

Simeiz Station: Geodetical Experiments and Single Dish Observations

N. Nesterov, A. Volvach

Abstract

This report summarizes an overview of the VLBI activities during 5 years. Horizontal station velocity was determined and estimates of its accuracy were obtained. An overview about the single dish activity and of the stability of the station with respect to local marks is given also.

1. Observations and Data Analysis

1.1. IVS

All available dual-band geodetic MARK III VLBI observations for 21 years, from 1979.59 till 2000.72 were used in the analysis: 3 058 sessions, 3 005 651 observations including 36 successful sessions with participation of the station Simeiz for 6 years: 1994.48–2000.36 with 19 631 good measurements of group delays (Petrov et al., 2000).

Simeiz station moves with respect to the Eurasian tectonic plate considered as rigid with rate 2.8 ± 0.9 mm/year in the direction with azimuth 27 deg. Thorough investigation of possible systematic effects has been done and the reliability of the estimate of the uncertainty has been evaluated. Performance of the receivers and H-maser was examined. The stability of the station with respect to local marks was investigated and an enhancement of inclination of the azimuthal axis (Pisa effect) of the telescope with velocity 2''6 per year was disclosed (see Fig.1).

The following position of the station Simeiz at the epoch 1997.0 and its rate of change in the ITRF97 system were obtained:

$$\begin{array}{ll} X = 3D3785231.070 \pm 0.006 \text{ m} & \dot{X} = 3D6.8 \cdot 10^{-10} \pm 0.3 \cdot 10^{-10} \text{ m/sec} \\ Y = 3D2551207.415 \pm 0.004 \text{ m} & \dot{Y} = 3D5.0 \cdot 10^{-10} \pm 0.4 \cdot 10^{-10} \text{ m/sec} \\ Z = 3D4439796.360 \pm 0.008 \text{ m} & \dot{Z} = 3D2.1 \cdot 10^{-10} \pm 0.8 \cdot 10^{-10} \text{ m/sec} \end{array}$$

The details of the analysis are stated in paper of Petrov et al., 2000.

1.2. Single Dish

The antenna temperatures from ten sources were measured by the standard ON–OFF method. Before measuring the intensity, we determined the source instrumental position by scanning. The radio telescope was then pointed alternately on the source and on the distance of 5 beamwidths off source. The antenna temperature from a source was defined as the difference between the radiometer responses averaged during 10 s at two different antenna positions. Depending on the intensity of the emission from sources, we made a series of 20–60 measurements and then calculated the mean signal intensity and estimated the rms error of the mean. The fluxes from the objects under study were calibrated using measurements of the calibration sources Cyg-A, Cas-A, Tau-A, Vir-A, whose flux densities are given in Mark-IV Field System Documentation (1993).

Table 1 shows measured flux densities of sources at 8 GHz as follows: column (1) - IAU source designation, column (2) and column (3) - date and time of observations, column (4) - flux densities, column (5) - the rms errors of the measured flux densities.

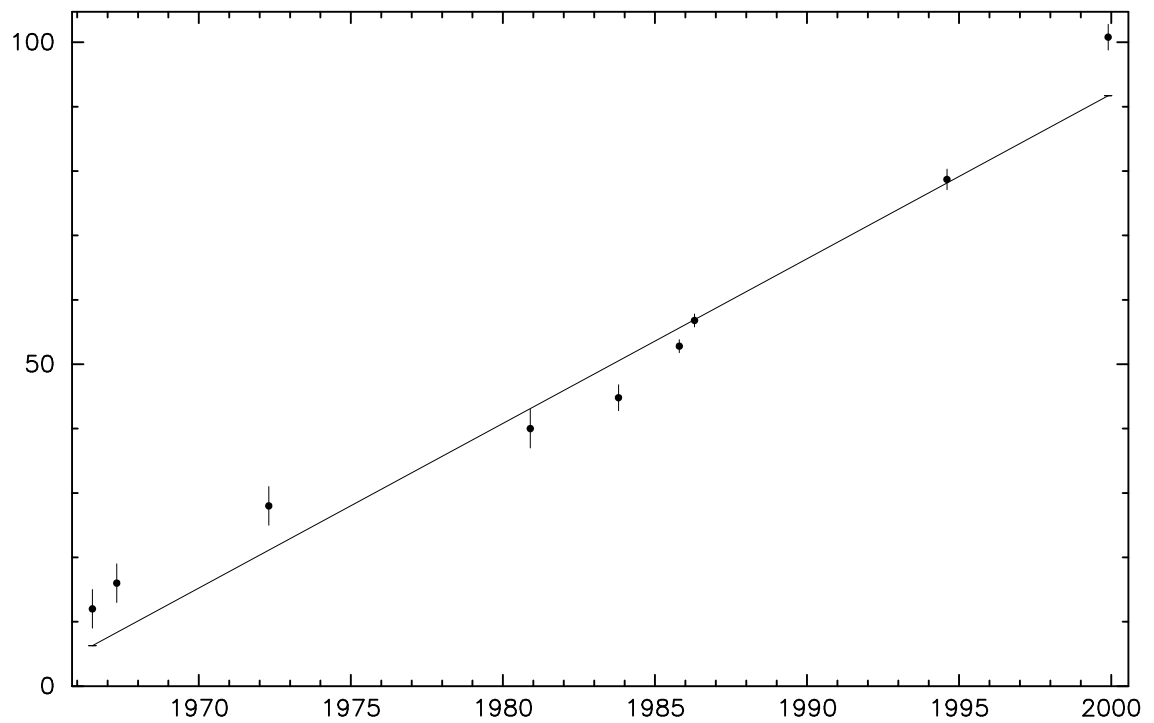


Figure 1. Deviation of azimuthal axis of the radiotelescope with respect to the local plumb line (in arc seconds) at different epochs.

Table 1. Single dish 8 GHz measured flux densities.

SOURCE	DAT(YY.MM)	TM(DD.UT)	FLUX(Jy)	SIGM(Jy)
0316+413	97.09	4.931	22.4	1.1
	97.12	10.668	20.9	1.4
0528+134	97.09	5.149	3.3	0.7
	98.02	1.685	3.1	0.9
0552+398	97.09	4.999	5.2	0.5
0642+449	97.09	30.294	1.9	0.3
	98.02	1.622	3.3	0.9
	98.04	20.303	2.7	0.8
	98.06	23.474	2.5	0.5
1226+023	97.08	29.651	30.5	3.7
1253-055	97.08	29.668	22.3	1.4
2037+421	97.09	4.898	19.2	1.6
	97.12	10.661	21.2	0.7
	98.02	2.344	20.9	1.0
2145+067	98.02	2.355	6.2	1.3
2200+420	98.02	3.406	3.8	1.3
2251+158	98.02	3.417	11.2	1.7

2. Discussion of Results and Conclusions

Estimates of the horizontal velocity of the radioastronomical station Simeiz were obtained using VLBI observations carried out under geodynamics programs during 1994-2000. The complete set of 3 million VLBI observations has been analyzed and it was found that the station moves with respect to the Eurasian tectonic plate considered as rigid with rate 2.8 ± 0.9 mm/yr in a north-east direction. Thorough study of possible local systematic effects has been done and the reliability of the estimate of the uncertainty has been evaluated. The stability of the station with respect to local marks was investigated and an inclination of the azimuthal axis (Pisa effect) of the telescope with velocity $2''6$ per year was disclosed. The estimate of vertical motion of the station 2.6 ± 3.0 mm/yr is not statistically significant.

The results of single dish S/X observations of sources used for geodesy investigations can be then reviewed after experiment to check the consistency of data from each source.

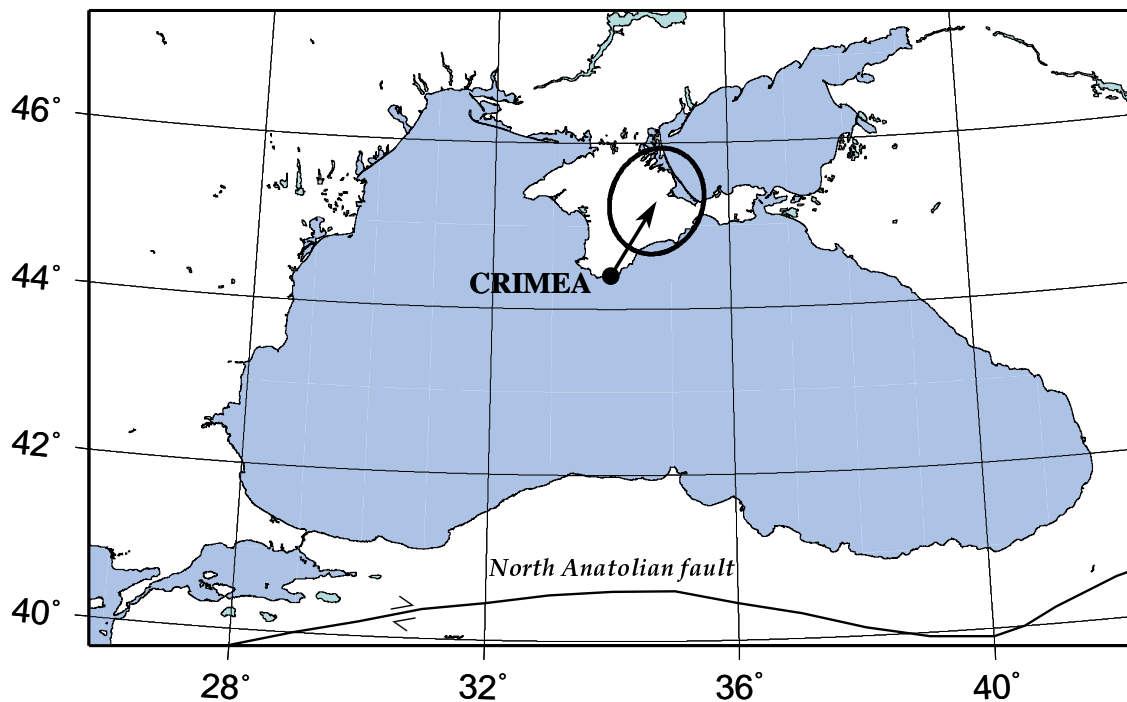


Figure 2. Motion of the station Simeiz.

References

- [1] *L. Petrov, O. Volvach, N. Nesterov* // Astron. Let.-2000.-submitted.
- [2] Mark IV Field System, Version 8.2, September 1,-1993,- Space Geodesy Program. NASA/Goddard Space Flight Center.