

Simeiz VLBI Station - Geodetic and Astrophysical Study

A.E. Volvach

Abstract

This report gives an overview about the geodetic VLBI activities at the Simeiz station. It also summarizes the seasonal and long-term variability of the Black Sea level near Yalta, Odessa, Ochakov, and Katsively.

1. General Information

The Simeiz VLBI Station (also known as CRIMEA in the geodetic community), operated by Radio Astronomy Laboratory of Crimean Astrophysical Observatory, is situated on the coast of the Black Sea near the village Simeiz, 20 km west of the city Yalta in the Ukraine (Figure 1).



Figure 1. Simeiz VLBI station.

The fundamental geodynamics area “Simeiz-Katsively” is also situated on the coast of the Black Sea near the village Simeiz. It consists of two satellite laser ranging stations, a permanent GPS receiver, a sea level gauge, and the radio telescope RT-22. All of these components are located within 3 km (Figure 2).



Figure 2. The geodynamics area “Simeiz-Katsiveli”.

RT-22, the 22-meter radio telescope which was set in operation in 1966, is among the five most efficient telescopes in the world. Various observations in the centimeter and millimeter wave ranges are being performed with this telescope now and will be performed in the near future. First VLBI observations were performed in 1969 on the Simeiz (RT-22) — Green Bank (RT-43, USA) intercontinental baseline. RT-22 is equipped with radiometers at the 92 cm, 18 cm, 13 cm, 6 cm, 3.5 cm, 2.8 cm, 2.3 cm, 2.0 cm, 13.5 mm, and 8 mm wavelengths.

2. The Black Sea Level

The 22-m radio telescope RT-22 is located 80 m from the edge of the Black Sea. The geodynamics area “Simeiz-Katsiveli” consists of two satellite laser ranging stations, a permanent GPS receiver, a sea level gauge, and the radio telescope RT-22 (Nesterov and Volvach, 2002). All these components are located within 3 km. The Yalta level gauge is located near Yalta, 20 km east of RT-22.

A temporal spectrum of the Black Sea level variations and a possible relation between this spectrum and dynamics of changes in the position of the CRAO RT-22 as an element of the European geodynamic VLBI network are discussed in [1].

Using some results of the international geodynamic VLBI program for 1994 — 2011, the coordinates of the station Simeiz have been determined. The measurement results for the Simeiz RT-22 coordinates are compared with long-term monthly-averaged measurements for the Black

Sea level which are performed at the stations located in Odessa, Ochakov, Sevastopol, Yalta, and Katsively. All the stations of the sea level measurements have a different water flow, which gives the opportunity to explore global geodynamic processes and a relationship between them and a solar activity cycle. A spectrum of sea level variations at various points shows the presence of periods from one to 11 and 22 years. Results are presented in Table 1.

Table 1. The main periods of the Black Sea level variations.

Station	Period (month)	Value of periodogram
Ochakov (1986-2005)	6	376
	12	5000
	14	624
	17	675
	20	698
	40	743
Odessa (1945-2010)	6	146
	12	12839
	20	1799
	28	1346
	44	2851
	53	1777
	99	1761
	132	2806
396	3173	
Yalta (1992-2003)	6	225
	10	282
	12	1420
	14	586
	21	358
	29	643
Katsively (1992-2009)	6	363
	12	1986
	17	594
	40	754

The periods for each station's level are estimated separately with the use of wavelet analysis (Figure 3).

3. Current Status and Activities

During last year the Space Geodesy and Geodynamics stations regularly participated in the International Network programs — IVS, the International GPS Service (IGS), and the International Laser Ranging Service (ILRS).

During the period of January 1 – December 31, 2012, the Simeiz VLBI station participated in 12 24-hour geodetic sessions. Simeiz regularly participated in the EUROPE and T2 series of

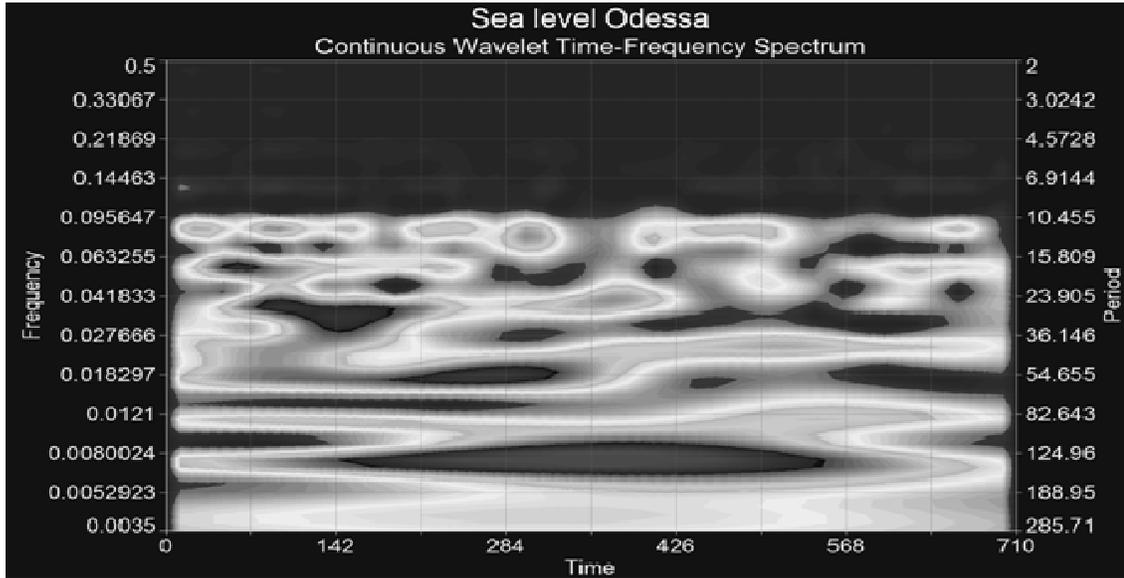


Figure 3. Wavelet analysis of the sea level in Odessa.

geodetic sessions.

Use of the Simeiz antenna is shared with the “Radioastron” program: the testing of the ground-based segment of the Radioastron mission at wavelengths of 1.35 cm.

In accordance with the scientific cooperation between Ukraine and Russia, the Simeiz (radio astronomy laboratory) team held a series of studies for the preparation of the operation of the ground segment of the “RadioAstron” mission. Using the 22-m radio telescope RT-22, the team prepared the scientific program of measurements, a substantial part of which is the study of the compact structures in the extragalactic sources. For testing of the model of the ground segment of “Radioastron”, RT-22 of Crimean Astrophysical Observatory in Simeiz and RT-70 (P-2500) in Evpatoria jointly conducted ground-based VLBI test experiments at 1.35 cm [2].

4. Future Plans

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

References

- [1] M.I. Ryabov, A. E. Volvach, et al., // Space Science and Technology. 2012. T.18. N.1. P.13 — 20.
- [2] Volvach A.E., Kostenko V.I., Larionov M.G., Volvach L.N., et al. // Bulletin of the Crimean Astrophysical Observatory. 2012. T.108. N.1. P.1 — 7.