Stations of Space Geodesy and Geodynamics of CrAO: Simeiz VLBI, Simeiz-1873 SLR, CrAO-GPS

A.E. Volvach, A.I. Dmitrotsa, V. Andreatta

Abstract

This report gives an overview about the geodetic VLBI, SLR and GPS activities at CrAO stations. We summarize briefly the status of the 22-m radio as IVS Radio Network Station Telescope, the laser Simeiz-1873, and the GPS-CrAO stations.

1. General Information

The fundamental geodynamics area "Simeiz-Katsively" is situated on the coast of the Black Sea near the village of Simeiz about 20 km west of the city of Yalta in the Ukraine. It consists of two satellite laser ranging stations, a permanent GPS receiver, a sea level gauge, and the radio telescope RT-22. All these components are located within 3 km (Figure 1).

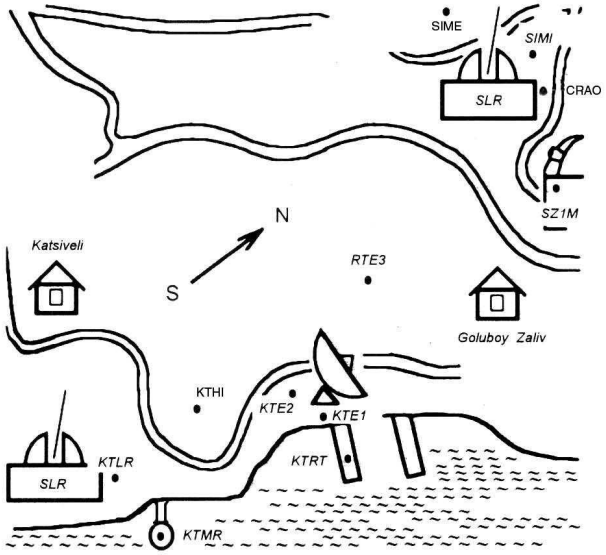

Figure 1. The geodynamics area "Simeiz-Katsively".

The positions of the points in the geodynamics test area "Simeiz-Katsively" have been determined by a special GPS survey campaign. Results are presented in Table 1.

1.1. "Simeiz" (Crimea) VLBI Station

The radio telescope RT-22 has a steering parabolic mirror with diameter 22 m and focal length 9 525 mm (Figure 2). The surface has a root mean square accuracy of 0.25 mm and an effective area of 210 m^2 which does not depend on elevation angle at geodetic frequencies 2.3 and 8.4 GHz. The antenna has an azimuth-elevation mounting with an axis offset of -1.8 ± 0.2 mm. The working range in azimuth is [-210°, 210°] (zero is to the south) and in elevation is [-1°, 85°]. The maximum

Table 1. Final solution for coordinates of points in the area "Simeiz-Katsively".

Station	X, m	RMS, m	Y, m	RMS, m	Z, m	RMS, m
KTHI	3785378.6041	0.0004	2551165.3915	0.0003	4439717.4172	0.0004
KTLR	3785923.9017	0.0005	2550781.8054	0.0003	4439471.6117	0.0004
KTRT	3785160.8761	0.0004	2551262.2573	0.0002	4439789.8357	0.0004
SIME	3783746.4067	0.0000	2551362.7445	0.0000	4441445.1801	0.0000
CRAO	3783897.2187	0.0006	2551404.3953	0.0004	4441264.2859	0.0006
SIMI	3783887.4552	0.0004	2551403.5454	0.0003	4441266.8603	0.0005
KTE2	3785236.0690	0.0477	2551188.5462	0.0308	4439784.2244	0.0531
KTE1	3785206.0519	0.0345	2551216.1368	0.0240	4439790.8836	0.0426

slewing rate is 1.5°/sec. The control system of the telescope provides accuracy of pointing at the level of 10″.

The foundation pit of the telescope is 9 meters deep, and it has three meters of crushed stones and then six meters of concrete. The height of the elevation axis above the foundation is 14.998 meters. The telescope is located 80 meters from the edge of the Black Sea.

The reference point of the radio telescope has IERS name "CRIMEA", ITRF name "Simeis", IERS DOMES number 12337S008, and CDP number 7332.

The reference point of the antenna is the point of projection of the azimuthal axis on the elevation axis. The coordinates of this point are determined in analysis of the observations. However, this point may move with respect to the local area where the radio telescope is located.

RT-22 was equipped with modern Mark 5A and Mark 5B+ VLBI recording systems and a new H-maser. That gives the possibility to continue astrophysical and fundamental geodetic VLBI observations.

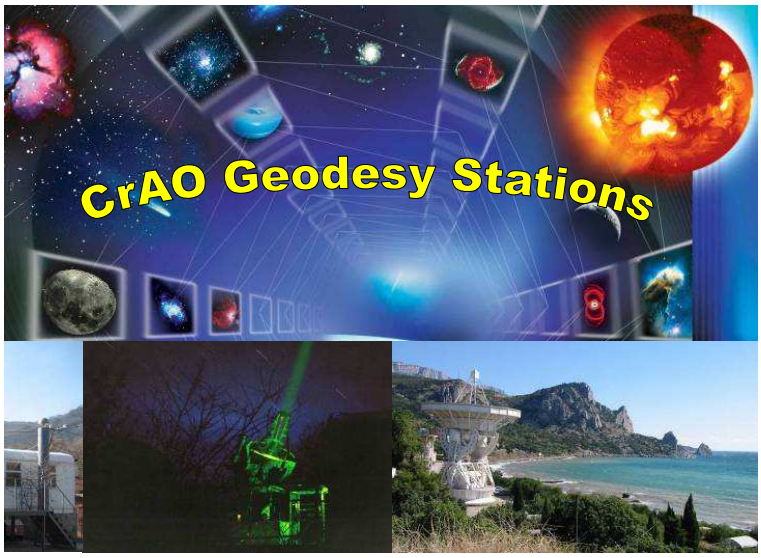

Figure 2. CrAO-GPS, Simeiz-1873 SLR, and Simeiz VLBI stations.

1.2. Satellite Ranging Station SLR "Simeiz-1873"

Regular satellite laser ranging started in our observatory in 1976 as an INTERKOSMOS station. In 1988 CrAO installed a new station (near the old station) with name Simeiz-1873 (Figure 2): Network: ILRS and EUROLAS, Name: Simeiz, Code: SIMI, Plate: Europe, CDP: 1873, IERS DOMES: 12337S003, Laser SOD: 12337S003. The coordinates of station are presented in Table 2.

Table 2. Coordinates to 01.01.2010 by ITRF2005 of the Simeiz-1873 station.

Latitude	44° 24′ 47.31″
Longitude	33° 59′ 27.44″
Height	364.24 m
X	3783902.127 m
Y	2551405.097 m
Z	4441257.417 m

1.3. GPS Station "GPS-CrAO"

The GPS-CrAO station (Figure 2) was upgraded in 2008. The GPS system includes a receiver and an antenna. The computer system and Meteorological Survey Equipment were supplied by NASA/Science Division/UNAVCO (Figure 3).

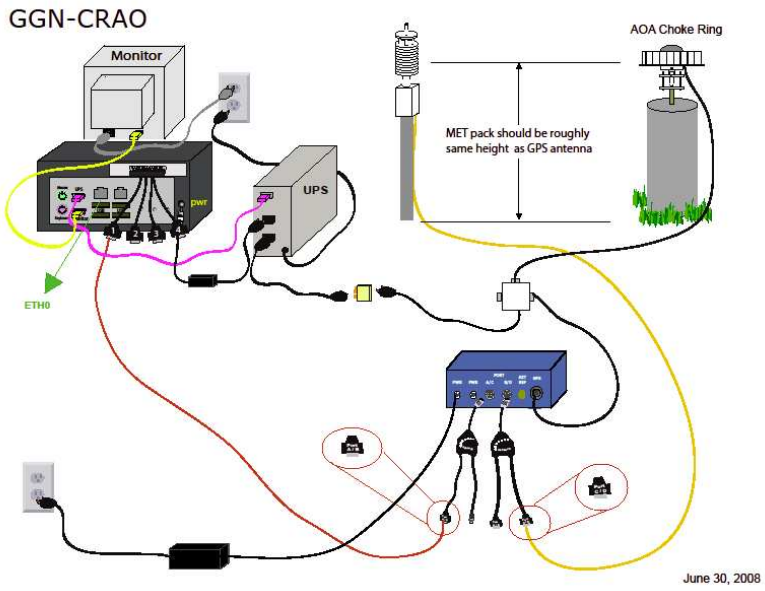

Figure 3. GGN-CrAO.

2. Current Status and Activities

In 2010 the Space Geodesy and Geodynamics stations regularly participated in the International Network programs of IVS, the International GNSS Service (IGS), and the International Laser Ranging Service (ILRS).

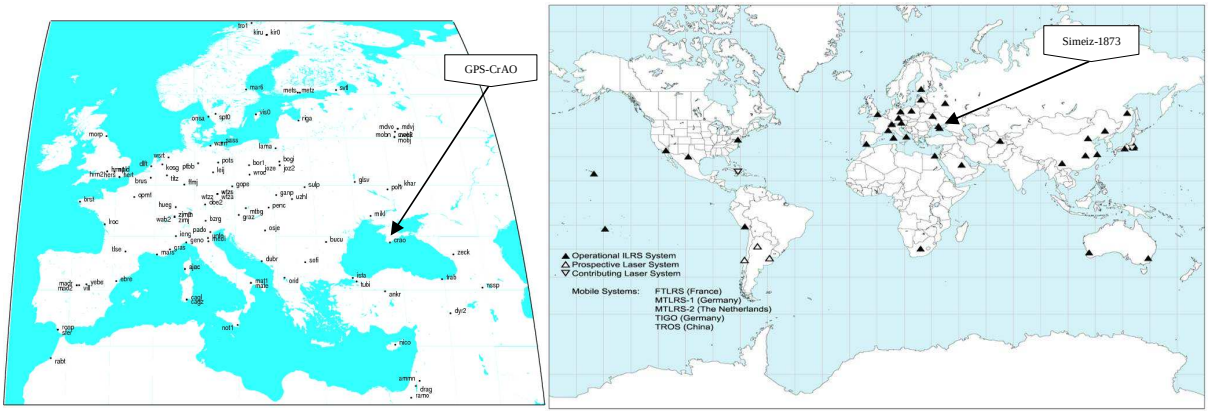

Figure 4. "GPS-CrAO" and "Simeiz-1873" stations of International Network - IGS and ILRS.

From January 1 through December 31, Simeiz VLBI station participated in twelve 24-hour geodetic sessions. Simeiz regularly participated in the EUROPE and T2 series of geodetic sessions.

Use of the Simeiz antenna is shared with the "Radioastron" program. The Research program provides for work with highly sensitive radiometers at frequencies of 22 GHz and 36 GHz. The catalog of sources for flight program "Radioastron" observations of a sample of sources from the preliminary "Radioastron" catalog were obtained at 22.2 and 36.8 GHz on the RT-22 radio telescope of the Crimean Astrophysical Observatory [1]. This makes it possible to obtain spectral characteristics of the sources near 22 GHz the fundamental frequency of the experiment "RadioAstron". To implement the project prepared by the scientific program, a substantial part of which is the study of compact structures in extragalactic sources, we conducted ground-based VLBI test experiments.

3. Future Plans

Our plans for the coming year are the following: put into operation the VLBI Data Acquisition System DBBC, upgrade the laser of SLR Simeiz-1873 station, and set up new GPS station near Simeiz VLBI station.

References

[1] A.E. Volvach // Space Science and Technology. 2009. T.15. N.5. P.82–97.