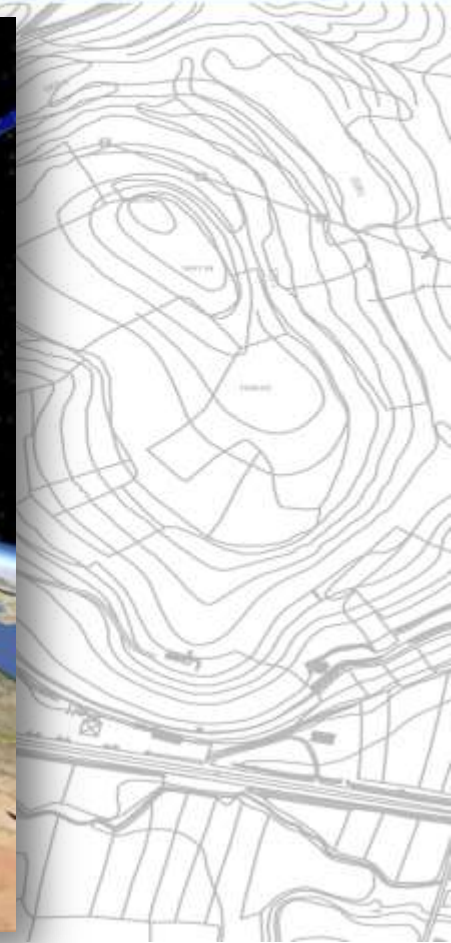




# BUSINESS MODEL OF CORS-Tr (TUSAGA-Aktif)

Presented at the FIG Working Week 2017,  
May 29 - June 2, 2017 in Helsinki, Finland



## Need

To obtain geographic location information (coordinates) speedy, accurate and in economic way.

However, in the past, getting accurate coordinates was time consuming, expensive and required expertise...



10) Başlangıç noktası B'nin koordinatlarına  $\Delta y_1$  ve  $\Delta x_1$  değerleri  $dy_1$  ve  $dx_1$  dağıtımları dikkate alınarak işletmelerine göre toplanır ve kontrol olarak C noktasının koordinatlarına ulaşılır.

$$Y_2 = Y_1 + \Delta y_1 + dy_1 = 22450,12m \quad \rightarrow \quad X_2 = X_1 + \Delta x_1 + dx_1 = 17208,68m$$

$$Y_3 = Y_2 + \Delta y_2 + dy_2 = 22561,99m \quad \rightarrow \quad X_3 = X_2 + \Delta x_2 + dx_2 = 17150,52m$$

$$Y_4 = Y_3 + \Delta y_3 + dy_3 = 22654,27m \quad \rightarrow \quad X_4 = X_3 + \Delta x_3 + dx_3 = 17134,07m$$

$$Y_C = Y_4 + \Delta y_C + dy_C = 22732,62m \quad \rightarrow \quad X_C = X_4 + \Delta x_C + dx_C = 17156,27m$$

Sonuçta C nirengi noktasının koordinatlarını C(22732,62; 17156,27) bulunması gerekmektedir. Poligon Koordinatlarının hesabı işlemleri açı ve uzunluk hataları dengeli şekilde dağıtarak doğru sonuçlar bulunmuştur.

Nokta No.	Kuruma Açısı $\beta$	Açıdaki Açılan (Saniye)	Konar S	$\Delta y = S \cdot \sin \alpha$	$\Delta x = S \cdot \cos \alpha$	Y	X
-15	138,2833						
175,8764							
-15'	132,2612	86,54	-73,66	-42,00	22374,45	17250,66	
198,2652							
-15'	130,5239	126,32	+111,90	-38,16	22450,12	17208,68	
180,7148							
-15'	111,2400	93,76	-92,30	-18,47	22381,90	17130,52	
171,1955							
-14'	82,4370	81,45	-78,27	+22,19	22654,27	17134,07	
132,1640							
(34,6024)	387,87	+388,23	-94,46	22732,62	17156,27		
1034,8980	-19	-19x		-358,14	94,39		
1000,0000	34,8986			+388,23	-94,46		
34,8986	$f_p = -74''$			$f_L = -10cm (13)$	$f_x = -39'$	$f_y = +37'$	
	$(f_p = -35,36)$			$f_Q = -4cm (14)$		$f_s = 0,314m$	



# TUSAGAKTİF

TÜRKİYE ULUSAL SABİT GNSS AĞI AKTİF



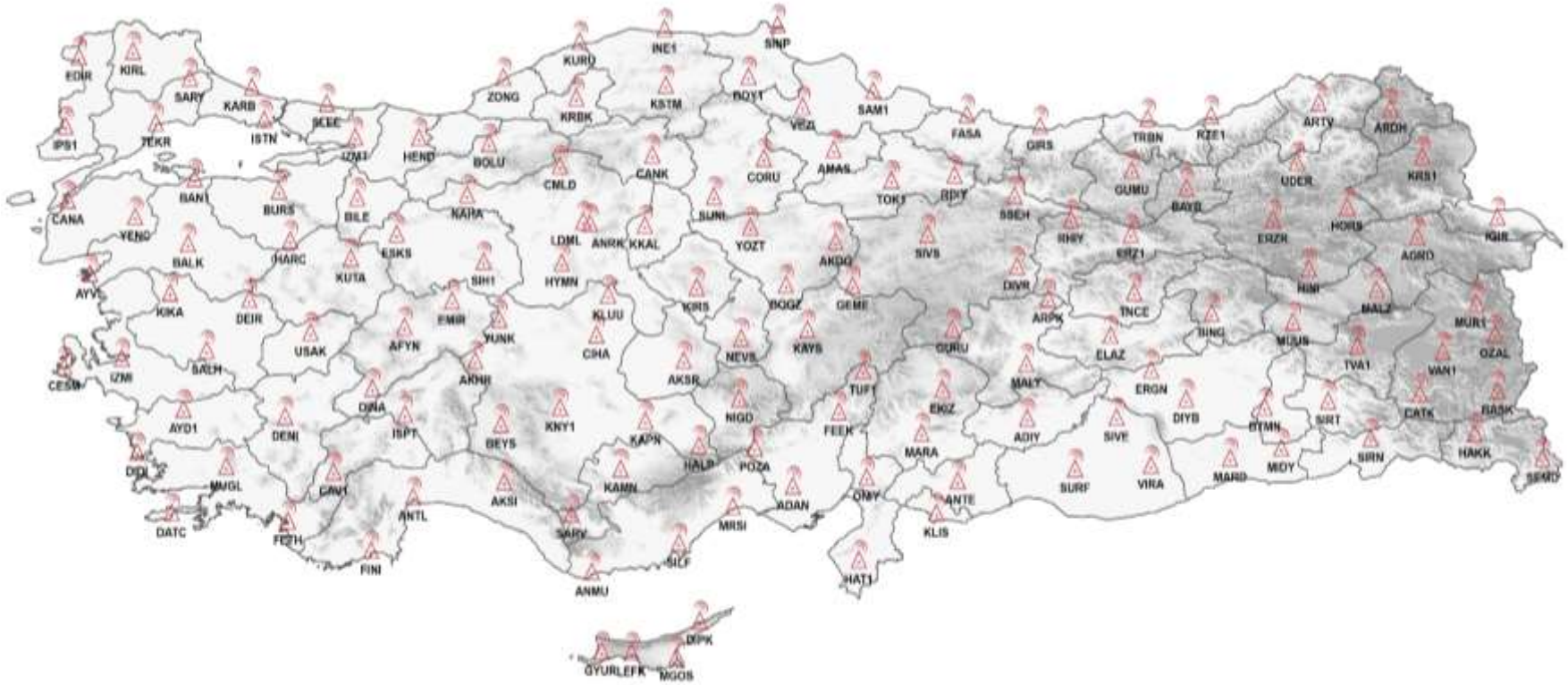
## Aim of the project

To determine geographic location information within 3-4 cm accuracy for 24 hours in real time (RTK) all across the Turkey and Turkish Republic of North Cyprus (T.R.N.C.).



Start-Ending Date : May 2006 - July 2010

# CORS-Tr Stations-146



Distance between stations 80-100 Km.'s

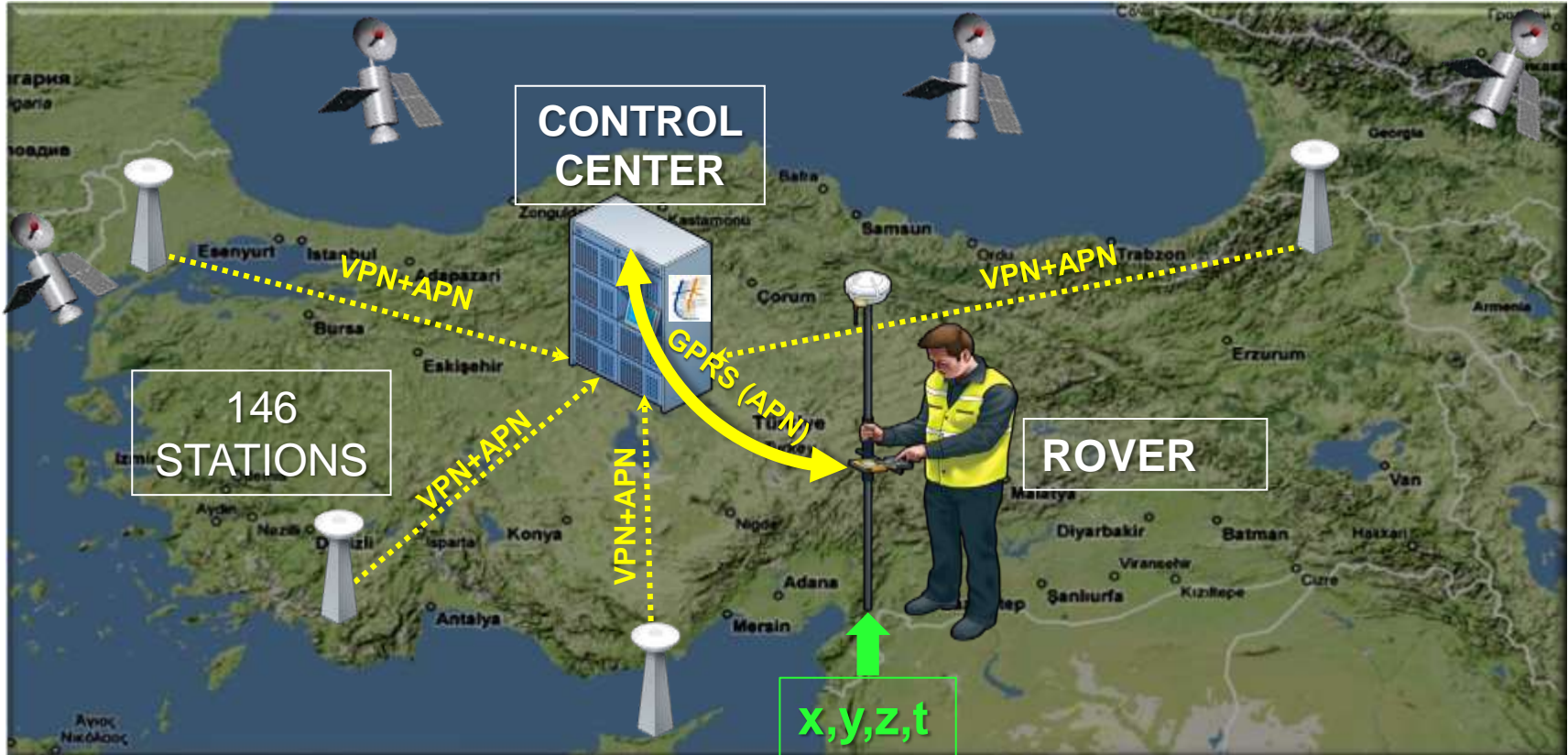
# CORS-Tr Stations



# CORS-Tr Control Center Ankara – GDLRC



# Network RTK Working Principle



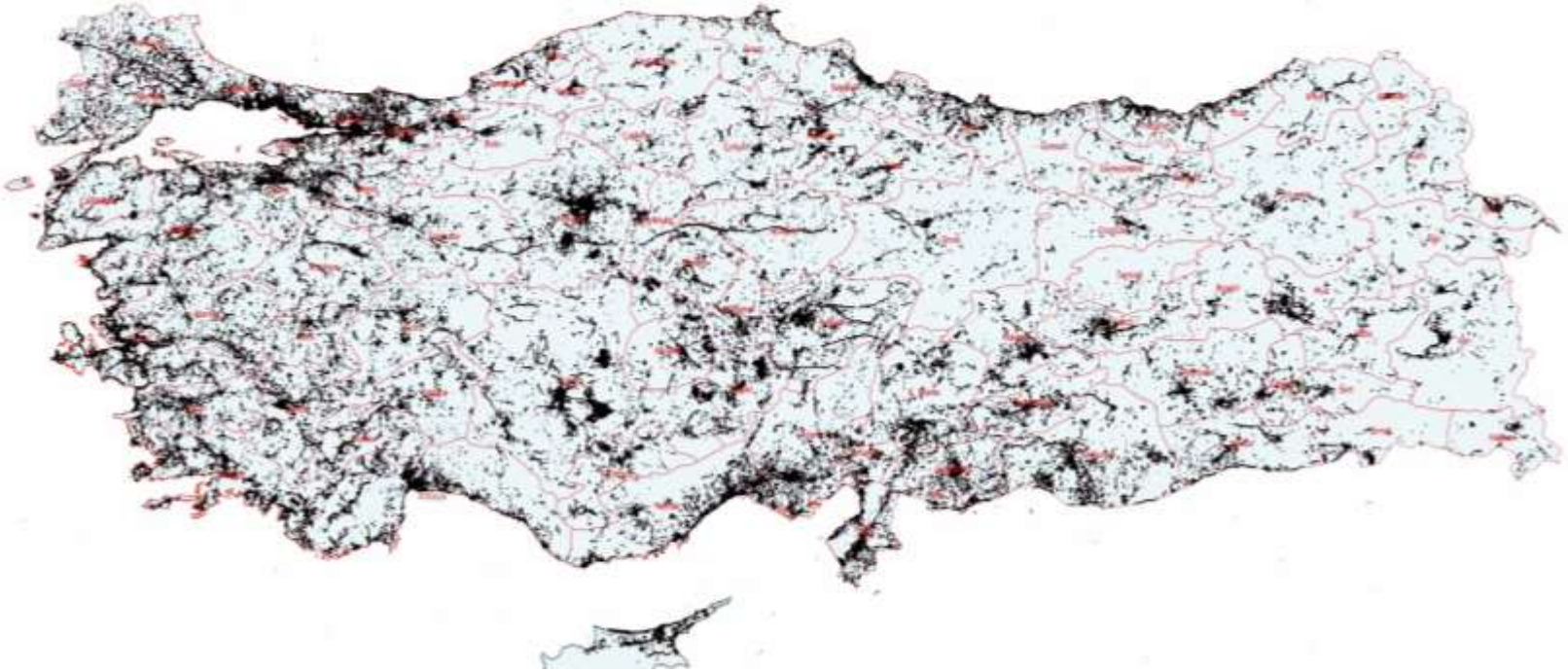
2005.0 Epok



# On-line Orthometric Height Value



## CORS-Tr Usage Map – 2016

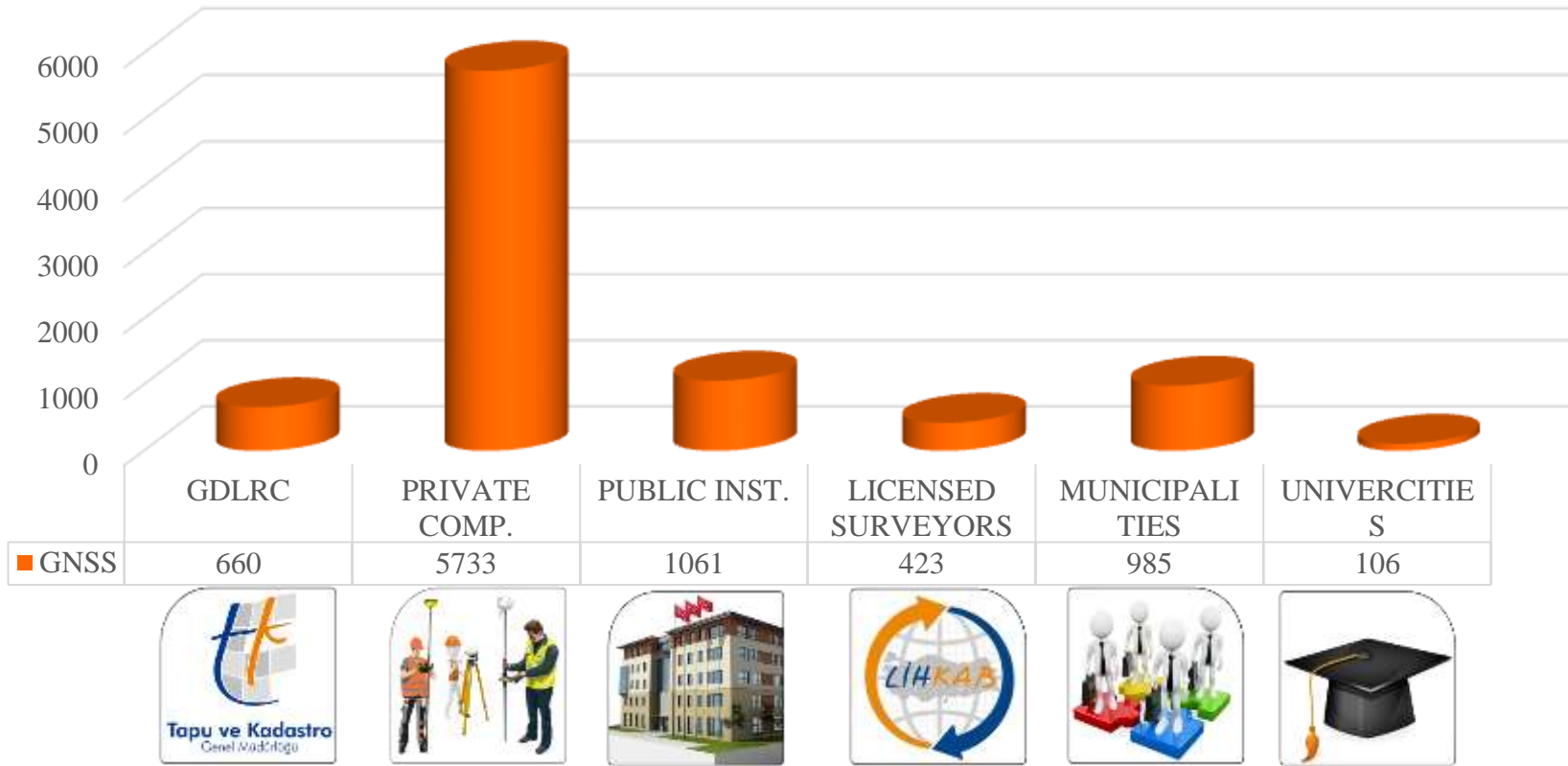


13.412.424 points ...

# CORS-Tr Operating/Users

**Total # Users**  
**8.968**

09.05.2017



**Daily total number of users (mean) :2400**  
**Simultaneous maximum number of users:840**

## Quality Checks

PERIOD	Nr of POINTS	RMS (m.)		
		EAST	NORTH	HEIGHT
2009	808	0,039	0,042	0,090
2014-1	723	0,045	0,039	0,078
2015-1	743	0,033	0,035	0,047
2015-2	701	0,029	0,027	0,058
2016-1	725	0,032	0,031	0,051
2016-2	697	0,029	0,028	0,046

2 times QC Checks every year ...

# CORS-Tr Operating/Web Services

The image shows a screenshot of the TUSAGAKTIF website. The browser address bar displays "tusaga-aktif.gov.tr". The website header features the "TUSAGAKTIF" logo in large red and black letters, with the subtitle "TÜRKİYE ULUSAL SABİT GNSS AĞI AKTİF" below it. To the left of the logo is the logo of the General Directorate of Land Registry and Cadastre (Tapu ve Kadastro Genel Müdürlüğü), and to the right is the coat of arms of the Republic of Turkey. Below the header, there are two main navigation paths. The left path, labeled "ABONELİK İŞLEMLERİ" (Subscription Operations), includes: Giriş (Login), Abonelik Rehberi (Subscription Guide), Ücretler (Fees), Sıkça Sorulan Sorular (Frequently Asked Questions), and İletişim 444 46 77 (Contact 444 46 77). The right path, labeled "Giriş" (Login), includes: Giriş (Login) and İstasyon Haritası (Station Map). Below these paths are social media icons for Facebook and Twitter. The main content area shows a preview of the website's interface, including the "Tapu ve Kadastro Genel Müdürlüğü" logo, the text "Web Sitesi Erişim Sayfası" (Website Access Page), and a list of services. The services listed are: "TUSAGAKTIF Kullunması için İstemciye Giriş Sayfası" (TUSAGAKTIF User Login Page) with a "Giriş" button, "TUSAGAKTIF Kullunması için İstemciye Giriş Sayfası" (TUSAGAKTIF User Login Page) with a "Giriş" button, "TUSAGAKTIF Kullunması için İstemciye Giriş Sayfası" (TUSAGAKTIF User Login Page) with a "Giriş" button, and "TUSAGAKTIF Kullunması için İstemciye Giriş Sayfası" (TUSAGAKTIF User Login Page) with a "Giriş" button. At the bottom, there are logos for Mastercard and VISA.

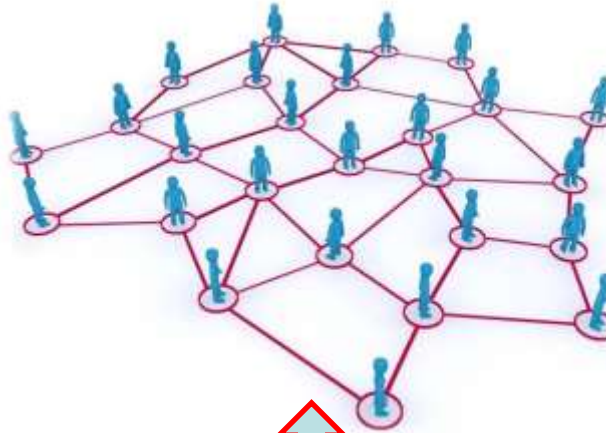
# CORS-Tr Operating/User support

<http://www.tkgm.gov.tr\tusagaaktif>



**444 GNSS**  
**444 4677**

2016  
**14.919 CALLS**



# User Web Service

<http://www.tusaga-aktif.gov.tr>



# User Web Service

<http://www.tusaga-aktif.gov.tr>

**TUSAGAKTIF**  
TÜRKİYE ULUSAL SAĞIT İMMOBİLİTESİ

Trimble® Pivot Web

• Ana Sayfa • VRS iScope Live!

- Ara Sayfa
- İstasyon Haritası
- Ağ Bilgisi
- 195 İstasyonlar
- İRM/ORM
- Referans Vektör Dökümü
- Hesabım
- Kişisel Bilgiler
- Şifre Değiştir
- Gönder
- Özellikler
- VRS iScope
- VRS iScope Live!
- Aktif Üyelikler
- Yönetim
- Bölgesel
- Bölge Ekle
- Bölgeyi Düzenle
- Firmalar/Kurumlar
- Firma/Kurumlar
- Yeni Firma/Kurum
- Onay Bekleyen Firmalar/Kurumlar
- E-posta adreslerini kaydet
- Firma/Kurum Detayları
- Detaylı Firma/Kurum Bilgisi
- Ekl Bilgi Alanları
- Yeni Alan Ekle
- Kullanıcı Bilgisi Detayları
- Ekl Bilgi Alanları
- Yeni Alan Ekle
- Organizasyon Yönetimi
- Organizasyonlar
- Yeni Organizasyon
- Yetki Yönetimi
- Yetki Genel
- Yeni Yetki
- Özellik Yönetimi

VRS iScope™ Live!



- 335 aktif kullanıcılar:
- K05344801 (RTK Fikis)
  - K01456501 (RTK Fikis)
  - K0210501 (RTK Fikis)
  - K072601802 (RTK Fikis)
  - K05554301 (RTK Fikis)
  - K070608302 (RTK Fikis)
  - K074204201 (RTK Fikis)
  - K070710501 (RTK Fikis)
  - K071000501 (RTK Fikis)
  - K01450004 (RTK Fikis)
  - K08470101 (RTK Fikis)
  - K073200801 (RTK Fikis)
  - K09381801 (RTK Fikis)
  - K0336030201 (RTK Fikis)
  - K073427001 (RTK Fikis)
  - K08425302 (RTK Fikis)
  - K073419701 (RTK Fikis)

VRS iScope™ Live!



Kullanıcı: K01296851  
Organizasyon: PALLI Kod 884  
Zemin: 19°23'57"087"-8  
En: K.38° 44' 14.08238"  
Boyut: D.38° 54' 56.10054"  
Yükseklik: 943.648  
Uydu: 13  
PGDP: 1.30  
Kategori: RTK Fikis



# Administrative Structure of CORS-Tr System

- CORS-Tr Project; was successfully transferred to GDLRC and GCM with the approval of TUBITAK (Technological Research Council of Turkey) in 2009
- CORS-Tr System is jointly operated by GDLRC and GCM on a protocol frame.
- “Cooperation Protocol on the Joint Operation of the CORS-Tr System” was signed on 2010 by GDLRC and GCM.
- According the protocol, the mission of executing the CORS-Tr was assigned to GDLRC and an Executive Board defined.
- CORS-Tr Executive Board was founded in order to take technical and administrative decisions for operating the system.



# Financial Structure of CORS-TR System

## Initial Installation Cost of CORS-TR System

CORS-Tr Project was completed in 2008 with a cost of **2.5 million USD** including academic researches by funding of **TUBITAK**.

## Operational Costs of CORS-TR System

- **Hardware Costs;** GNSS Stations and Control Center (CC )
- **Software Costs;** CC Software and GNSS Firmware
- **Maintenance / Repair Costs;** Changing station locations, maintenance, reparing
- **Communication Costs;** 2XMetro internet and 146 VPN Internet connections
- **Promotion costs;** Seminars, symposiums, trainings, etc. for CORS-Tr

# Financial Structure of CORS-TR System

## CORS-TR System Costs

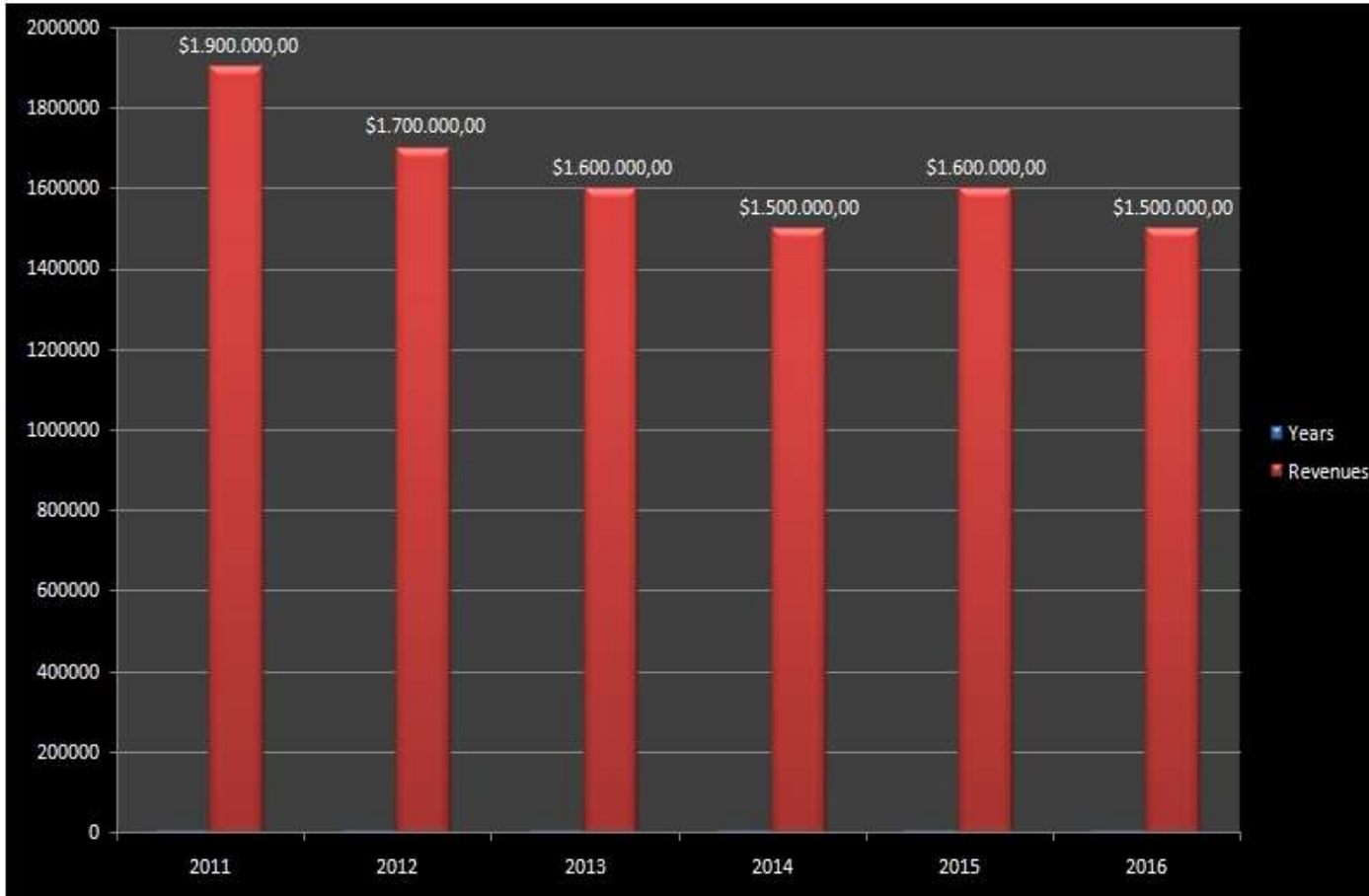
Year	Equipment	Software	Maintenance	Promotion	Communication	Total
2010	\$23.000,00	\$0,00	\$15.000,00	\$0,00	\$60.000,00	\$98.000,00
2011	\$7.000,00	\$0,00	\$0,00	\$0,00	\$125.000,00	\$132.000,00
2012	\$413.000,00	\$0,00	\$25.000,00	\$0,00	\$112.000,00	\$550.000,00
2013	\$6.000,00	\$0,00	\$0,00	\$35.000,00	\$319.000,00	\$360.000,00
2014	\$458.000,00	\$176.000,00	\$0,00	\$0,00	\$288.000,00	\$922.000,00
2015	\$0,00	\$0,00	\$0,00	\$0,00	\$305.000,00	\$305.000,00
2016	\$59.000,00	\$0,00	\$0,00	\$0,00	\$211.000,00	\$270.000,00
<b>Grand Total</b>	<b>\$966.000,00</b>	<b>\$176.000,00</b>	<b>\$40.000,00</b>	<b>\$35.000,00</b>	<b>\$1.420.000,00</b>	<b>\$2.637.000,00</b>

# Financial Structure of CORS-TR System

## CORS-Tr Fees

SERVICE TYPE	DATA TYPE	Price (VAT INC.)	EXPLANATION
FIRST SUBSCRIPTION	-	40 USD	Once
RTK Services	Network-RTK	35 USD	Monthly
		220 USD	Annual
	Network-DGPS	15 USD	Monthly
RINEX Data	RINEX 1 s	0.14 USD	Station/Hour
	RINEX 30 s	FREE	Station/Day

# Financial Structure of CORS-TR System



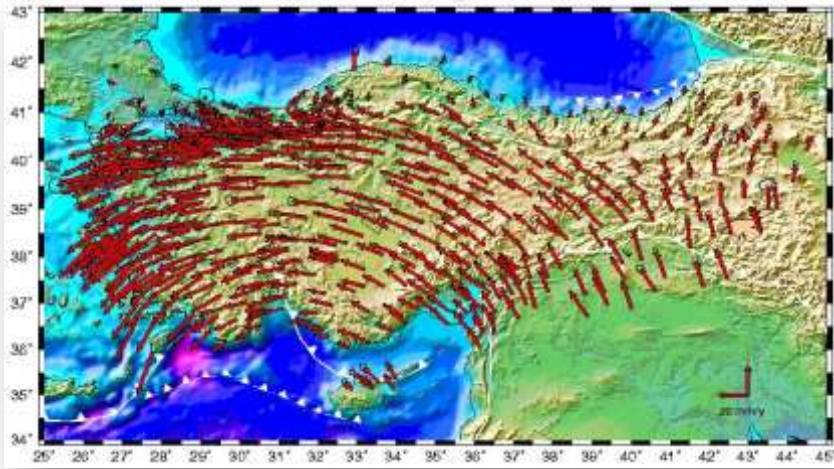
CORS-Tr System Revenue between 2011 and 2016

## CORS-Tr Benefits

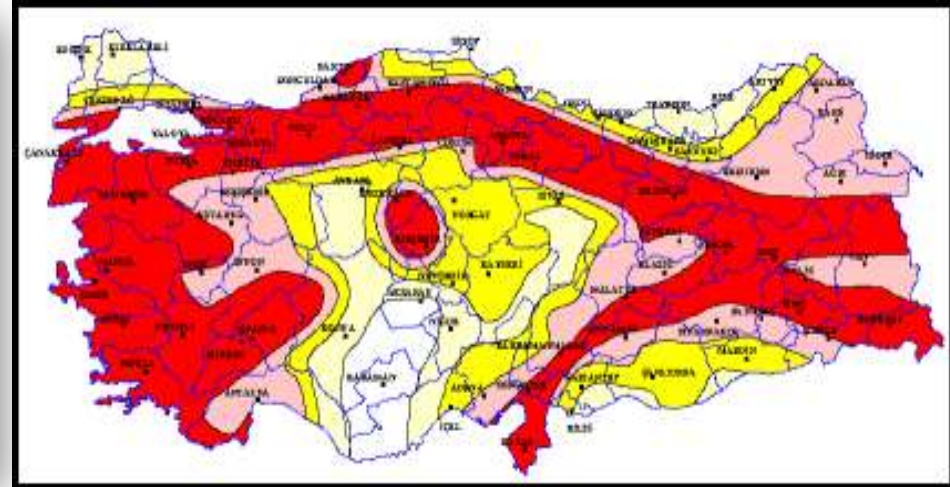
- There is no need for establishing and measuring triangulation points and benchmarks which comprises **30% of mapping and cadastre works** in terms of duration and cost. approximately **25 millions USD** is saved from the allocated resources for mapping which is approximately 75 millions USD/Year.



# CORS-Tr Project Benefits



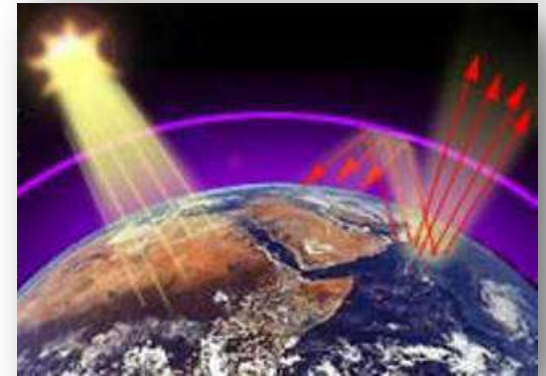
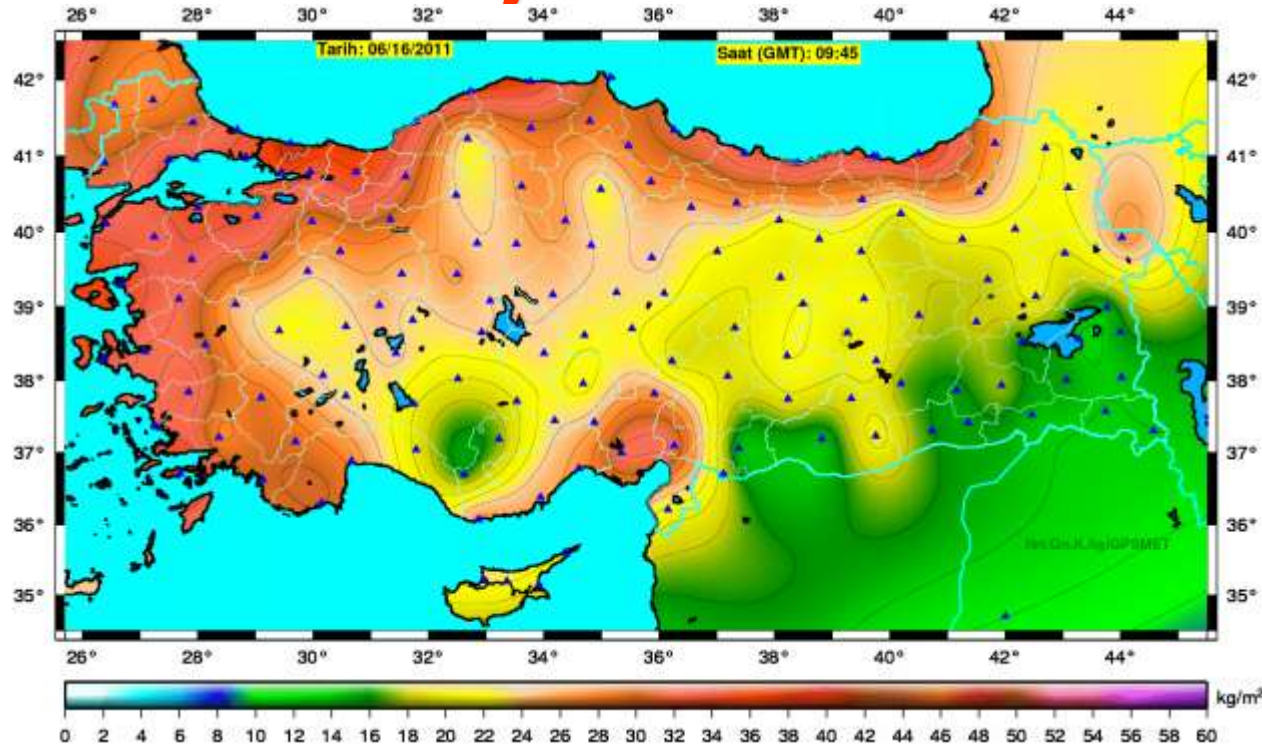
Determination of velocity areas



Determination of tectonic movements



## CORS-Tr Project Benefits



**Studies on modelling atmosphere (ionosphere and troposphere) for the purpose of getting meteorological estimations and determining precipitable water vapour (PWV) were started at the General Directorate of State Meteorology and academic institutions.**



# Financial Structure of CORS-TR System

## Fee and Number of Users of CORS-Tr System

YEAR	Nr of USERS	YEARLY RTK MEM. FEE (USD)
2011	2900	500
2013	3900	395
2014	5200	357
2015	6300	277
2016	7500	258
2017	9000	215

# GOOD COORDINATION STARTS WITH GOOD COORDINATES !



**SEDAT BAKICI**  
**HEAD OF GEOMATICS DEPARTMENT**

 : sbakici@tkgm.gov.tr

 : +90.532.697 85 21

 : +90.312.463 10 50

 : 39°.8562, 32°.8465



**THANK YOU ...**