National report of Ukraine

O. Kucher ⁽¹⁾, Yr. Stopkhay ⁽¹⁾, R. Vysotenko ⁽¹⁾, I. Zaiets ⁽²⁾, A. Marchenko ⁽³⁾,

 Research Institute of Geodesy and Cartography, Kyiv, Ukraine
 State Service of Geodesy, Cartography and Cadastre, Kyiv, Ukraine
 Institute of Geodesy, National University "Lviv Polytechnic", Lviv, Ukraine

EUREF2011 Symposium, May 2011, Chisinau, Moldova

Introduction

The following activities during last years should be mentioned:

- development of the permanent GNSS network,
- initiation of the State coordinate system UCS-2000 in the areas of municipal networks (cities),
- estimation of the strain rate tensor from GPS observations in the Eastern Europe,
- new new regular (2'x3') grid of the Bouguer anomalies for geodetic aims,
- preparations to the readjustment of the State vertical network,
- modeling the gravity field in the Ukraine area from gravity gradients of GOCE data,
- further densification of GPS-leveling data to a number of about 4000 GPS-leveling points for new quasigeoid solution,
- finalization of practical activity of the search of Struve Arc points in the Ukraine area.

1. Permanent (▲) and periodically observed (▲) GNSS-stations



2. Adopted criteria for UCS-2000:

- 1) it is eccentric, the center of UCS-2000 selected as the center of Krassowsky's ellipsoid is defined under the standard condition of minimal deviation between reference ellipsoid and quasigeoid in the Ukraine area;
- 2) its orientation is given initially by the orientation of ITRF2000 at epoch 2005.0 (scale is identical to the ITRF2000 scale at the same epoch);
- its realization is based on the Ukrainian permanent network and preferred stations of the State network of 1st order via common adjustment of GNSS observations and classic terrestrial data;
- 4) UCS-2000 should be close to the horizontal system S-42 (Pulkovo).

After practical realization of these requirements the new system keeps old maps of the scale 1:10000 or smaller given in the S-42 system. In addition the accurate connection between the reference system UCS-2000 and the coordinate systems ITRS/ITRF2005 and ETRS89 was derived.

Accuracy estimation of the position of geodetic stations given in UCS-2000

	Accuracy estimation (in m) of geodetic stations of different orders						
Statistics	1 st order,	2 nd order,	3 rd order,	4 th order,	Total: 24657		
	813 points	5586 points	10084 points	8174 points	points		
Min	0.001	0.001	0.001	0.003	0.001		
Max	0.026	0.112	0.099	0.143	0.143		
Mean	0.003	0.020	0.032	0.032	0.028		

Further densification of the Ukrainian State Geodetic Network (SGN):

1) new points (restoring old and installing new sites) were developed (650 points),

2) a special work for the transformation from UCS-2000 to different municipal (local) coordinate systems was started,
3) at present there are 18 municipal coordinate systems where parameters of the transformation must be derived,
4) among these local coordinate systems connected with various municipal areas (cities) new 12 geodetic networks were constructed.

Dilatation rate in the Eastern Europe (ETRS89)



3. Current status of the Ukrainian vertical reference system

- all leveling polygons of the 1st order leveling between Ukraine and neighboring countries were connected,
- new regular (2'x3') grid of the Bouguer anomalies for calculation of geopotential numbers was constructed,
- creation of the database for the adjustment of leveling networks of 1st and 2nd orders via geopotential numbers,
- in the process of preparation to the readjustment of the State vertical network all necessary data of the leveling of 1st and 2nd orders between Ukraine and bordering countries were transmitted to Bundesamt für Kartographie und Geodäsie (BKG),
- building of the special geodynamic polygons in the areas of atomic power station,

New regular grid (2'x3') of the Bouguer anomalies in the Ukraine and Moldova area



Distribution of GPS-leveling data



Vertical networks of 1st (-) and 2nd (-) orders

Order	Number	Len	gth of lines, I	km	Number of Perime		ter, km
	of lines	Min	Max	Total	polygons	Min	Max
Ι	29	70.7	1301.9	11975.0	18	135.5	2234.9
II	62	37.5	383.9	11179.5	72	218.0	883



4. Current status of the Struve Arc points in the Ukraine area



Finally we can conclude:

- Among 63 points of Struve Arc in the Ukraine area only 15 point are saved,
- A large number of Struve Arc points – 26 stations were destroyed,
- A large number 22 points were replaced in the Ukraine area by the centers of the State Geodetic Network points (SGN).

Saved points of Struve Arc in the Ukraine area

No	Struve No	Point Name	Result	No	Struve No	Point Name	Result
35	213	Katerinowka	UNESCO	48	211	Bazalia	Found
37	215	Felschtin	UNESCO	49	216	Alexandrowka	Found
38	218	Baranowka	UNESCO	50	264	Izmail	Found (cupola of bell
							tower of temple)
43	196	Golobi	Found	51	265	Staro-	UNESCO
						Nekrassowka	
44	206	Matwejewzi	Found	52	KUS	Kusmin	Found
45	207	Mosty	Found	53	POG	Pogarelaja	Found
46	208	Ssiwki	Found	62	Sselyshe	Sselyshe	Found
47	256	Pandaklia	Found				

Izmail – cupola of bell tower of the Orthodox temple of Saint Mikolay



Struve Arc center of the Golobi point filled by the lead



Matwejewzi





Conclusions

- Common adjustment of GNSS observations and classic terrestrial data have led to the State geodetic network UCS-2000 with accuracy from 1 to 3 cm.
- The UCS-2000 reference system has accurate parameters of transformation with the realizations of ITRS and ETRS systems and 12 municipal (local systems) around different cities.
- To make available the connection with the United European Leveling Network by means of geopotential numbers new regular (2'x3') grid of the Bouguer anomalies for calculating geopotential numbers was constructed.
- **Preparation to the readjustment of the State vertical network all necessary data of the leveling of 1st and 2nd orders between Ukraine and neighboring countries included also data transition to BKG.**
- A special work for the construction of tailored model of the gravity field in the Ukraine area was started and includes as initial data gravity gradients of GOCE data.
- Further densification of GPS-leveling data in 2011 to a number of about 4000 GPS-leveling points allows new quasigeoid solution based on gravimetry, altimetry (Black Sea and Azov Sea areas), GOCE, and GPS-leveling data.
- **Finally among 63 points of Struve Arc in the Ukraine area only 15 point are saved.** A large number of Struve Arc sites – 26 points were destroyed and 22 **points were replaced by centers of the State Geodetic Network points.**

Thank you for your attention!

Gravity gradients distribution for the time-period of 1 day



Gravity gradients distribution for the time-period of 1 month

