- Effects of North Atlantic Oscillation on precipitation and stream flow at Buyuk Menderes Basin
- Producing Climate Indices and Climate Change Monitoring in the Middle East
- Hydrological Impacts of Thinning in a Deciduous Forest Ecosystem
- Soil Buffering System Against Acid Deposition in Belgrad Forest Ecosystems
- Variations of pH values of stream water in mature Oak-Beech forest ecosystems in Belgrad Forest near İstanbul Turkey
- Groundwater Pollution Originating from Geological Formation and an Example of Konya-Cumra-Karapınar Plain with GIS Application
- Probabilistic Assessment of Overtopping Reliability of a Dam Analysis of Dry Periods of Coruh River Basin
- Current Level of Surface and Groundwater Observation Network of Turkey
- Synthetic Data-based Meteorological Drought Modeling
- The effect of Dense Maritime Traffic on the Bosphorus Strait and Marmara Sea Pollution
- The effect of the Koprubasi Mine on the Groundwater Contamination in Manisa, Turkey
- Analysis Mediterranean Precipitation Associated with the North Atlantic Oscillation (NAO) Index via Hilbert-Huang Transformation
- Polution of the Drinking Water Sources of İstanbul City and the Preventive Measures: Buyuk Cekmece Lake Case Study

### **C.2.2 National Journals**

- Trends in Flood, Mean and Low Flows of Turkey  
*Turkey Engineering News, TMMOB Turkish Chamber of Civil Engineers, 2003.*
- Power of the Statistical Tests for Trend Detection  
*Turkish Journal of Engineering and Environmental Sciences, Vol.27, p. 247-251, 2003*
- Envelope Curves for Maximum Floods in Turkey  
*Technical Journal of Turkish Chamber of Civil Engineers, IMO Vol. 15 (1),3125-3130, 2004.*

- Investigation Deterministic and Stochastic Characteristics of River Flows  
*Ç.U. Eng. Arc. Fac. Bulletin (Ç.Ü.J.FAC.ENG.ARCH.), June, 20(1): 129-138*
- Evaluation and Selection of Streamflow Network Stations Using Entropy Methods  
(2006) *Turkish Journal of Engineering and Environmental Sciences, 30 (2), Pages 91-100.*
- Snowmelt Lysimeters for Real-time Snowmelt Studies in Turkey  
(2005) *Turkish Journal of Engineering and Environmental Sciences, 29 (1), Pages 29-40. Cited 1 time.*
- Determination of Monthly Pan Coefficients Using Penman Method: Lake Egirdir application  
(2005) *Technical Journal of Turkish Chamber of Civil Engineers 16 (1), Pages 3395-3402.*
- The Recent Technique In Regional Regional Frequency Analysis with Application in Western Black-Sea  
(2004) *Technical Journal of Turkish Chamber of Civil Engineers, 15 (2), Pages 3155-3169.*
- Separation of Hydrograph Components Using Stable Isotopes Case Study: The Güvenc, Basin, Ankara  
(2003) *Turkish Journal of Engineering and Environmental Sciences, 27 (6), Pages 383 - 395.*

### **C.2.3 National Proceedings / Symposium / Conference**

- Determination of Drought Periods in Coruh River Basin  
*II. National Symposium on Water Engineering, 21-24 Sep 2005.*
- Sampling Variances of Regional Flood Quantiles Affected by Intersite Correlation  
*4. National Hydrology Congress, 23-25 June, 2004*
- Trend Analysis of Annual Mean StreamFlows in Turkey  
*4. National Hydrology Congress, 23-25 June, 2004.*
- An Investigation of Spatial Variability Behaviors at the Scale of the Sampling Span of Monthly Average Precipitation and Application to GAP Area  
*4. National Hydrology Congress Proceedings, Page: 105-115, ITU Civil Eng, 23-25 June 2004, Istanbul.*