

GNSS Application trends in Central Asia



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Outline

- About the Central Asia
- Traditional Reference Ellipsoid and Coordinate Systems
- GPS and GNSS Technologies
- Use of GNSS Technology in Central Asia today
- National Geodetic and GNSS Networks of Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan
- New National Coordinate Systems in Central Asia
- Analysis of GNSS trends in the region
- Conclusion and discussions



About the Central Asia



- Countries of the Central Asia: **Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan**
- Total area of the region: **3,994,300 km²**
- The population: **>55 mln**



Traditional Local Reference Ellipsoid

Ellipsoid name	Krasovsky 1940
Large semi axle (a)	6 378 245 m
Flattening, f	1/298.3
Regions	Former USSR

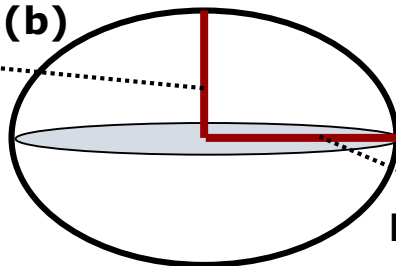


Prof. Feodosy Krasovsky



Kronstadt sea gauge

Small semi axle (b)

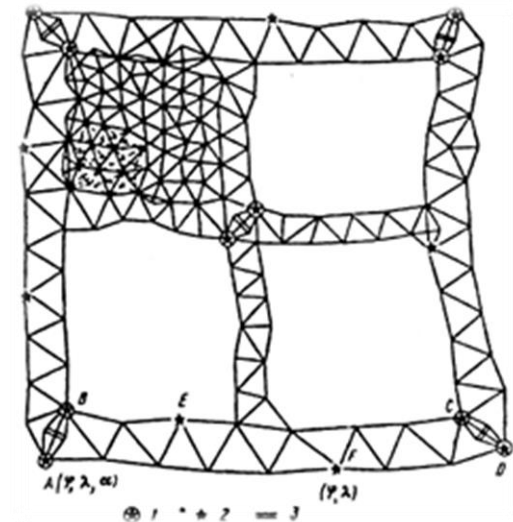
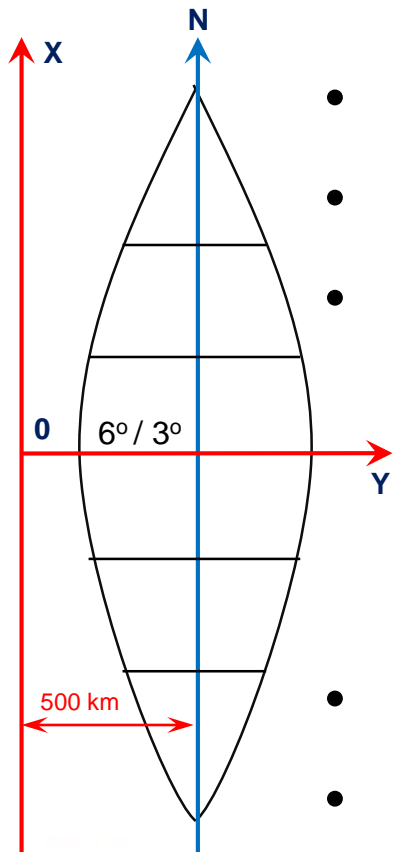


Large semi axle (a)

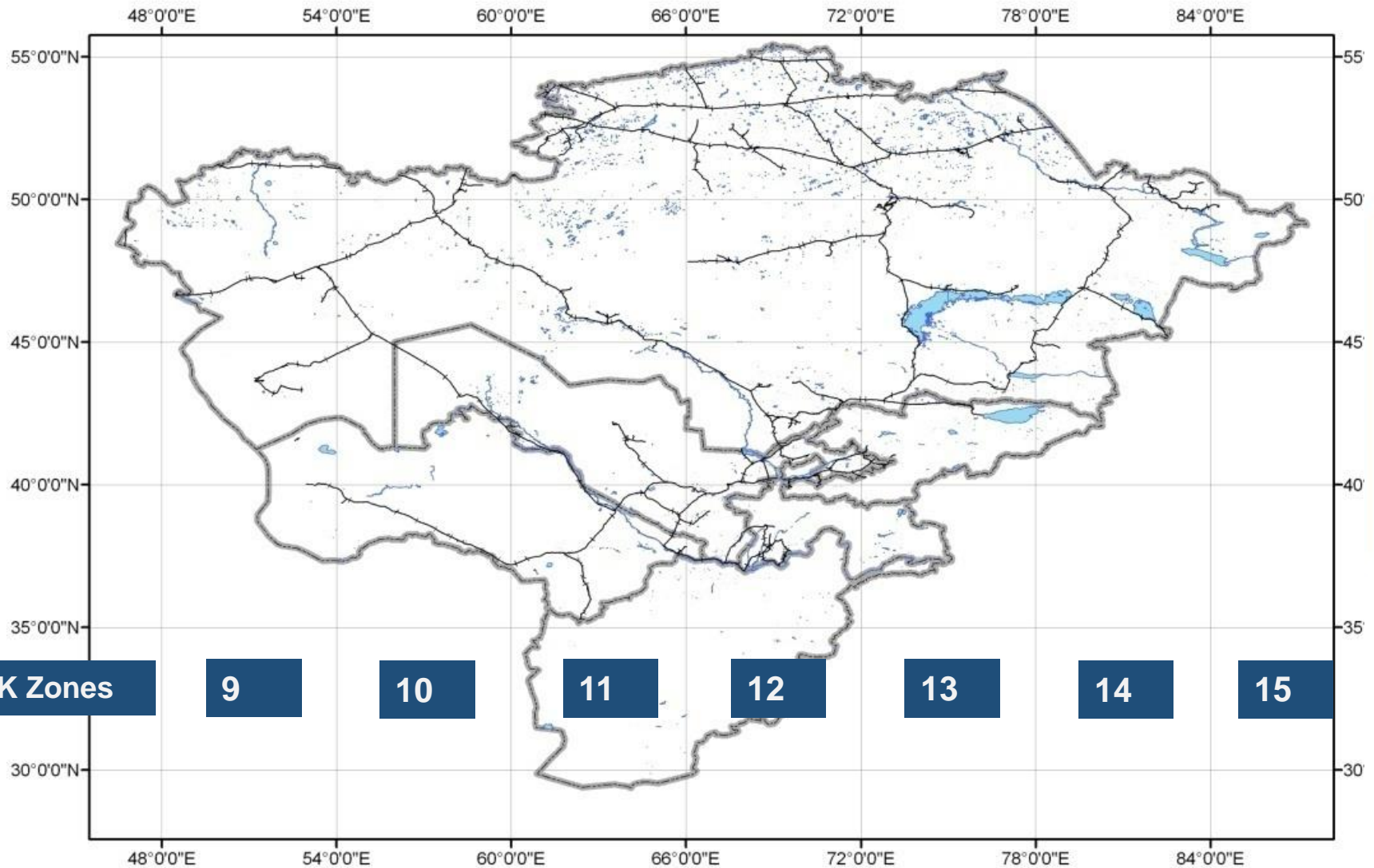


Traditional Reference Systems

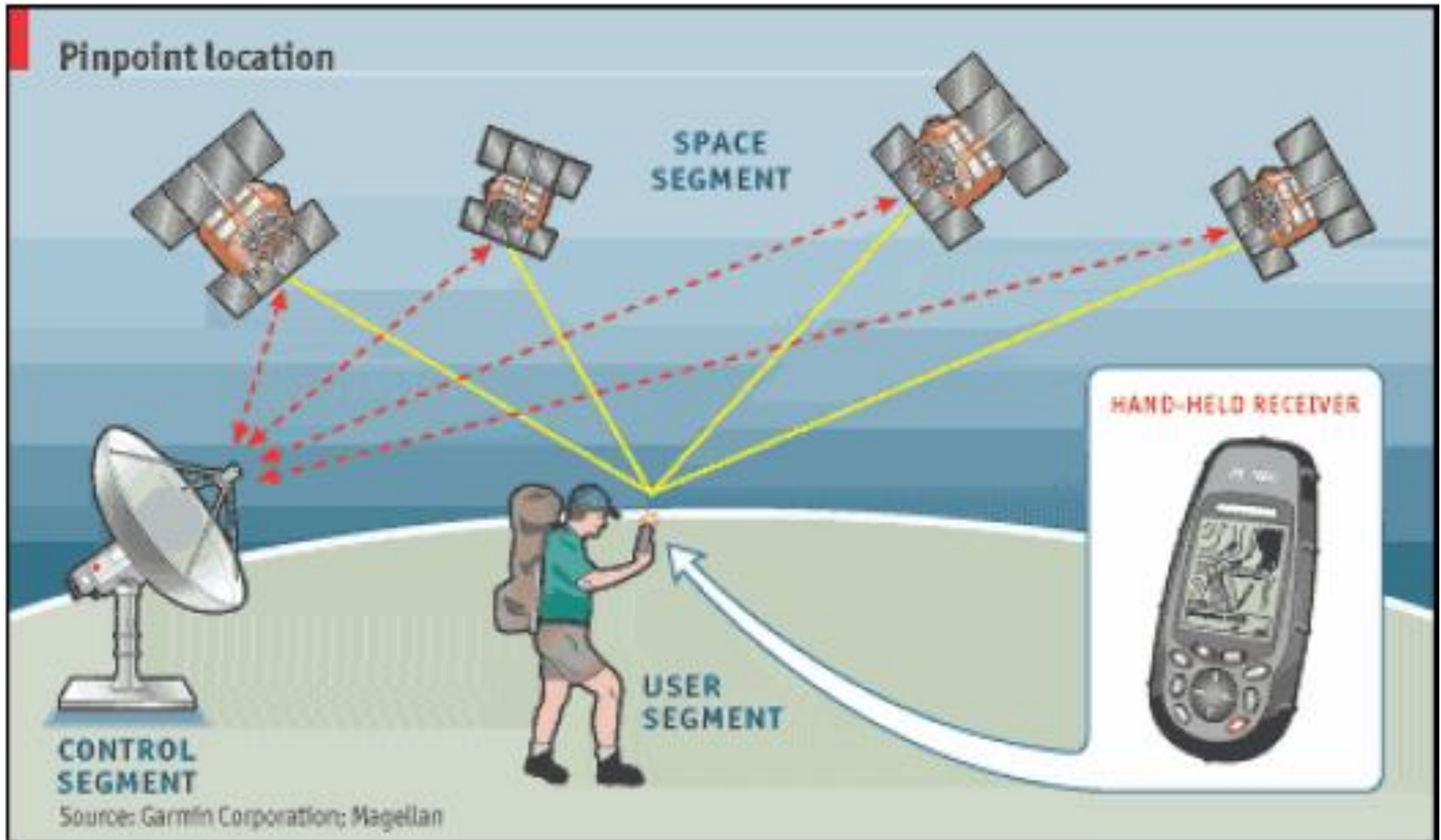
- Cartographic projection: Gauss-Kruger –
6° and 3° zones
- Geodetic, 2D Coordinate systems –
SK 42, 63, 95 (Pulkovo 1942, 1963, 1995)
- Datum: Pulkovo 1942
- The altitude system: Baltic sea level
- State geodetic networks
 - Horizontal – 4 classes
 - Levelling – 4 classes
 - Gravimetric – 4 classes
- Limitation for civil use
- High secrecy of all coordinates!!!



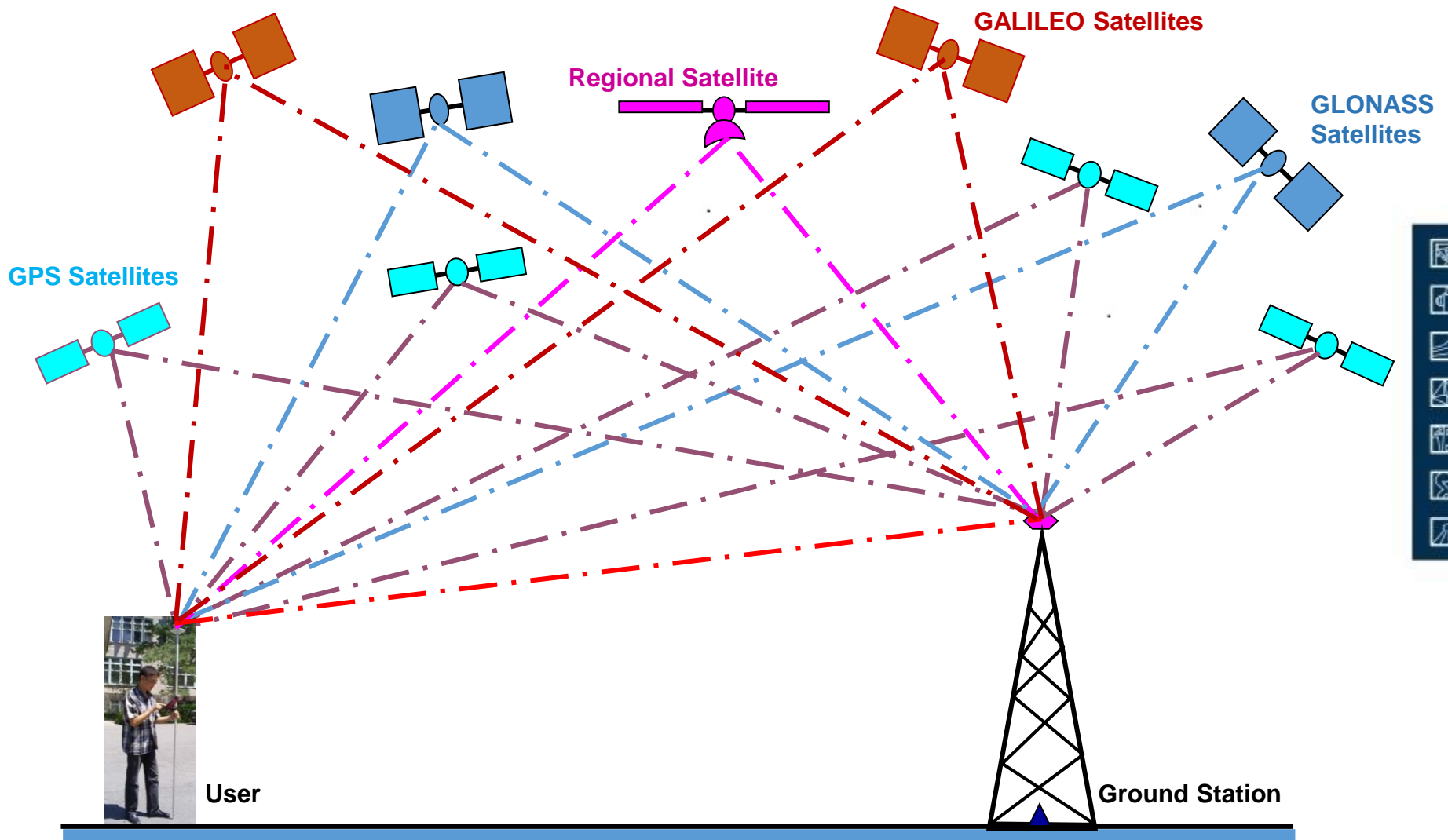
2D Coordinate system - Pulkovo 42



GPS Technology



GNSS Technology

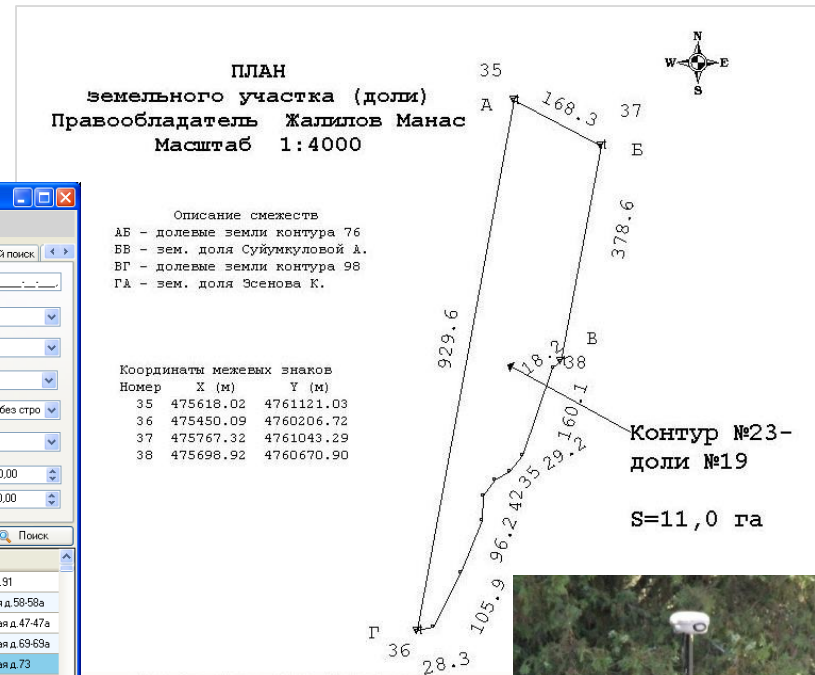
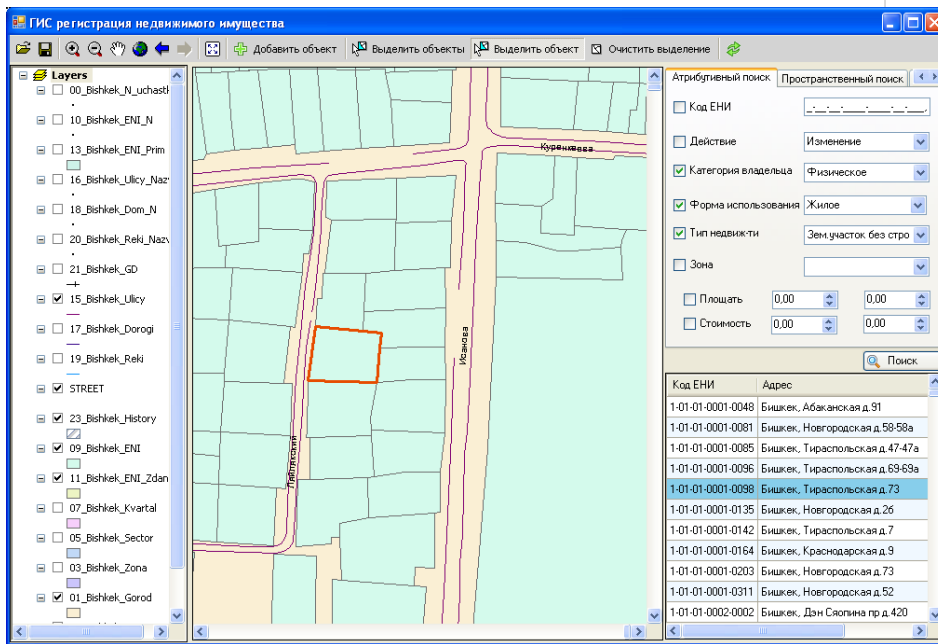


GNSS in Central Asia

- Land Cadaster and Real Estate management (LIS)
- Digital mapping and Geoinformation systems
- Transportation and Logistics
- Engineering Survey (geodetic investigations, construction and monitoring of buildings, transport and hydro-technical facilities)
- Global and Regional Geodynamic studies
- Natural Risk management (risk assessment and early warning):
 - Earthquakes
 - Landslides
- Military and National Border Guard Services, etc.



Land and Real Estate Registration Projects

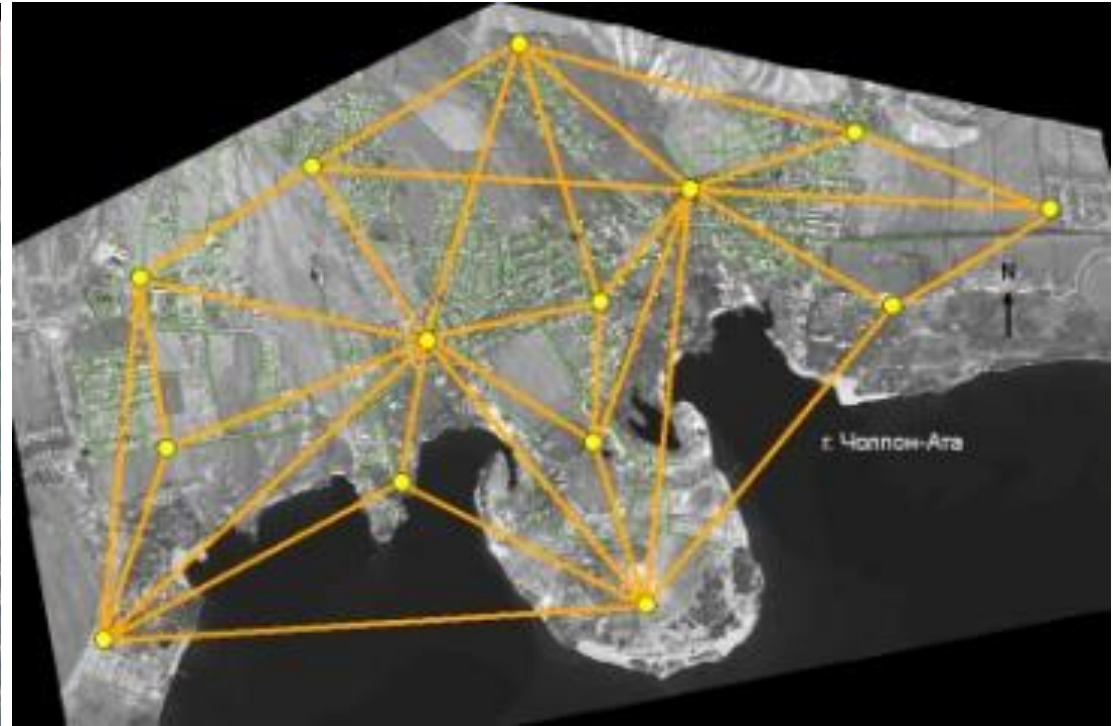
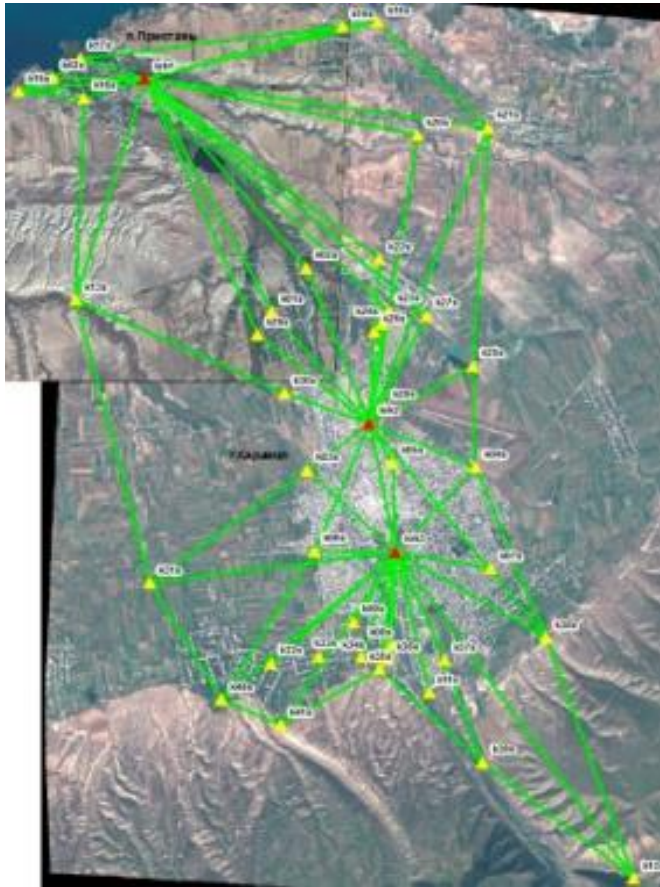


WB Projects “Registration of Land and Real Estate 1&2”,
 2000-2012 (\$15,2M)

Department of Cadastre and Real Estate Registration (DCR)
 State Registration Service of the Kyrgyz Republic (SRS KR)



Local GNSS Survey Networks for Urban Infrastructure mapping



22 GNSS Ground Control Points (GCP) in the Balykchy city, 13 GCP in the Cholpon-Ata city and 55 GCP in the Karakol city. Combined topographic survey with GPS/GNSS receivers and totalstations. Number of Survey points - 4000.

ADB Project “Sustainable Development of Issyk-Kul”, 2010-2011

Use of GPS in Pasture Mapping

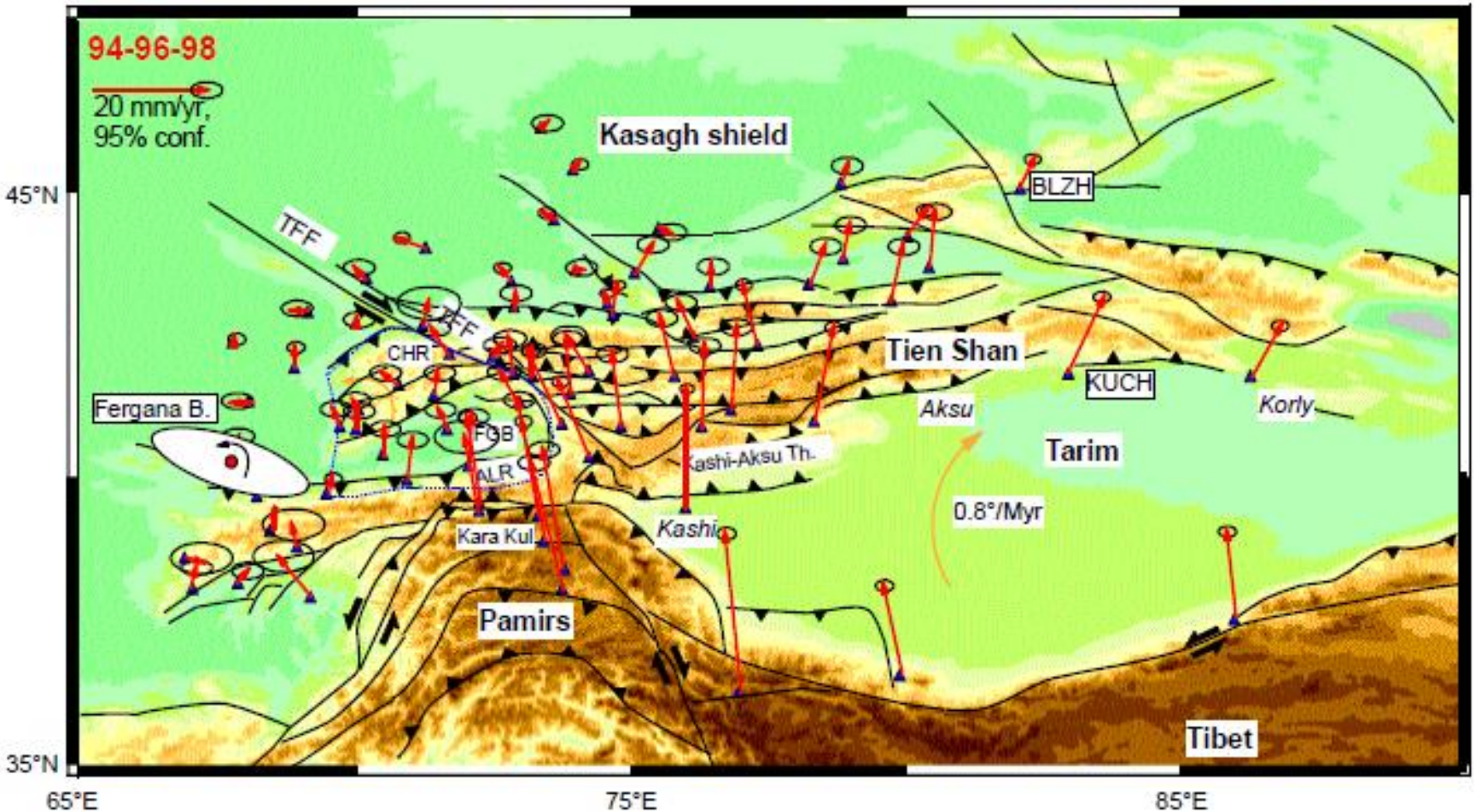
Project “Agricultural Investments and Services”
Pasture Management Component
World Bank 2008-2013 (\$34 M)

Pastures – 9,15 mln Ha
GPS survey, georeferencing of maps
Digital pasture maps



DP MA KR

Central Asian Tectonic Science Project (CATS, GFZ, 1994-1998)




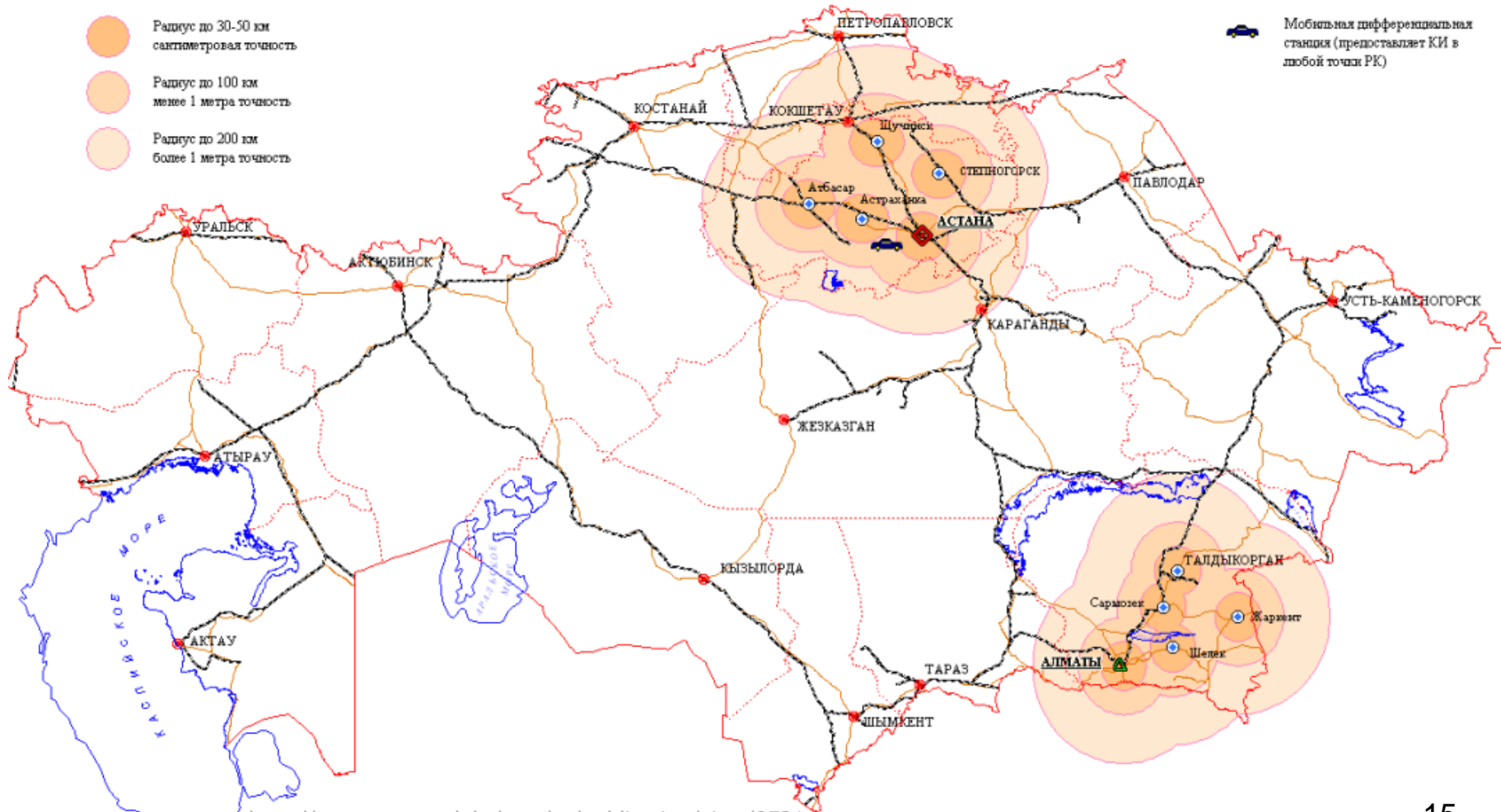
National GNSS Networks of the Central Asian countries



National GNSS Network of Kazakhstan (10 CORS in 2013)






- Radius до 30-50 км
сантиметровая точность
- Radius до 100 км
менее 1 метра точность
- Radius до 200 км
более 1 метра точность

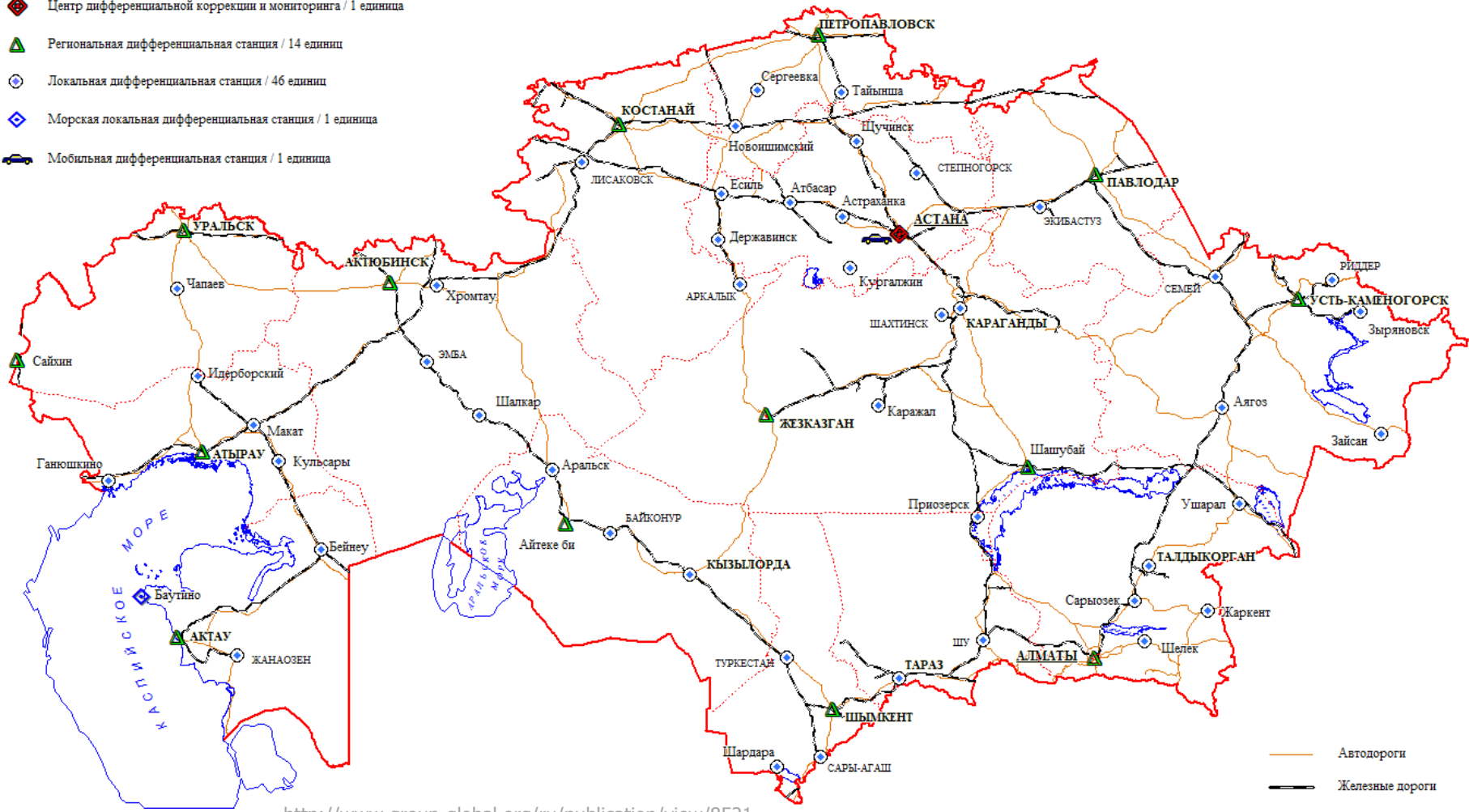
 Мобильная дифференциальная станция (предоставляет КИ в любой точки РК)



<http://www.group-global.org/ru/publication/view/8521>

National GNSS Network of Kazakhstan (60 CORS in 2014-15)

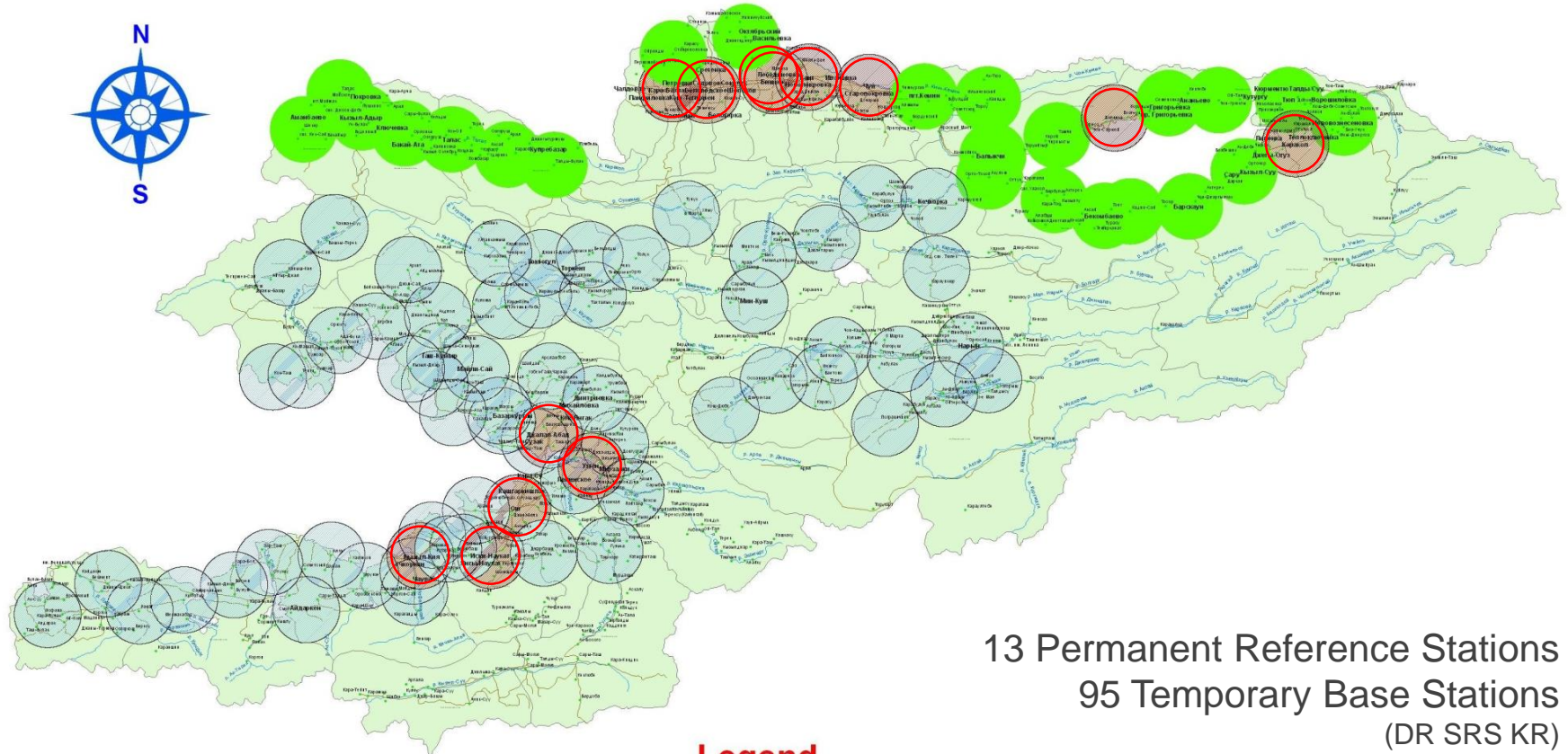
-  Центр дифференциальной коррекции и мониторинга / 1 единица
-  Региональная дифференциальная станция / 14 единиц
-  Локальная дифференциальная станция / 46 единиц
-  Морская локальная дифференциальная станция / 1 единица
-  Мобильная дифференциальная станция / 1 единица



<http://www.group-global.org/ru/publication/view/8521>



National GNSS Network of Kyrgyzstan (13 CORS in 2014)



13 Permanent Reference Stations
95 Temporary Base Stations
(DR SRS KR)

Legend

- Settlements
- Temporary Base Stations
- Observed Temporary Base Stations
- Operational Permanent Base Stations
- Permanent Base Stations
- Road
- River
- Rayons - Provinces
- Urban Areas

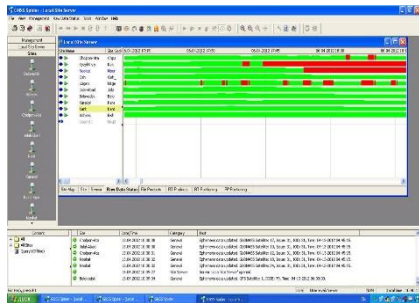
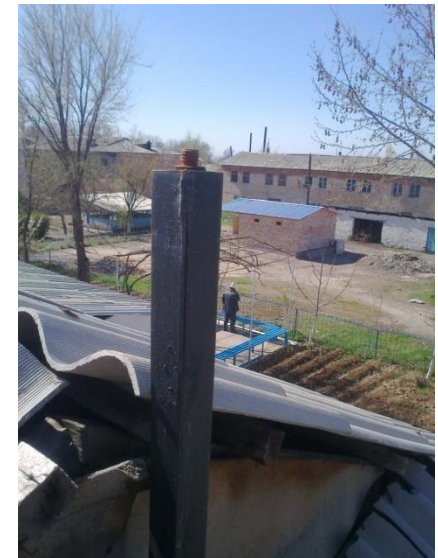
This map is courtesy of DCR SRS KR

Base Stations of the National GNSS Network of Kyrgyzstan

Temporary Base Stations



KYRPOS



Continuously Operating Reference Stations (CORS)



ITRF Coordinates of the Base Stations in Issyk-Kul oblast, Kyrgyzstan

GEOGRAPHIC

• 0553BAZ	42° 35' 20.77843" N	76° 26' 18.35856" E	2002.1263
• BAET	42° 37' 38.89097" N	76° 58' 22.39561" E	1641.4578
• BARSKAUNptr	42° 11' 01.55023" N	77° 33' 50.75999" E	1581.9695
• CHIRPYKptr	42° 32' 21.45448" N	76° 32' 15.05950" E	1674.2178
• KARABULUNptr	42° 45' 23.32103" N	78° 15' 03.27141" E	1579.2903
• KOKKIAptr	42° 29' 27.73543" N	78° 37' 23.18126" E	2925.4069
• KYZYL-SUU	42° 20' 38.73700" N	78° 00' 25.74384" E	1723.5680
• ORTOKSptr	42° 01' 46.23753" N	76° 55' 50.92933" E	2808.8346
• SEMENptr	42° 40' 28.37018" N	77° 34' 22.92119" E	1580.5445



KYRPOS

GEOCENTRIC

	X	Y	Z
• 0553BAZ	1103144.0091	4573270.9850	4295362.1137
• BAET	1059726.8239	4580291.7040	4298255.4786
• BARSKAUNptr	1019559.1202	4623406.1161	4261812.9869
• CHIRPYKptr	1096049.0390	4578578.0305	4291063.7106
• KARABULUNptr	955316.6731	4593227.4060	4308749.4967
• KOKKIAptr	929594.4708	4619889.5809	4287956.7072
• KYZYL-SUU	981309.9123	4619535.1514	4275091.3911
• ORTOKSptr	1073402.5529	4623936.1352	4249919.7244
• SEMENptr	1010920.8694	4587635.5058	4302061.5621

http://gosreg.kg/index.php?option=com_content&view=article&id=+336&Itemid=214

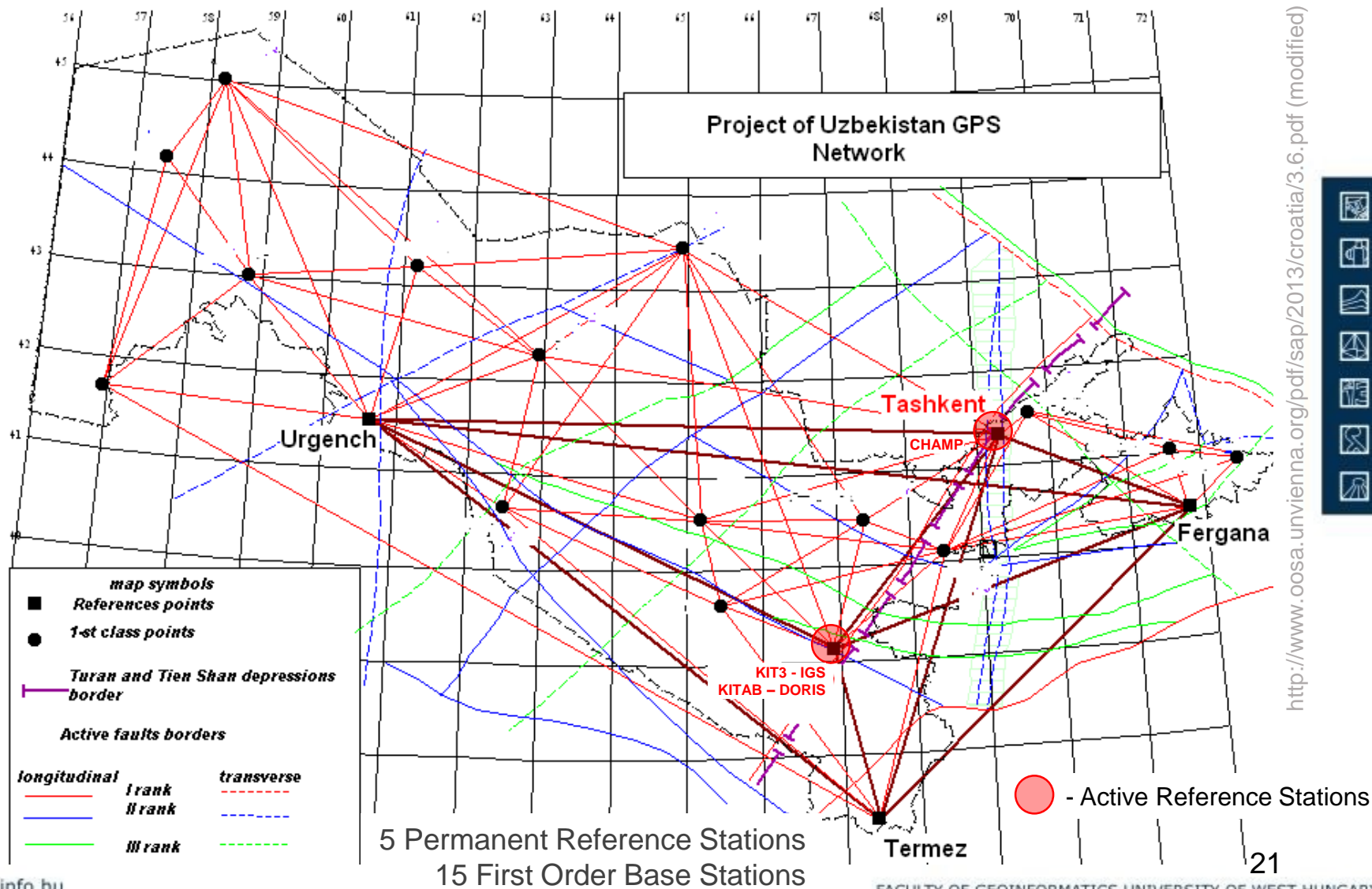


GNSS in Tajikistan (planning stage of the National GNSS Network)



 - Active Reference Station

Project of the National GNSS Network of Uzbekistan



<http://www.oosa.unvienna.org/pdf/sap/2013/croatia/3.6.pdf> (modified)



New National Coordinate Systems of the Central Asian countries

- Kazakhstan (planning stage)
- Kyrgyzstan has implemented new National Coordinate System “Kyrg06” in 2010 (ITRF 2005, UTM, 3°)
- Tajikistan (planning stage)
- Uzbekistan (planning stage)

The World Geodetic System 1984 (WGS 84) and the Universal Transverse Mercator (ITRF based UTM) projected coordinate system have been widely used today in all countries of the region.



Perspectives and trends of GNSS applications in the Central Asian countries



Land Information Systems and GIS

The screenshot displays the GeoMedia Professional interface. The main map area shows a GIS overlay on a topographic map, with a specific land parcel highlighted in orange and labeled with the ID '5-04-04-0021'. A detailed inset map in the bottom-left corner shows an aerial view of a residential area with various parcels outlined in red and green, and labeled with numbers like 82, 101, 166, 004, 89, 108, 109, 111, 201, 259, 259a, 257, and 255. The 'Legend' window on the left lists several layers, including 'Ulicy_Nazvy (394)', 'Ulicy (5 099)', 'ENI_N (21 282)', 'Dom_N (20 972)', 'ENI (20 092)', 'm10p00.jpg (1)', 'List (86)', 'm13p00_o.jpg', 'm13p00_o.jpg', 'ENI_Zdanie', 'Kvartal', 'm11p01_o.jpg', 'Labels of Kvartal', 'Labels of List (86)', 'ENI_Prim', 'Sector', 'Zona', 'GD', 'Reki', 'Reki_Nazv', and 'Gorod'. The 'ENI Properties' window in the bottom-right corner displays the following data:

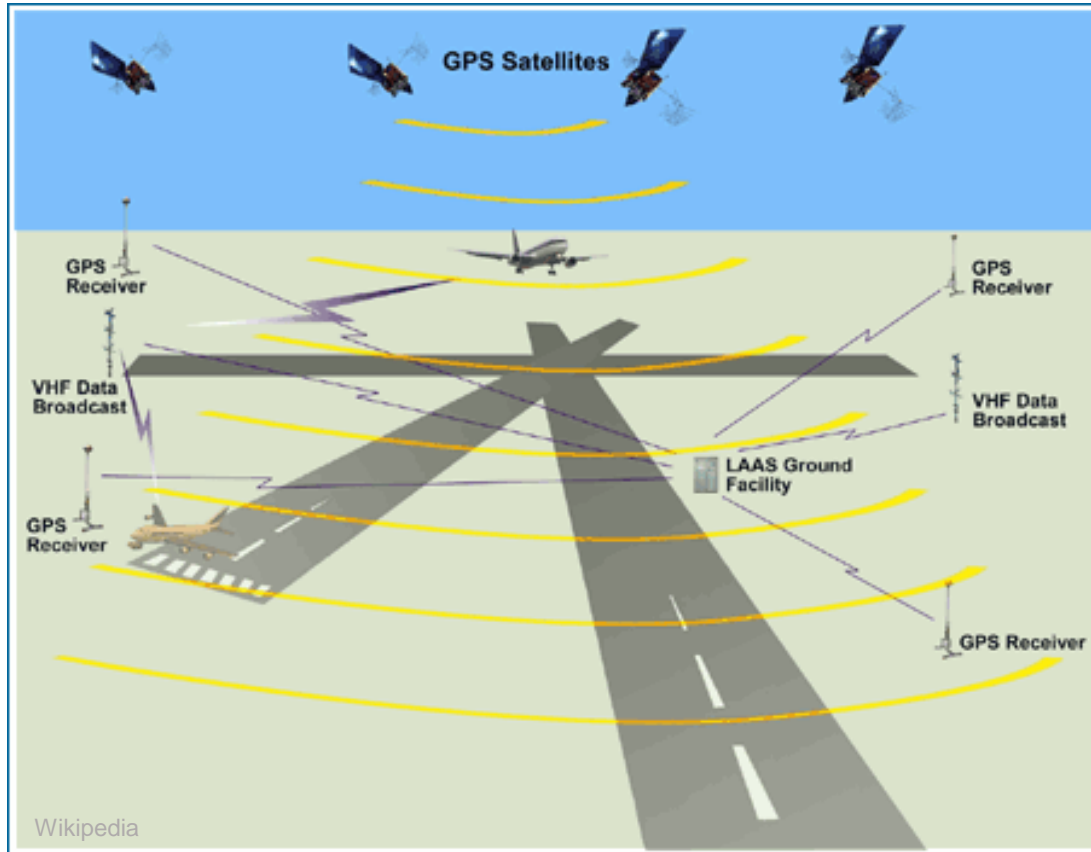
General	Attributes
Name	Value
INDEX	10566
Идентификационн	1-02-04-0023-0166
Адрес	Б.ПР.Бишкек,Фрунзе,410/1
Форма_собственн	Ч
Назначения	Ж
Имя_собственник	Мадалинова Фатима Исмаровна
Площадь_юридик	1019,0
Площадь_фактик	799,0
Категория_собств	4
Вид_недвижимости	33
Кадастровая_инде	п
Дата_и_время_за	
Дата_предавител	
Дата_полной_реги	19.12.2003
Дата_прекращени	
Правоустановлен	ДКП 492311.08.2000
Общая_собственн	
Объединение_Раз	
Предыдущий_код_	
Дата_и_время_за	
Дата_регистрации	
Дата_прекращени	
Документ_ограни	
Вид_ограничения	
Орган_самоуправл	Местное самоуправление г. Бишкек
Общая_площадь_о	405,4
Материал_стен	К



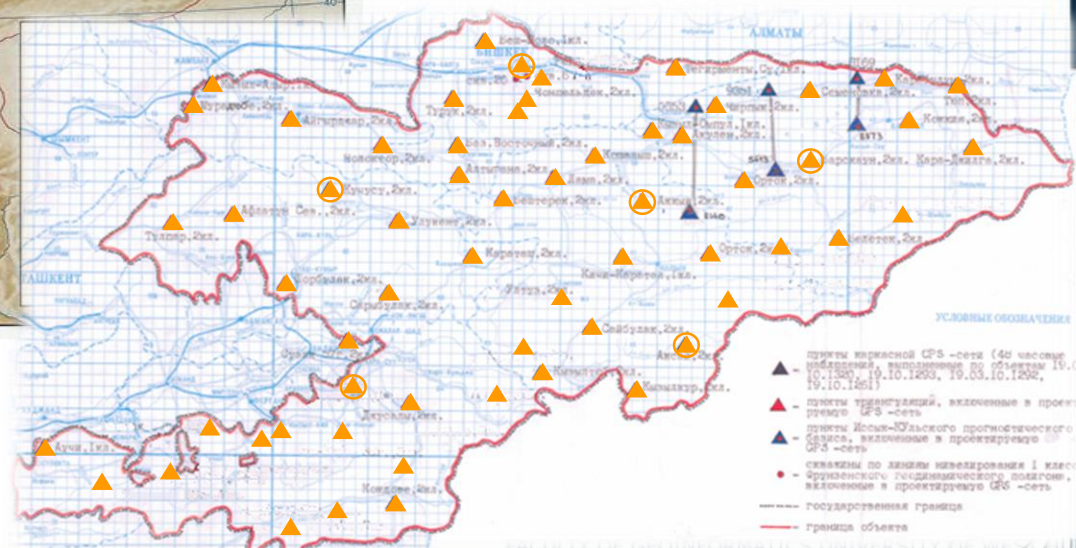
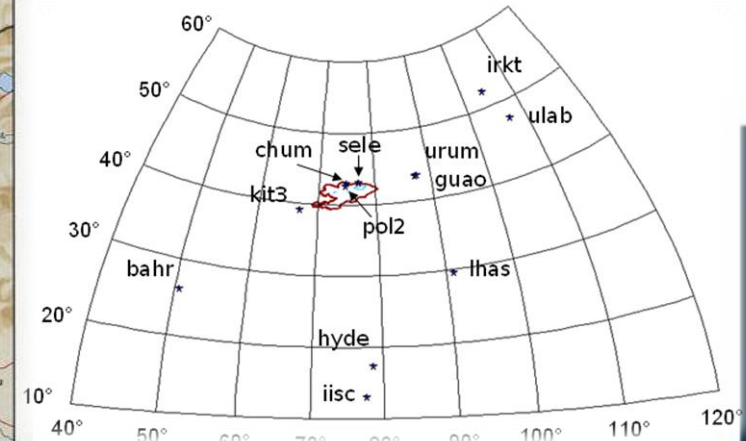
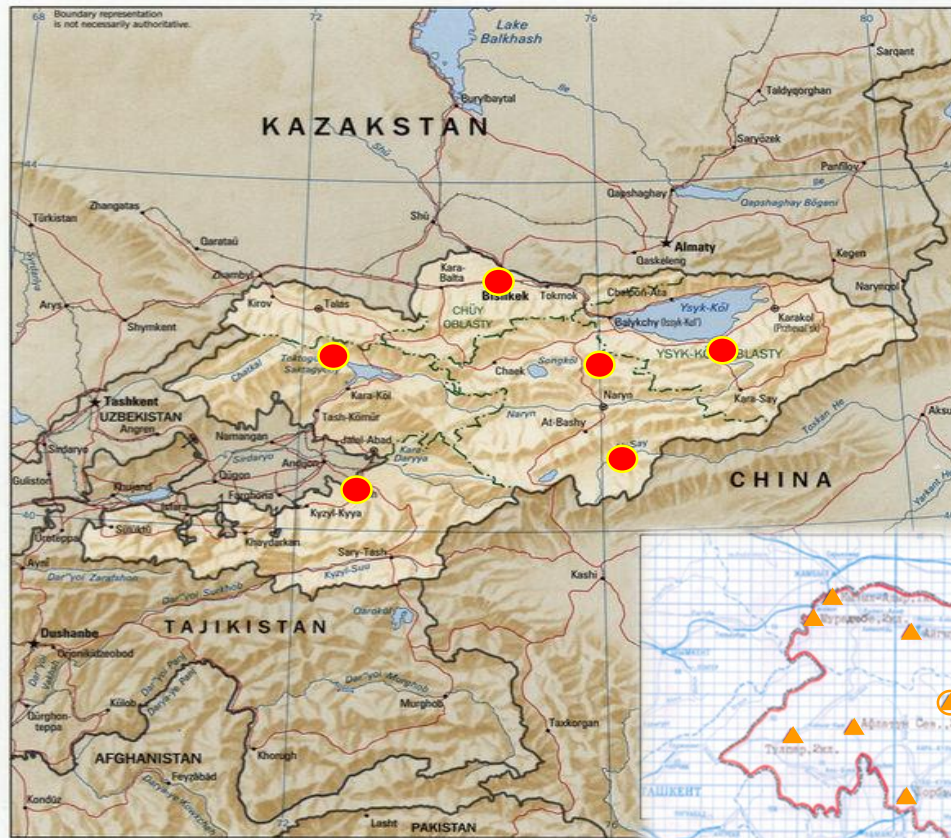
Engineering Survey and Mapping



Air traffic, transport and logistics



GNSS Observations for the new National Geodetic Networks (Kyrgyzstan)



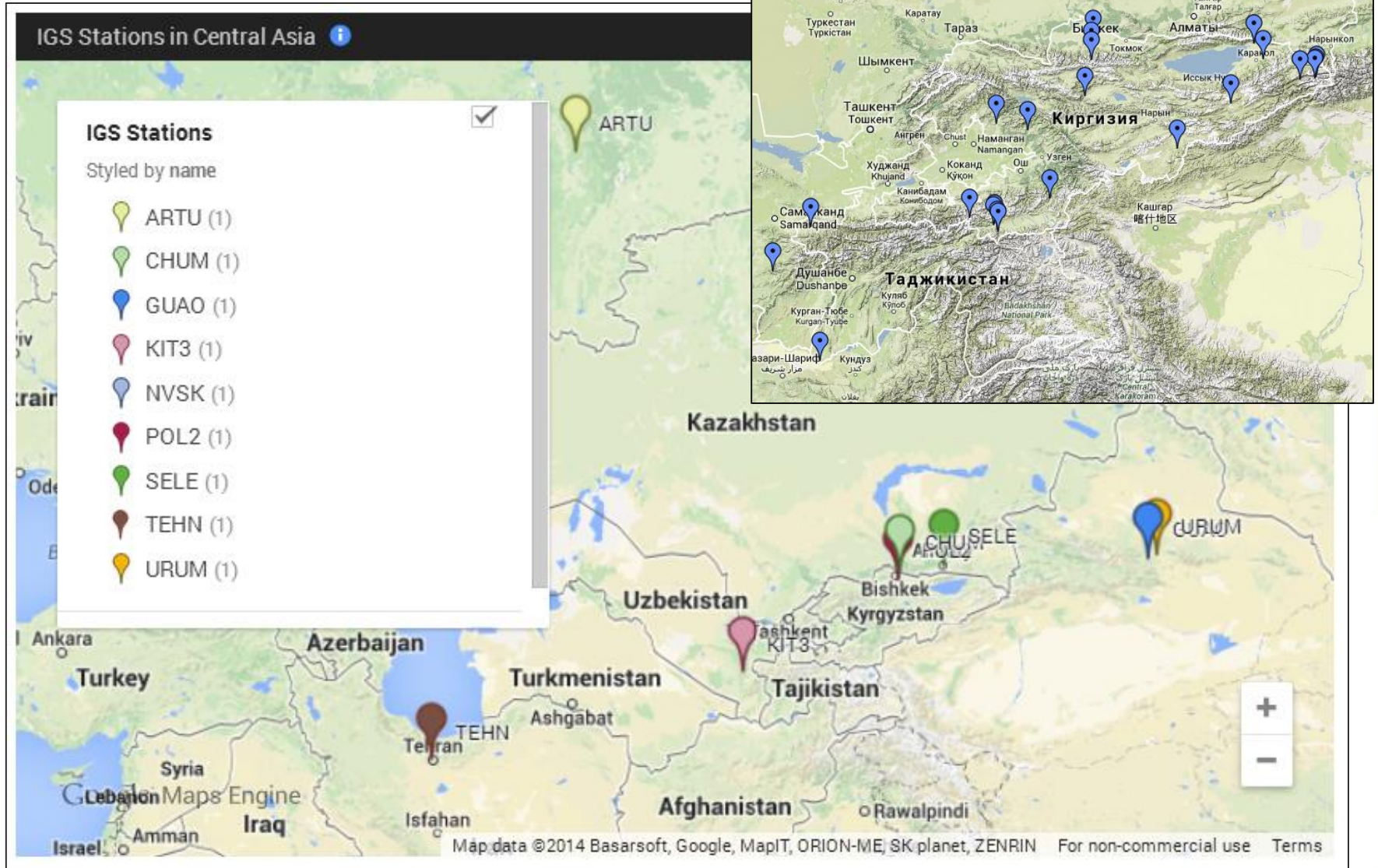
Zero Order 6 Geodetic Points
 First Order 67 Geodetic Points
 SGCS KR, 2007



Geodynamic and Environmental Studies in the Central Asian (CATS, GFZ)



Globalization and Regional cooperation



Conclusion and discussions

- LIS and GIS
- Surveying and Mapping (GNSS technology is replacing the traditional surveying based on the old state geodetic networks; ITRF / Pulkovo)
- Air traffic, transport and logistics (commercial navigation and LBS services)
- Development of the new National coordinate systems (GNSS Observations and International Reference Systems)
- Geodynamic and Environmental Studies (seismic active region)
- Active GNSS Networks (all countries are implementing, but network management is weak because of the weak economies and underestimation)
- Development of the common Central Asian geodetic datum and interoperable reference networks, NSDI and open data sharing



Acknowledgment

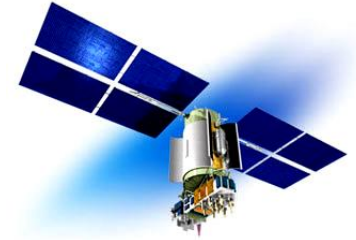
My participation at GIS Open 2014 and PhD study visit to the University of West Hungary were funded by “gSmart” project of the Erasmus Mundus Programme



Very appreciated:

the kindest scientific advises from Dr. György Busics, UWH,
very helpful input into my research work by Prof.Dr. Bela Markus, UWH
as well as valuable comments of my colleagues from
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Thank you for your attention!

Köszönöm a figyelmet!

Чоң рахмат!

