Zelenchukskaya Radio Astronomical Observatory

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Abstract

This report summarizes information on recent activities at the Zelenchukskaya Radio Astronomical Observatory in 2011. During the previous year a number of changes were carried out at the observatory to improve some technical parameters and upgrade some units to required status. The report also provides an overview of current geodetic VLBI activities and gives an outlook for the next year.

1. General Information

Zelenchukskaya Radio Astronomical Observatory (Figure 1) was founded by the Institute of Applied Astronomy (IAA) as one of three stations of the Russian VLBI network QUASAR [1]. The sponsoring organization of the project is the Russian Academy of Sciences (RAS). The Zelenchukskaya Radio Astronomical Observatory is situated in Karachaevo-Cherkesskaya Republic (the North Caucasus) about 70 km south of Cherkessk, near to the Zelenchukskaya village. The geographic location of the observatory is shown on the IAA RAS Web site: *http://www.ipa.nw.ru/PAGE/rusipa.htm* (Table 1). The basic instruments of the observatory are a 32-m radio telescope equipped with special technical systems for VLBI observations, GPS/GLONASS/Galileo receivers, and an SLR system installed in 2011.

Figure 1. Zelenchukskaya observatory.

2. Technical Staff

Andrei Dyakov — observatory chief,
Dmitry Dzuba — FS, pointing system control,
Anatoly Mishurinsky — front end and receiver support.

Table 1. Zelenchukskaya Observatory location and address.

Longitude	$41°34'$
Latitude	$43°47'$
Zelenchukskaya Observatory	
Karachaevo-Cherkesskaya Republic	
369140, Russia	
ipazel@mail.svkchr.ru	

3. Technical and Scientific Information

Table 2. Technical parameters of the radio telescope.

Year of construction	2000
Mount	AZEL
Azimuth range	$\pm 270°$ (from south)
Elevation range	from $-5°$ to $95°$
Maximum azimuth - velocity - tracking velocity - acceleration	 1.5 °/s 1.5 ′/s 0.2 $°/s^2$
Maximum elevation - velocity - tracking velocity - acceleration	 0.8 °/s 1.0 ′/s 0.2 $°/s^2$
Pointing accuracy	better than $10''$
Configuration	Cassegrain (with asymmetrical subreflector)
Main reflector diameter	32 m
Subreflector diameter	4 m
Focal length	11.4 m
Main reflector shape	quasi-paraboloid
Subreflector shape	quasi-hyperboloid
Main reflector surface accuracy	$\pm$ 0.5 mm
Frequency range	1.4–22 GHz
Axis offset	-3.0 ± 1.5 mm

The electrical part of the gear and pointing system of the radio telescope was upgraded in 2008 — 2010. A new DAS R1002M designed at the IAA [2, 3] has been used in all kinds of VLBI observational programs since October 2011. The DAS R1002M is suited to work with Mark 5B and Mark 5B+ recording systems.

4. Co-location of VLBI, GPS/GLONASS and SLR System

The Topcon GPS/GLONASS/Galileo receiver with meteo station WXT-510 was tested and put into operation (Figure 2).

Figure 2. Topcon GPS/GLONASS/Galileo receiver at the Zelenchukskaya observatory.

The SLR system "Sazhen-TM" (Figure 3) was mounted in May 2011. The "Sazhen-TM" SLR system was manufactured by Open Joint-stock Research-and-Production Corporation "Precision Systems and Instruments". The technical parameters of the system are presented in Table 3.

Figure 3. "Sazhen-TM" SLR system at Zelenchukskaya observatory.

Table 3. Technical parameters of the SLR system "Sazhen-TM".

Ranging distance, day	400-6000 km
Ranging distance, night	400-23000 km
Aperture	25 cm
Wavelength	532 nm
Beam divergence	12″
Laser pulse frequency	300 Hz
Pulse energy	2.5 mJ
Mass	170 kg
Normal points precision	1 cm
Angular precision	1-2″

5. Current Status and Activities

The Zelenchukskaya observatory participates in IVS and domestic VLBI observational programs. During 2011 Zelenchukskaya station participated in 49 diurnal IVS sessions — IVS-R1, IVS-R4, IVS-T2, IVS-R&D, EURO, and CONT11.

Zelenchukskaya participated in 49 diurnal sessions in the frame of the domestic Ru-E program for determination of all Earth orientation parameters and in 55 one-hour Ru-U sessions for obtaining Universal Time using e-VLBI data transfer.

6. Outlook

Our plans for the coming year are the following:

- To participate in IVS observations
- To carry out domestic observational programs for obtaining Universal Time with e-VLBI data transfer and Earth orientation parameters once a week
- To carry out SLR observations of geodetic and navigation satellites
- To participate in EVN and RADIOASTRON observational sessions
- To continue geodetic monitoring of the antenna parameters.

References

[1] Finkelstein A., Ipatov A., Smolentsev S. The Network "Quasar" : 2008-2011 // "Measuring the future", Proc. of the Fifth IVS General Meeting, A. Finkelstein, D. Behrend (eds.), St. Petersburg, "Nauka", 2008. pp. 39–46.

[2] Grenkov S. A., Nosov E. V., Fedotov L. V., Koltsov N. E. A Digital Radio Interferometric Signal Conversion System // Instruments and Experimental Techniques, 2010. Vol. 53, No. 5. pp. 675–681.

[3] Nosov E. Next-Generation DAS for the Russian VLBI-Network. // 20th EVGA Meeting. MPIfR, Bonn. 2011. pp. 41–43.