National Report of Croatia

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Introduction

The National report gives a brief overview of fundamental geodetic works in the Republic of Croatia having been carried out since the last EUREF Symposium. Also in paper some future activities concerning fundamental geodetic works were presented.

GPS Activities

The Project of establishment of homogenous GPS-point-network 10x10 km started in 1997 and continued in 2002 was completed in the year 2003. Because of large number of points the network was divided into two parts. Both networks were measured and computed separatly in different ITRF reference frames and epochs. After re-computation of EUREF and CROREF GPS campaigns carried out in Croatia and Slovenia in 1994-1996 and recognising new solution within Resolutions of the EUREF Symposium in Dubrovnik in 2001 as combined EUREF-CRO94/95/96 solution for Croatia (Marjanović and Bačić, 2002) new common adjustment of GPS-point-network 10x10 km (Figure 1) were computed. The whole network has been adjusted on 63 referent points and 7289 space vectors have been optimized (Bašić et al, 2002). High accurancy of adjusted coordinates has been established, 98% of points meets a 2D-standard deviation less then 2 cm, while 93% meets space 3D-standard deviation less then 3 cm. Final results are given in ITRF96, epoch 1999.6, as well as in ETRS89 datum, epoch 1989. In addition, new transformation parametars between ETRS89 referent system and official Croatian coordinate system (HKDS) have been determined on the basis of 241 identical points. These parametars confirm previously defined non-homogeneous existing trigonometric network, but also show the importance of geoid's model-HRG2000 usefullness for height transformation. By finalizing 10x10 km GPS network, practical conditions for introducing new horizontal geodetic datum, have been established.

The following table contains overview of number and order of points included in first and second order Croatian GPS network:

GPS CAMPAIGN	POINT ORDER	NUMBER OF POINTS	TOTAL
EUREF-CRO94/95/96	1	48	
	2	9	
	3 and 4	6	
	other	30	93
GPS network 10 x 10 km (1997. and 2001.)	1	4	
	2	177	
	3 and 4	7	
	GPS 10 x 10 km	828	1016

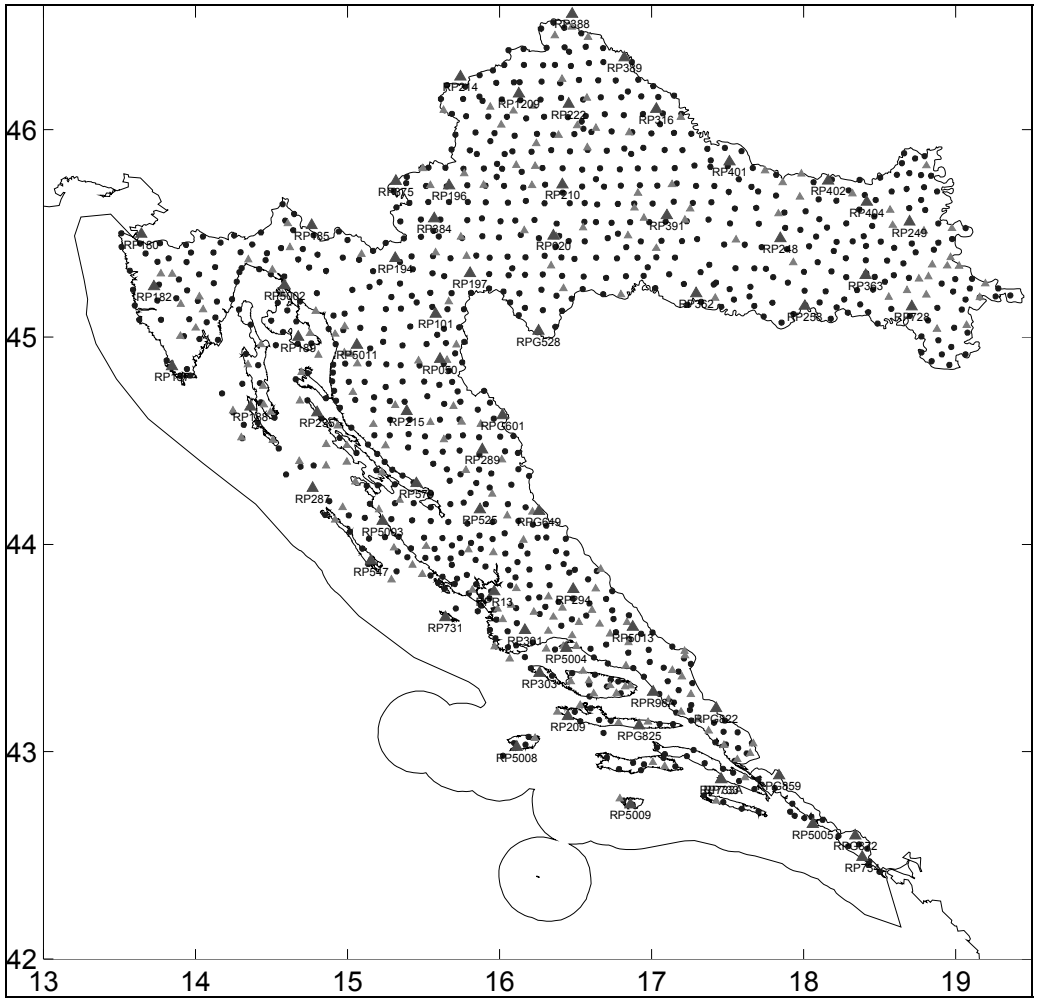

Figure 1: GPS-point-network 10x10 km

Maintenance of EUREF stations

1.	Number of EUREF non-permanent stations in Croatia: 10.
2.	Avarage distance between stations: ≈ 100 km.
3.	The EUREF GPS Sites *0730 Šatorina* and *0732 Sveti Nikola* estimated within SLOCRO-1994 GPS Campaign during the last years were damaged or destroyed, therefore after re-computation of combined solution EUREF-CRO94/95/96 we proposed to replace them with new sites *Kremen* and *Vis Hum.* Till now we have not received information from EUREF database center about changing official coordinates and new EUREF numbers for those two points.
4.	The internal use of EUREF stations in Croatia is as zero order network.
5.	We are planning to observe the network of our EUREF stations together with certain number of the first order trigonometric points in year 2004. Also due to our strategy the points of zero, first and second order GPS network will be periodicaly checked and controlled.

In order to provide unified computation procedures of GPS measurements State Geodetic Administration contracted Faculty of Geodesy in Zagreb to develop two computer programs (Bašić et al, 2003). The first program is DAT_ABMO for transformation between ETRS89 and Croatian national coordinate system by using sets of default transformation parameters or by using transformation parameters computed on the base of identical points in both coordinate systems. The second program is IHRG2000 for computation of geoid undulations for transition from elipsoidal heights to ortometric heights (Figure 2).

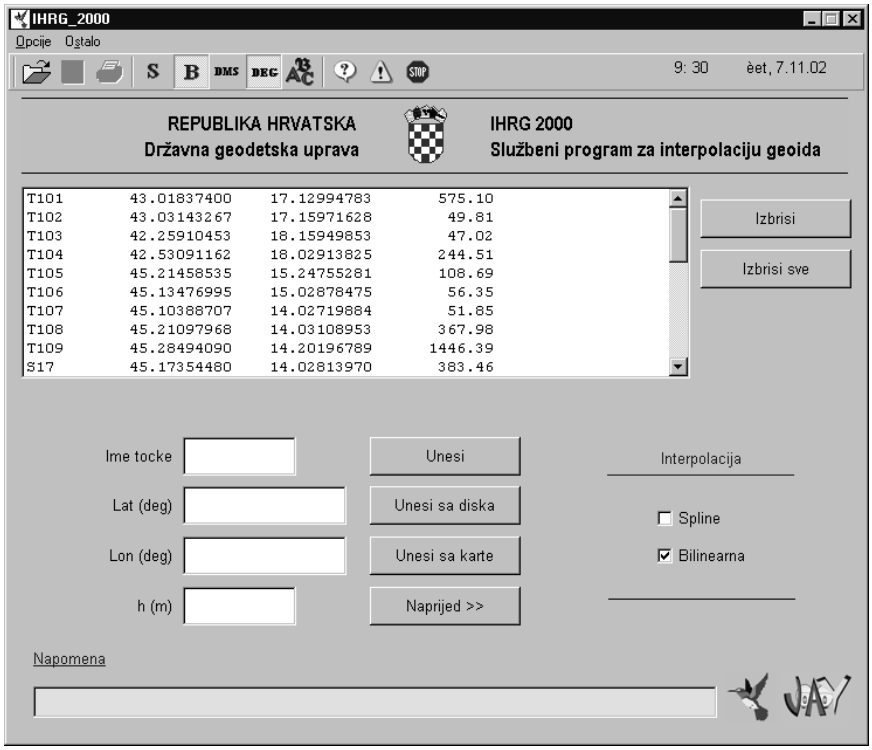

Figure 2: Program IHRG2000 - computation of geoid undulations

Geodetic Point Database

In the year 2002 the Project of development and establishment geodetic point database was started and contracted to be finished till the end of 2003. The project will be produced in Oracle Database System in combination with ESRI ArcGIS software in order to performe connection with the Register of Spatial Units and digital maps 1 : 25 000. The database contains all alpha-numerical information for 46150 points as shown in following table:

POINTS	NUMBER OF POINTS
trigonometric	33 630
GPS	1 109
levelling	11 411
TOTAL	**46 150**

Due to our program for the year 2003 we have planned to scan all site description forms and to intergrate them into database with purpose to establish a connection between graphical and alpha-numerical data.

Revision of Trigonometric and GPS points

The main reason for development database system was to gather information about all geodetic points at one place which will be used as base for revision. Within EUREF, CROREF and GPS-point-network 10x10 km projects, revision of first and second order trigonometric points was done. At SGA we are planning to finnish the revision of trigonometric points of all orders in next 4 years. The revision of all levelleing points in our country was made in period from 1992 to 2000.

Levelling

Due to the lack of any kind of levelling networks in the larger part of Zadar County, particullary in the area where the survey of several cadastral municipalities was contracted, the need for setting levelling network of mentioned area has occured.
It has been decided to perform the level figure as technical level with higher degree of accurancy.The decision has been made after having in consideration the following: current and future practical needs, field recognition, analysis of current levelling network level figure is attached to and the fact that the size and geographic location of the area where network has not been developed.

The total lenght of level figure is 70 km, 78 new benchmarks have been stabilized, and their heights have been determined in existing official height datum (Trieste 1875.) as well as in the proposed new height datum (5 mareographs 1970.) Succesfull performance of these tasks becomes of even higher importance after taking into account the fact that these are first tasks concerning increasing density of lower rows levelling network after a period of 30 years.

Gravimetry

Because of some hardware and software problems with the one of our two SCINTREX gravity meters, the measurements planned for the year 2002 were posponed to 2003. After test and control measurements we are planning to observe all 42 first order gravity points in co-operation with Croatian Geodetic Institute and Faculty of Geodesy till the end of the year and to establish for the first time our national gravimetric network (Hećimović, 2002).

After absolute gravity measurements on six points from 1996 to 2000 we are planning to establish eccentric points to secure and control main point, but also to provide levelling, GPS and classical measurements for connection to national networks.

References:

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