The IVS Network Station Onsala Space Observatory

Rüdiger Haas, Gunnar Elgered

Abstract

We summarize briefly the status of the Onsala Space Observatory in its function as an IVS Network Station. The activities during the year 2004, the current status, and future plans are described.

1. Overview

Descriptions of the IVS Network Station at the Onsala Space Observatory (OSO) have been included in previous IVS annual reports, see e.g. [1] and references in there. In 2004 we started to use the 1 Gbps fiber link connection for eVLBI tests. The first ever intercontinental real-time VLBI fringes were obtained on the baseline Onsala–Westford. We organized a first NORDIC experiment including the available stations in Fennoscandia. Unfortunately, no fringes on baselines with Onsala were found in this experiment. One of the two masers at the observatory failed and was taken out of operation. Throughout the year 2004 we still experienced problems with the amplifiers of the telescope's azimuth encoders. In late November the cooling system of the S/X receiver failed and thus the last three experiments in 2004 had to be observed with a warm receiver.

2. Staff Associated with the IVS Network Station at Onsala

The staff associated with the IVS Network Station at Onsala remained mainly the same as reported in the IVS Annual Report 2003 [1].

Table 1. Staff associated with the IVS Network Station at Onsala. All e-mail addresses end with @oso.chalmers.se; the complete telephone numbers start with the prefix +46-31-772.

Function	Name	e-mail prefix	telephone extension
Responsible P.I.s	Rüdiger Haas	haas	5530
	Gunnar Elgered	kge	5565
Observatory director	Roy Booth	roy	5520
Ph.D. students and	Sten Bergstrand	sten	5566
Postdoc involved in	Camilla Granström	camilla	5566
VLBI observation	Martin Lidberg	lidberg	5578
	Tobias Nilsson	tobias	5575
	Borys Stoew	boris	5575
Field system responsibles	Biörn Nilsson	biorn	5557
	Michael Lindqvist	michael	5508
VLBI equipment responsibles	Karl-Åke Johansson	kaj	5571
	Leif Helldner	helldner	5576
VLBI operator	Roger Hammargren	roger	5551
Telescope scientists	Per Bergman	bergman	5552
	Lars Lundahl	lundahl	5559

3. Geodetic eVLBI Activities During 2004

The Onsala Space Observatory is connected to the Swedish Internet backbone via a 1 Gb/s optical fiber link since late 2003 [1]. This made it possible for us to carry out a number of eVLBI activities during 2004. Table 2 lists Onsala's eVLBI activities concerning the geodetic application of VLBI. The highlight is that the first ever successful intercontinental real-time eVLBI fringes were achieved on March 25, 2004, on the baseline between Onsala and Westford.

Table 2. Geodetic eVLBI activities at the Onsala Space Observatory during 2004.

February 27	Intensive network tests between Onsala and the Haystack correlator
March 25	Real-time eVLBI experiment Onsala–Westford at 32 Mbps, correlated at the Haystack correlator, first intercontinental real-time eVLBI fringes
April 26	Successful autocorrelation of Onsala data at the Haystack correlator at 64 Mbps
August 31	Failed eVLBI test Onsala–Westford at 256 and 128 Mbps
September 13	Failed eVLBI test Onsala–Westford
November 08	Real-time demonstration experiment at the SuperComputing 2004 conference, successful correlation of pre-recorded data from Onsala at the Haystack correlator a data rates higher than 200 Mbps [5]

4. Geodetic VLBI Observations During 2004

In 2004 the observatory was involved in the six VLBI-experiment series EUROPE, IVS-R1, IVS-R4, IVS-T2, RDV, and RD04. We volunteered to replace Matera in five IVS-R1 and IVS-R4 sessions in the second half of 2004. Furthermore, we organized a NORDIC session including all VLBI stations in northern Europe. In total, OSO participated in 29 geodetic VLBI experiments during 2004 (see Table 3). The six RDV sessions were recorded on tapes. All other experiments were recorded on Mark 5 disc modules.

5. Technical Problems of the Onsala VLBI System During 2004

Although new amplifiers for the telescope's azimuth encoders had already been installed in late 2003, the problem with the encoders continued in 2004. Unfortunately several experiments suffered considerable loss of observational data due to problems with the telescope's azimuth encoders during 2004 (see Table 3).

Radio interference in S-band due to UMTS mobile telephone signals continued to be a disturbing factor in 2004. Some correlation reports mentioned explicitly the radio interference.

The EFOS maser at Onsala failed in June 2004 and was switched off completely. A repair of this maser would have been too expensive and could not be afforded. The observatory's Kvarz maser continues to be connected to the VLBI system.

In late November the cooling system of the S/X receiver failed. A new cooling head had to be purchased and was installed at the end of the year. However, three complete experiments had to be observed with a warm receiver (see Table 3).

Table 3. Geodetic VLBI experiments at the Onsala Space Observatory during 2004.

Exper.	Date	Remarks (problems)	Exper.	Date	Remarks (problems)
R4.103	01.08	o.k.	R1.131	07.12	o.k.
T2.025	01.13	o.k.	EURO.72	07.13	o.k., encoder problems
R4.105	01.22	o.k.	RDV.45	07.14	o.k., encoder problems
NORD.01	03.01	no fringes with Onsala	R4.133	08.05	o.k., encoder problems
RDV.43	03.03	o.k.	RDV.46	08.25	o.k.
R4.111	03.04	o.k.	EURO.73	09.06	o.k., encoder problems
R4.113	03.18	o.k.	R1.139	09.07	o.k., encoder problems
RD.0401	03.24	no correlation report yet	R1.140	09.13	o.k., encoder problems
R4-115	04.01	o.k., encoder problems	T2.033	09.14	o.k.
EURO.71	04.06	o.k.	RDV.47	10.06	o.k.
RDV.44	05.05	o.k.	R4.149	11.23	o.k., but partly RX warm
RD.0403	05.12	o.k.	RDV.48	12.01	RX warm,not correlated yet
R4.121	05.13	o.k.	R4.151	12.09	o.k., but RX warm
R1.129	06.28	o.k.	EURO.74	12.14	RX warm, not correlated yet
R4.128	07.01	o.k.			

Table 4. Technical problems of the Onsala VLBI system during 2004.

Whole year	Sometimes failing amplifiers of the azimuth encoder motors
Whole year	RFI in S-band
June	EFOS maser failed and was taken out of operation
November	Cooling system of the S/X receiver failed, repaired in December

6. Telescope Stability, Local Tie, and Pressure Sensor Calibration

Also in 2004 we continued to monitor the vertical changes of the telescope tower by an invar monitoring system [1], [3]. The campaign based GPS measurements using an antenna mounted on top of the VLBI telescope [4] have been continued, too.

Throughout the year 2004, the calibration campaign for the Onsala pressure sensor was continued [1], using a reference barometer provided on a long term loan by the Swedish Meteorological and Hydrological Institute (SMHI). The pressure readings of the two sensors are highly correlated (Fig. 1a). The differences in pressure readings do not show a significant dependence on the magnitude of the pressure (Fig. 1b). However, a slight seasonal dependence of the differences in pressure readings is detected (Fig. 1c), with an amplitude of about 0.25 hPa.

7. Outlook and Future Plans

The Onsala Space Observatory will continue to be an IVS Network Station and to participate in the IVS observation series. For the year 2005 a total of 26 experiments in the series EUROPE, IVS-R1, IVS-T2, RDV, and RD05 are planned.

We plan to continue to participate in international eVLBI activities and hope to increase the number of eVLBI experiments.

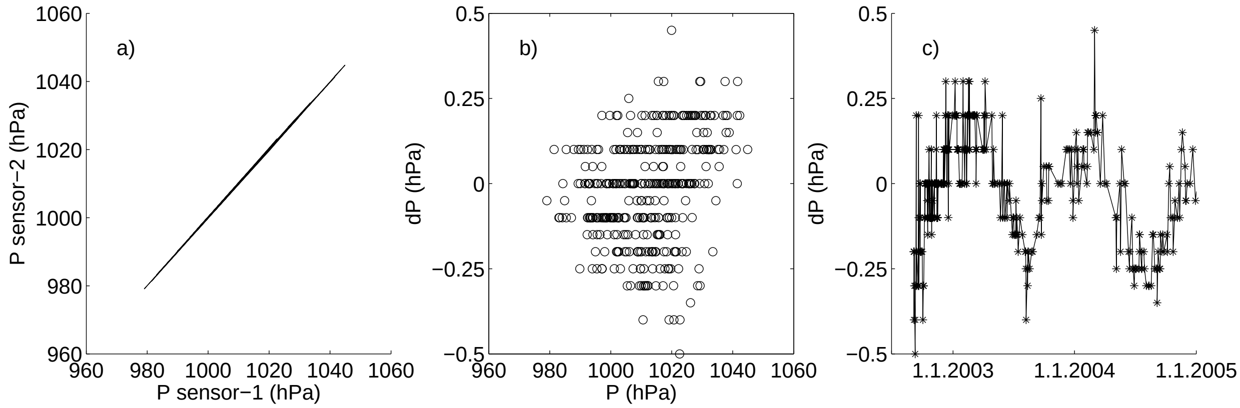

Figure 1. Results of the calibration campaign for the Onsala presssure sensor: a) Scatter plot of the pressure readings of the two sensors. b) Difference of pressure readings as a function of the pressure value. c) Time series of difference in pressure readings.

On the technical side, we will continue to work on the problem of the sometimes failing azimuth encoder amplifiers in order to reduce the loss of observational data.

The relevant VLBI system parameters will be monitored also in the future in order to detect possible error sources as early as possible and to maintain a high quality of the observational data. The stability of the telescope, its vertical height changes and the local tie to other monuments will be monitored also in the future.

References

[1] Haas, R., and Elgered, G.: The IVS Network Station Onsala Space Observatory. In: N. R. Vandenberg and K. D. Baver (Eds.): *IVS 2003 Annual Report*, NASA/TP–2004-212254, 76–79, 2004.

[2] Elgered, G., and Haas, R.: The Geodetic VLBI Network Station at the Onsala Space Observatory – Activities During 2002. In: W. Schwegmann and V. Thorandt (Eds.): *Proc. of the 16th Working Meeting on European VLBI for Geodesy and Astrometry*, Bundesamt für Kartographie und Geodäsie, 61–66, 2003.

[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 13th Working Meeting on European VLBI for Geodesy and Astrometry*, 60–64, 1999.

[4] Bergstrand, S., Haas, R., 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.

[5] http://evlbi.haystack.mit.edu/sc2004.html