The IVS Network Station Onsala Space Observatory

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Abstract

We summarize briefly the status of the Onsala Space Observatory in its function as an IVS Network Station. The activities during the year 2002, the current status, and future plans are described.

1. Introduction

The IVS Network Station at the Onsala Space Observatory (OSO) has been described to some extent in earlier IVS annual reports, see e.g. [1]. During 2002 some minor changes in the technical setup of the station have been necessary, mainly due to maintenance related repair work. The staff associated with the IVS Network Station remained mainly the same as reported earlier.

2. Geodetic VLBI Observations During 2002

During 2002 the observatory has been involved in the four regular VLBI experiment series EUROPE, IVS-R1, IVS-T2, and RDV, and in the special series CONT02. In total OSO was scheduled to participate in 31 geodetic VLBI experiments during 2002. Table 1 gives an overview on the experiment, problems that occured and the feedback from the correlation.

Table 1. Geodetic VLBI experiments at the Onsala Space Observatory during 2002.

Exper.	Date	Remarks (problems)	Exper.	Date	Remarks (problems)
IVS-R1001	0107	lost, formatter problem	C02-01	1016	o.k., ionosph.-like phase instab.
RDV-31	0116	o.k.	C02-02	1017	o.k., ionosph.-like phase instab.
IVS-T2001	0129	o.k., varying parity errors	C02-03	1018	o.k.
IVS-R1005	0204	o.k., varying parity errors	C02-04	1019	o.k., but 3 hours lost
IVS-R1009	0304	o.k., some low elev. obs. lost	C02-05	1020	not correlated yet
RDV-32	0306	o.k.	C02-06	1021	o.k.
EURO-63	0326	o.k.	C02-07	1022	not correlated yet
IVS-R1017	0429	o.k.	C02-08	1023	o.k., ionosph.-like phase instab.
EURO-64	0618	o.k., S-band RFI, 1 pass lost	C02-09	1024	not correlated yet
IVS-T2007	0709	no fringes, clock problem	C02-10	1025	o.k., ionosph.-like phase instab.
RDV34	0724	o.k.	C02-11	1026	o.k., ionosph.-like phase instab.
EURO-65	0902	o.k.	C02-12	1027	not correlated yet
RDV-35	0925	o.k.	C02-13	1028	o.k.
EURO-66	1203	not correlated yet	C02-14	1029	not correlated yet
RDV-36	1211	o.k.	C02-15	1030	not correlated yet
IVS-T2012	1217	not correlated yet			

The experiment IVS-R1001 was lost due to problems with the formatter. The phase-locking did not work properly and a synthesizer board had to be changed. During experiment IVS-R1009 the lower elevation limit of the telescope was by mistake at 9 degrees for some hours. Thus, a number of low elevation sources were missed. The correlation of the Onsala data of experiment IVS-T2007 did not produce fringes because of a problem with the station clock. The 1 pps synchronisation did not work properly and had to be repaired. In the first half of 2002 some experiments showed occasionally high parity errors. However, in the second half of the year the recording quality stabilised with a reasonably low level of parity errors.

3. Performance Monitoring and Maintenance of the VLBI System

Aiming to produce high quality VLBI data, the VLBI system performance is monitored continuously. The goal is to detect possible problems early and to do the necessary repair and maintenance work. Some problems occured during 2002 and are described in the following subsections. Table 2 gives an overview of the maintenance and upgrade work of the OSO VLBI system during 2002.

Table 2. Maintenance and upgrade work of the Onsala VLBI system during 2002.

Jan.	Step attenuator changed for IF1; Formatter synthesizer board changed
Feb.	Capstan motor failed; spare from MPIfR Bonn borrowed; old Capstan motor repaired at PTC
Apr.	Kvarz maser failed; high ion-pump current; EFOS-7 maser connected to the VLBI system; Kvarz maser turned off; 10-year maintenance planned for August.
Aug.	Local oscillator in S/X receiver unstable; spare multiplier borrowed from Haystack; Old multiplier sent to Honeywell for repair. 10-year maintenance on Kvarz maser.
Sep.	Kvarz maser connected again to the VLBI system; start to measure phase drift between EFOS-7 and Kvarz maser; values are taken every second and saved in a file on the time monitoring PC as 30 s avarages. New FS-computer installed and tested.
Nov.	Phase-locking problem on Kvarz maser, probably due to low hydrogen flow. Maintenance is planed for January 2003; EFOS-7 maser connected to the VLBI system.

3.1. Maser Problems

In April the Kvarz Chi-75 maser failed and had to be disconnected from the VLBI system; the EFOS-7 maser was connected instead. After maintainance of the Kvarz maser it was connected again to the VLBI system in September and we started to monitor the phasedrift between the two masers. In November the Kvarz maser had problems again which showed up clearly as instabilities in the phasedrift between the two masers, see Fig. 1. The EFOS-7 maser was connected again to the VLBI system and another mainenance of the Kvarz maser is planned for January 2003.

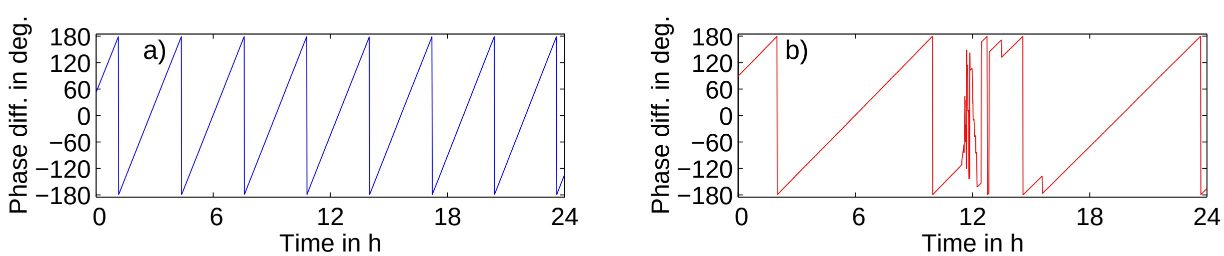

Figure 1. Phase difference between the Kvarz Chi-75 and EFOS-7 masers over 24 hours: a) stable phasedriftn in September 2002, b) instable phasedrift in November 2002.

3.2. Cable Length Measurements

The Goddard VLBI team asked us to perform a couple of tests to develop a model for phase-cal corrections based on cable measurements. From cable measurement performed under various conditions we conclude that the cable measurements are temperature dependent and depend on the azimuth of the telescope, but not significantly on the elevation, see Fig. 2.

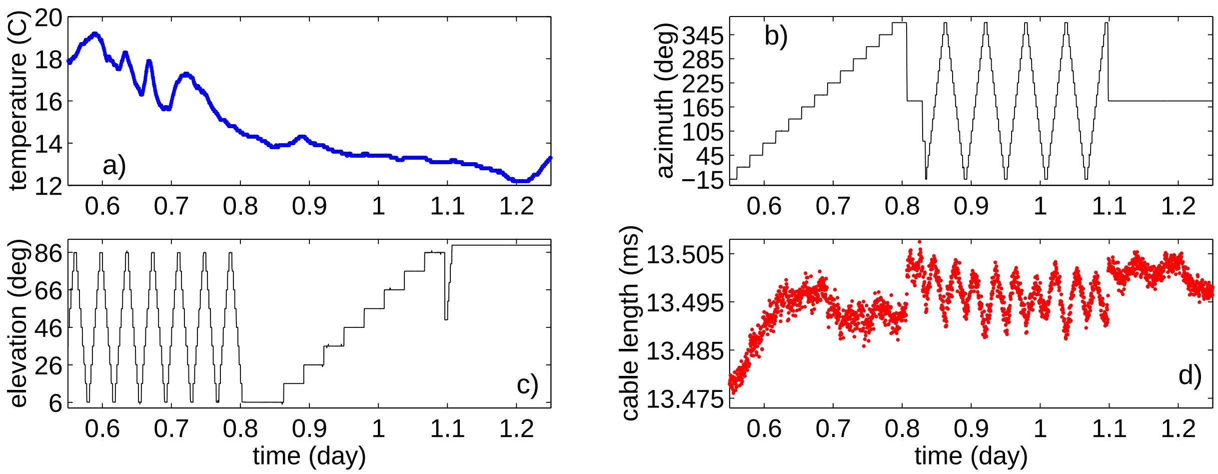

Figure 2. Cable measurements under various conditions: a) Outdoor temperature, b) Azimuth of the telescope, c) Elevation of the telescope, d) Cable measurements.

3.3. Local Oscillator Problems

The CONT02 preparation tests revealed a problem with the local oscillator of the Onsala S/X-receiver. The phase was unstable on time scales of seconds to hours, see Fig. 3. A spare multiplier was borrowed from Haystack and the old device was sent to Honeywell for repair.

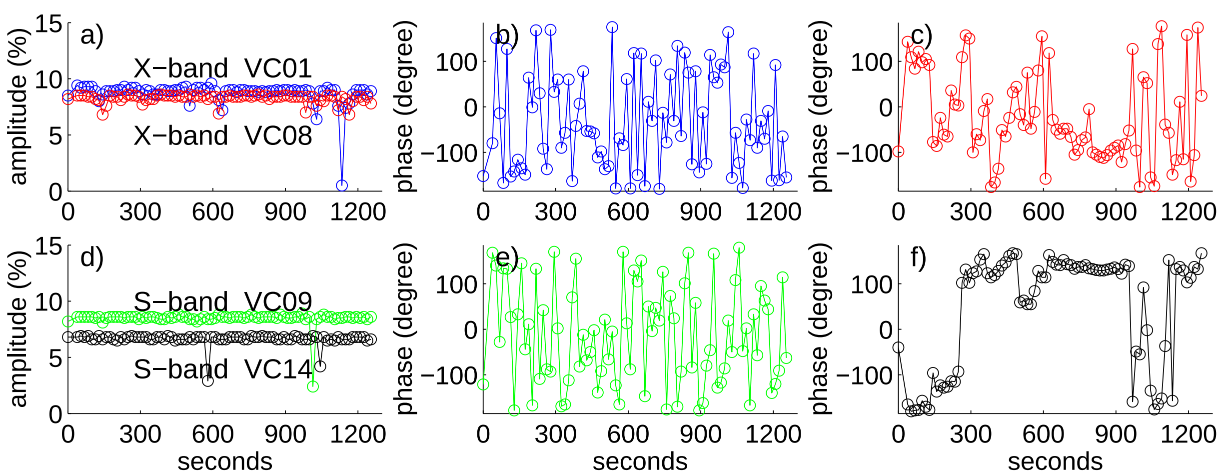

Figure 3. Pcal measurements in summer 2002: a) amplitudes of X-band VC01 and VC08, b) phase of X-band VC01, c) phase of X-band VC08, d) amplitudes of S-band VC09 and VC14, e) phase of S-band VC01, f) phase of S-band VC14. The phases are unstable on time scales of seconds.

3.4. Interference in S-band (IF2 low)

During the summer 2002 a new Universal Mobile Telecommunications System (UMTS) transponder was installed about 5 km from the observatory. The transmitted signals cause interfering peaks in the bandpass of S-band, see Fig. 4.

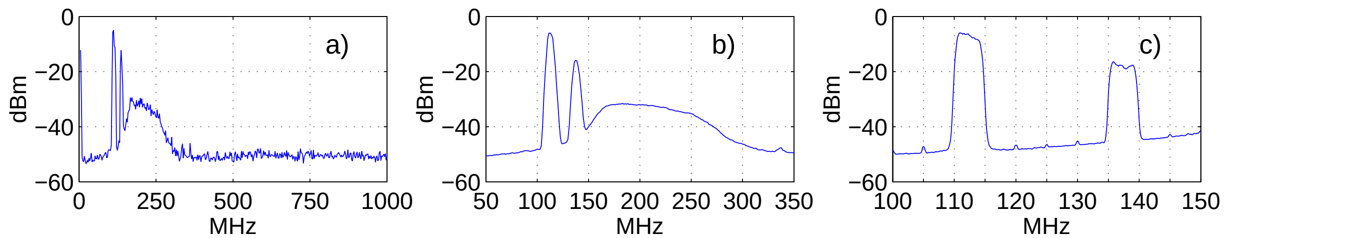

Figure 4. Bandpass of S-band (IF2 low): a) original bandpass, b) averaged bandpass zoomed to 50–350 MHz, c) zoomed to 100–150 MHz. Two interfering signals of 5 MHz bandwidth are clearly visible.

4. Local Tie Monitoring, Telescope Stability, Reference Point Determination

Also during 2002 the campaign based GPS measurements using an antenna mounted on top of the VLBI telescope [2] have been continued. We also continue to monitor the vertical changes of the telescope tower by a monitoring system based on an invar rod [3].

During spring and early summer 2002 we performed classical geodetic measurements to determine the reference point of the 20 m telescope in a local geodetic network. A number of observation pillars and ground markers were installed on the radome foundation and inside and outside the radome building. Since the telescope reference point is not directly accessable, an indirect method applying target markers that were fixed on the telescope cabin has been used. The work was performed together with a visiting exchange student of the University of Karlsruhe. Preliminary analysis of the measurements indicates that the telescope has an axis offset on the order of 5 mm.

5. Outlook

The Onsala Space Observatory will continue to be an IVS network station and to participate in the IVS observation series. For the year 2003 a total of 15 experiments in the series EUROPE, RDV, IVS-R4 and IVS-T2 is planned. An upgrade to the disk-based Mark 5 is planned for 2003. We also plan for e-VLBI by investigating a 10 Gbit/s link to the observatory from the Swedish internet backbone. We plan to develop a filter system against the disturbing RFI in S-band.

References

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[2] Bergstrand, S., R. Haas, and Johansson, J. M.: A new GPS-VLBI tie at the Onsala Space Observatory. In: N. R. Vandenberg and K. D. Baver (Eds.): *IVS 2000 General Meeting Proceedings*, NASA/CP-2000-209893, 128–132, 2000.

[3] Elgered, G., and Haas, R.: Geodetic Very-Long-Baseline Interferometry at the Onsala Space Observatory 1997–1998. In: W. Schlüter and H. Hase (Eds.): *Proc. of the 13'th Working Meeting on European VLBI for Geodesy and Astrometry*, 60–64, 1999.