The IVS Network Station Onsala Space Observatory

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Abstract

This report shortly summarizes the status of the Onsala Space Observatory in its function as an IVS Network Station. We describe the activities during the year 2006, the current status, and future plans.

1. 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 2005 [1]. However, two Ph.D. students left the observatory during the year.

Table 1. Staff associated with the IVS Network Station at Onsala. The complete telephone numbers start with the prefix +46-31-772.

Function	Name	e-mail	telephone
Responsible P.I.s	Rüdiger Haas	rudiger.haas@chalmers.se	5530
	Gunnar Elgered	kge@oso.chalmers.se	5565
Observatory director	Hans Olofsson	hans.olofsson@chalmers.se	5520
Ph.D. students involved in VLBI observation	Sten Bergstrand (until 2006.02.28)	sten@oso.chalmers.se	5566
	Camilla Granström (until 2006.05.31)	camilla@oso.chalmers.se	5566
	Martin Lidberg	lidberg@oso.chalmers.se	5578
	Tobias Nilsson	tobias@oso.chalmers.se	5575
Field system responsibles	Biörn Nilsson	biorn@oso.chalmers.se	5557
	Michael Lindqvist	michael@oso.chalmers.se	5508
VLBI equipment responsibles	Karl-Åke Johansson	kaj@oso.chalmers.se	5571
	Leif Helldner	helldner@oso.chalmers.se	5576
VLBI operators	Roger Hammargren	roger@oso.chalmers.se	5551
	Fredrik Blomqvist	blomqvist@oso.chalmers.se	5552
Telescope scientists	Lars EB Johansson	leb@oso.chalmers.se	5564
	Lars Lundahl	lundahl@oso.chalmers.se	5559

2. Geodetic VLBI Observations during 2006

In 2006 the observatory was involved in the five VLBI-experiment series EUROPE, R1, T2, RDV, and RD06. Initially, 26 experiments were planned for 2006. The first two experiments in 2006 were lost due to problems with the telescope drives. We therefore agreed to compensate for this by observing two additional experiments. One other experiment in the summer was lost again due to telescope problems. In the summer of 2006, the Onsala Program Committee agreed to a request by IVS to observe 10 additional R1-experiments during the autumn of 2006 as a replacement for the closed Gilcreek station. In total, Onsala participated successfully in 35 geodetic VLBI experiments during 2006 (see Table 2). All experiments were recorded on Mark 5 disc modules, and some of the data were transferred via optical fiber to the Bonn correlator.

Table 2. Geodetic VLBI experiments at the Onsala Space Observatory during 2006.

Exper.	Date	Remarks (problems)	Exper.	Date	Remarks (problems)
EURO-79	01.24	lost, telescope problems	EURO-83	09.04	o.k.
RD06-01	01.25	lost, telescope problems	R1-241	09.11	5 scans lost
T2-043	02.07	o.k., 2 scans lost	R1-242	09.18	o.k.
R1-211	02.13	o.k., ca 5 scans lost	RD06-07	09.19	no corr. rep. yet
R1-216	03.20	o.k., 4 scans lost	R1-243	09.25	5 scans lost
EURO-80	03.21	o.k., 3 scans lost	R1-244	10.02	1 scan lost
RD06-02	03.29	o.k., 10 scans lost	RD06-08	10.04	no corr. rep. yet
R1-218	04.03	o.k., 40 scans lost	R1-245	10.09	warm RX, cooling during exp.
RDV-56	04.25	o.k., 3 scans lost	R1-247	10.23	2 scans lost
RD06-03	04.26	o.k., 7 scans lost	R1-249	11.06	o.k.
EURO-81	05.29	o.k., 1 scan lost	R1-250	11.13	o.k.
RD06-04	06.28	o.k., 3 scans lost	EURO-84	11.14	o.k., 1 scan lost, e-VLBI to Bonn
EURO-82	07.03	o.k., 40% of scans lost	RD06-09	11.15	no corr. rep. yet
R1-233	07.17	ca 15 scans lost	R1-253	12.04	o.k.
RD06-05	07.19	9 scans lost	T2-048	12-05	2 scans lost, no corr. rep. yet
R1-235	07.31	16 scans lost	RDV-60	12.06	o.k.
R1-236	08.07	16 scans lost	R1-254	12.11	1 scan lost
RD06-06	08.23	lost, telescope problems	RD06-10	12.12	no corr. rep. yet
RDV-58	08.30	15 scans lost	R1-255	12.18	o.k., 2.5 hours lost, e-VLBI to Bonn

The previously reported problems with the azimuth encoders [1], [2] continued unfortunately also partly during 2006. Three experiments were completely lost due to telescope problems, and during most experiments between 1-15 scans were lost, see Table 2. Communication problems between the field system and the telescope computer caused data loss of about 2.5 hours in the R1-255 experiment.

The new antenna control system was finalized in 2006 and installed in the second half of the year. The new system appears to reduce the number of lost scans and the ongoing fine-tuning of the system is expected to avoid telescope problems in the future.

Also in 2006 radio interference in S-band, due to UMTS mobile telephone signals was a disturbing factor.

3. Geodetic e-VLBI Activities during 2006

In the second half of 2006 we started with network connection tests to the Bonn correlator.

A first e-VLBI data transfer to Bonn was performed in November with the EURO-84 data. The EGAE software [3] was used and 30 minute average values of the achieved data rates are shown in the left graph in Figure 1. Since the EGAE software does read first from the Mark 5 module to the system hard-disk and then transfers the data with bbftp [4], the shown average values are significantly lower than the actually achieved data rates for the transfer Onsala to Bonn. Data rates of up to 100 Mbit/s were achieved in this test.

In December we did a first test to use our PCEVN-computer [5] for the data transfer of geodetic

VLBI experiments. Parts of the R1-255 experiment were recorded on the PCEVN-computer that was daisy-chained to the Mark 5 computer. After the R1-255 experiment the data were transferred with the tsunami-protocol [6] to the Bonn correlator. Data rates of more than 600 Mbit/s were achieved, see right graph in Figure 1.

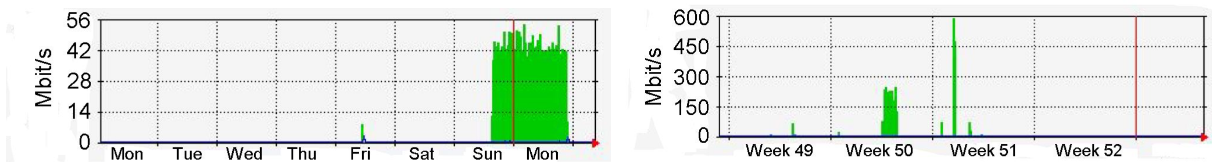

Figure 1. Left: EURO-84 e-VLBI data transfer from Onsala to Bonn using the EGAE software. Shown are 30 minute average values. The actually achieved data rates were on the order of 100 Mbit/s. Right: R1-255 e-VLBI data transfer (week 51) from Onsala to Bonn using the PCEVN and the tsunami-protocol. Shown are 2 hour average values and the achieved data rates were on the order of 600 Mbit/s. (The data transfer in week 50 was a regular real-time e-VLBI experiment with the EVN.)

4. Monitoring Activities

We continued also in 2006 to monitor the vertical height changes of the telescope tower with the invar monitoring system [7], [8]. Figure 2 shows mean temperature (left) and vertical height variation (right) of the telescope tower since 1996. Mean temperature and vertical height change are highly correlated and the annual vertical height variation is roughly 3 mm peak-to-peak.

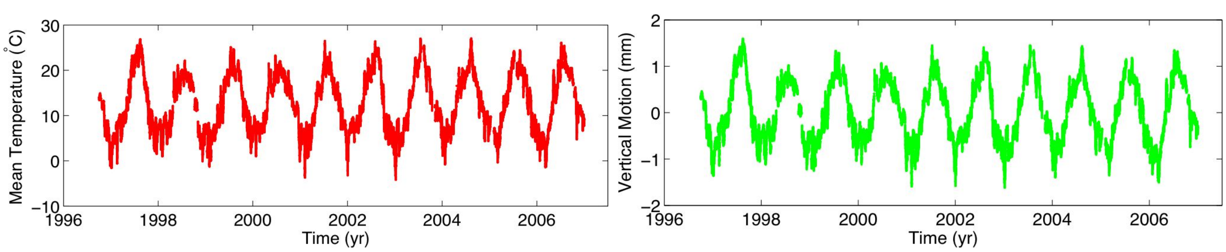

Figure 2. Left: time series of mean temperature of the telescope tower. Right: time series of relative vertical height of the telescope tower measured with the invar monitoring system.

The calibration campaign for the Onsala pressure sensor has continued [7]. We do parallel manually recordings with a Vaisala barometer that we borrow from the Swedish Meteorological and Hydrological Institute (SMHI), and the Onsala barometer (Setra Systems) that is used for VLBI. The SMHI barometer is calibrated every year at the SMHI headquarters.

Figure 3 shows the time series of pressure differences (a) and the corresponding amplitude spectrum (b). The amplitude spectrum reveals a clear annual signal with an amplitude of almost 0.18 hPa. We suspect that it is related to temperature influences on one or both pressure sensors.

A microwave radiometer is operated at the observatory to monitor the atmospheric water vapor content. However, during 2006 the instrument was in maintenance for large parts of the year.

The observatory hosts a gravimeter platform, which is used for repeated absolute gravity mea-

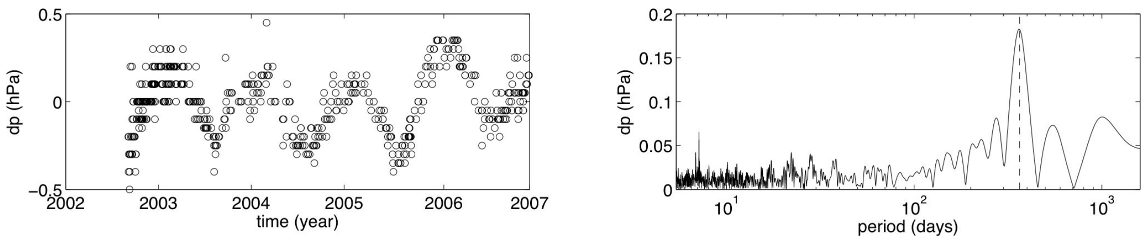

Figure 3. Left: time series of pressure differences Vaisala - Setra. Right: corresponding amplitude spectrum of the pressure differences. The annual period is indicated with a vertical dotted line.

surements for several years. The University for Environment and Life Sciences at Ås, Norway, visited the observatory during their Absolute Gravimetry campaign between October 6 and 8, and the Institut für Erdmessung, University of Hannover, Germany, between October 7 and 10.

5. 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 2007 a total of 27 experiments in the series EUROPE, R1, T2, RDV, and RD06 are planned. We aim at an increased and regular use of e-VLBI data transfer, e.g. with the PCEVN.

During 2007 the network connection of Onsala will be upgraded from 1 Gbit/s to 10 Gbit/s.

We will continue to monitor the relevant VLBI system parameters to be able to detect possible error sources as early as possible and to achieve and maintain high quality of the observational data. This monitoring activity includes the stability of the telescope, the local tie, the pressure sensor calibration and the operation of a microwave radiometer.

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