

Geodetic Observatory Wettzell - 20m radio telescope and Twin telescope

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Abstract

In the year 2012 the 20m radio telescope at the Geodetic Observatory Wettzell, Germany contributed again very successfully to the IVS observing program. Technical changes, developments, improvements and upgrades have been made to increase the reliability of the entire VLBI observing system. In parallel the new Twin radio telescope Wettzell (TTW) got the first feed horn, while the construction of the HF-receiving and the controlling system was continued.

1. General Information

The 20m Radio telescope in Wettzell (RTW) is an essential component of the Geodetic Observatory Wettzell (GOW) and is jointly operated by Bundesamt für Kartographie und Geodäsie (BKG) and Forschungseinrichtung Satellitengeodäsie (FESG) of the Technische Universität München (Technical University Munich). In addition to the RTW also an ILRS laser ranging system, several IGS GPS permanent stations, a large laser gyroscope G (ringlaser) and the according local techniques as time and frequency, meteorology and super conducting gravity meter, etc. are operated. Currently also the building of the first fully VLBI2012 compliant Twin telescope on location of the GOW is in the final phases. It should extend the observation possibilities according to the new technical suggestions of the IVS Working Group 3 (WG3).

Within the responsibility of the GOW are also the TIGO system in Concepción, Chile, operated mainly together with the Universidad de Concepción (see separate report about TIGO), and the German Antarctic Receiving Station (GARS) O'Higgins at Antarctica, operated together with the German Space Center (DLR) and the Institute for Antarctic Research Chile (INACH) (see separate report about O'Higgins).

2. Staff

The staff of the GOW consists in total of 34 members (excluding students) for operations, maintenance, repair issues and for improvement and development of the systems. The staff operating RTW is summarized in table 1. One additional engineer is on a position which is funded by the "Novel EXploration Pushing Robust e-VLBI Services" (NEXPRoS) project in cooperation with the Max-Planck-Institute for Radioastronomy (MPIfR), Bonn. It was also possible to support the student operators to work within development projects and interships.

3. Observations in 2012

The 20m-RTW has been supporting the geodetic VLBI-activities of the IVS and partly for other partners, as the EVN, for almost 30 years. All successfully observed sessions in the year 2012 are summarized in table 2. After the repair of the bearings in 2010 the RTW is again completely in all schedules as before and except from some problems with the gears and the servo system, which are also overaged, the telescope is in a very good and stable state. Main priority in operations

Table 1. Staff - members of RTW

Name	Affiliation	Function	Mainly working for
Ulrich Schreiber	BKG	head of the GOW (till March 2012)	GOW
Reiner Dassing together with Johannes Ihde	BKG	interim head of the GOW (from April 2012)	GOW
Alexander Neidhardt	FESG	interim head of the GOW (from April 2012)	GOW
	FESG	head of the RTW group and VLBI station chief	RTW, TTW (partly O'Higgins, laser ranging development)
Erhard Bauernfeind	FESG	mechanical engineer	RTW
Ewald Bielmeier	FESG	technician	RTW
Gerhard Kronschnabl	BKG	electronic engineer	RTW, TTW (partly TIGO and O'Higgins)
Christian Plötz	BKG	electronic engineer	O'Higgins, RTW
Raimund Schatz	FESG	software engineer	RTW
Walter Schwarz	BKG	electronic engineer	RTW (partly O'Higgins and VWR)
Reinhard Zeitlhöfler	FESG	electronic engineer	RTW
Martin Ettl	FESG/MPIFR	IT and computer scientist	NEXPreS (EU FP7)
Jan Kodet	FESG	applied physical engineer	Reference systems (DFG)
Yvonne Klingl	FESG/BKG	student	Operator WLRS/RTW
Gerhard Mühlbauer	FESG/BKG	student (Apr to Dec 2012)	Operator WLRS/RTW
Daniel Prexler	FESG/BKG	student	Operator WLRS/RTW
Johannes Vogl	FESG/BKG	student (Apr to Sep 2012)	Operator RTW/WLRS, VLBI project work

was laid to participate in all daily one-hour INTENSIVE-sessions (INT) in order to determine UT1-UTC. For these sessions the complete data transfer is done with e-VLBI techniques. RTW now routinely uses the increased Internet connection capacities of 1 Gbit/sec for the e-transfers to Bonn, Tsukuba and Haystack also for the 24h-sessions. According to the implementation of a field system extension for remote control, weekend INTENSIVEs were partly done in the new observation modes by remote attendance, remote control from students at the laser ranging system (WLRS) or completely unattended.

In addition to the standard sessions RTW was also active for other special observations as the tracking of the ESA Venus Express spacecraft and RadioAstron satellite for the EVN. Another participation to the EVN network was made with the monitoring of the supernova SN2011dh in M51. These sessions were coordinated by the Joint Institute for VLBI Europe (JIVE).

Table 2. RTW observations in 2012

program	number of 24h-sessions	special program	number of 1h-sessions
IVS R1	52	1h-INT1(Kokee-RTW)	229
IVS R4	51	1h-INT2/K(Tsukuba-RTW)	153
IVS T2	7	1h-INT3/K(Tsukuba-RTW-NyAl)	40
IVS R&D	10	ESA VENUS Express	6
RDV/VLBA	6	EVN RadioAstron	62
EUROPE	6	EVN sopernova monitoring	10
total	132	total (in hours)	454
total (in hours)	3168		

4. Technical Improvements and Maintenance

Regularly tasks and maintenance days (obtaining replacements for the hardware, 8-pack reparations, gear maintenance, exchange of motors after reaching their lifetime, NASA field system updates, cryo-system maintenance, servo replacements, improvements for e-VLBI issues) were scheduled for the usual maintenance work. The components of the servo system are overaged and on the market not available anymore. Therefore it was possible to commission a replacement of the whole system, to upgrade it to a similar, modern technique as installed in the Twin telescopes. The upgrade will be done in the mid of 2013. Upgrades and repairs were also necessary for the Mark4 data acquisition rack. The revision of the replacement dewar systems for Wettzell and O'Higgins were commissioned to the cooperation partners at the observatory at Yebes in Spain, where specialists update the systems to the state-of-the-art.

The usage of the EVN-PC for e-Transfer was continuously extended. In addition the installation and test usage of e-Transfer for the 24h-sessions to Bonn, Haystack and Washington was installed and tested with up to 600Mbit per second. Used is a combination of the Mark5 software "fuseMk5" and the communication protocol "Tsunami" on a regular Mark5B system. Meanwhile all R1 sessions are regularly sent to the Bonn correlator using e-VLBI techniques, which reduces the shipping costs tremendously. Parallel to that all Mark5 systems were updated or upgraded.

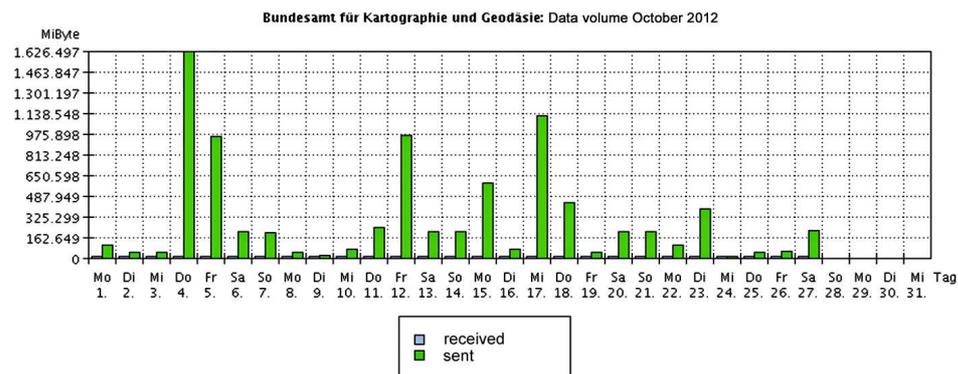


Figure 1. Example of the transfer volume with e-VLBI from the 20m radio telescope.

The usage of the new Digital Baseband Converters (DBBC) was forced. They were tested, calibrated and adjusted again. Several test data were correlated at the correlator Bonn to check the functionality and quality. Additionally new CoMo boards were ordered to upgrade to a standard version of the equipment. The development is still under progress.

The remote control software "e-RemoteCtrl" was also extended mainly by the TUM. In close cooperation to the developers of the NASA field system and with other test sites at Australia (e.g. Hobart, Kathrine and Yarragadee) new features were established. The deliveries are on time, so that the newly implemented authentication and authorization with user roles could be successfully tested. The AuScope network and the Wettzell site already use the software routinely. During the days off around new year the Wettzell radio telescope was completely controlled from remote including the preparation of the data transfer. Students at the laser ranging system regularly use the software, to control the radio telescope parallel to the laser observation to optimize shift times. The software development is funded in task 3 of work package 5 of the NEXPREs project and is performed in cooperation with the MPIfR.

As a pilot study ideas for a permanent survey of the telescopes were realized to enable reference movements, which are surveyed with a total station and 20 to 30 reflectors in the back-structure. First software models for the calculation of the positions and the surveying are implemented.

The broadband RFI- and data acquisition for the RFI surveys for a possible new location for the TIGO system in La Plata, Argentina was prepared in Wettzell. Therefore a RFI measuring system was implemented and developed to allow a broad-band analysis of dual-polarized RFI signals with an omnidirectional antenna.

Another new field is the preparation of the tracking to global navigation satellites. Therefore new amplifier and receiver boards were implemented, which can be used after the waveguides for S- and X-band to receive the L-band of the satellite. Additionally the software from the laser ranging system was changed to create schedules for the NASA Field System, which can be used to track the satellites with the 20m radio telescope, using 1 second orbit sampling points.

5. The TWIN radio Telescope Wettzell (TTW)

The Twin Telescope Wettzell project is Wettzells realization of complete VLBI2010 conformity. While the last years the construction of the buildings and telescopes was in the main focus, the year 2012 was used to install parts of the interior and to commission the final elements for the receiving system. Therefore at the beginning of 2012 the final review for the telescopes was completely possible without any critic points. Both telescopes are now completely controllable and movable. After then the first installations, like air conditioning, helium flex-lines, communication cable to the operator building, etc., were made by the Wettzell team. In the operator building now all server racks are mounted and partly populated with hardware and computers. The network was installed and configured to build up a separate network enclave for VLBI.

A big milestone was the final review of the first three-band feedhorn (triband horn from the company Mirad, Switzerland for S/X/Ka-band). The first test results offer an excellent receiving performance in combination with the ring-focus antennas of Twin. There some delays with the final review of the dewar, as amplifiers for the S-band, provided by the BKG, became defective during the tests. They had to be shipped back to the vendor.

A final design review for the second horn of the broadband feedhorn was held in June 2012. The second horn is a "Elevenfeed" from Omnisys, Sweden, which allows tunable frequency bands between 2 and 14 GHz. The constructive parameters could be fixed to start the construction of the feedhorn.

A special task was the organization of the IVS VLBI2010 workshop for technical specifications for March 2012. Local organizers were the BKG and the FESG/TUM. Several new technical issues were discussed and presented during this meeting. More than 80 participants from geodetic fields, industry and science attended the very successful meeting.

6. Plans for 2013

During 2013, dedicated plans are:

- Upgrade of the gear, servo and control system of the 20m radio telescope
- Inauguration of the first Twin telescope in April
- Finalize the NEXPreS developments