

Geodetic Observatory Wettzell - 20-m Radio Telescope and Twin Telescope

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Abstract

In 2011 the 20-m 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 mechanical assembly of the new Twin radio telescope (TTW) was finished while the HF-receiving system was constructed.

1. General Information

The 20-m 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, GOW also operates an ILRS laser ranging system, several IGS GPS permanent stations, a large laser gyroscope G (ringlaser), and the associated local techniques such as time and frequency, meteorology and super conducting gravity meter. Currently also the first fully VLBI2010-compliant Twin telescope is being built on location. 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 in 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 work, and the improvement and development of the systems. The staff operating RTW are in Table 1. One additional engineer is on a position which is funded by the "Novel EXploration Pushing Robust e-VLBI Services" (NEXPREs) 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 internships.

3. Observations in 2011

The 20-m RTW has supported the geodetic VLBI activities of the IVS and partly those of other partners, such as the EVN, for over 25 years. All successfully observed sessions in the year 2011 are summarized in Table 2. After the repair of the bearings the RTW once again observes in all sessions and, except for some problems with the gears and the servo system, which are also dated, the telescope is in a very good and stable state. The main priority for operations was

Table 1. Staff members of RTW.

Name	Affiliation	Function	Mainly working for
Johannes Ihde	BKG	interim head of the GOW (until February 2011)	GOW
Ullrich Schreiber	BKG	head of the GOW (since March 2011)	GOW
Alexander Neidhardt	FESG	head of the RTW group and VLBI station chief	RTW, TTW (partly O'Higgins, laser ranging)
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 WVR)
Reinhard Zeitlhöfler	FESG	electronic engineer	RTW
Martin Ettl	FESG/MPIfR	IT and computer scientist	NEXPreS
Thomas Guggeis	FESG/BKG	student (January to September 2011)	RTW, project work, WLRS
Yvonne Klingl	FESG/BKG	student (May to December 2011)	WLRS, RTW, project work
Daniel Prexler	FESG/BKG	student (May to December 2011)	WLRS, RTW, project work
Martin Riederer	FESG/BKG	student (January to March 2011)	RTW, project work
Johannes Vogl	FESG/BKG	student (January to December 2011)	RTW, project work, WLRS

the participation in all daily one-hour INTENSIVE sessions (INT) in order to determine UT1-UTC. For these sessions the complete data transfer is done electronically (e-transfer). RTW now routinely uses the increased Internet connection capacities of 1 Gbit/sec for the e-transfers to Bonn, Tsukuba, and Haystack. Following the implementation of a Field System extension for remote control, weekend INTENSIVES were partly done in the new observation modes of remote attendance, remote control from students at the laser ranging system (WLRS), or completely unattended.

In addition to the standard sessions, RTW also observed fifteen CONT11 sessions of the IVS within a network of thirteen stations in September 2011. During the CONT11 campaign all stations ran observations continuously over a period of fifteen days. Within these days the RTW had only dropouts of a few minutes. The data were saved on Mark 5A (standard) and as backup on Mark 5B+ or EVN PC hard drive. In addition, the RTW staff also operated the TIGO VLBI telescope remotely during the Chilean night shifts, using the e-RemoteCtrl software from Wettzell. Other special observations were done for Digital Baseband Converter (DBBC) tests and for spacecraft tracking. Within these additional one-hour observations the ESA Venus Express and Mars express spacecraft were observed at X-band with the Wettzell radio telescope using a framework of the assessment study for possible contributions in the European VLBI network to the upcoming ESA deep space missions.

4. Technical Improvements and Maintenance

During the report period usual maintenance work had to be done. Regularly, tasks and maintenance days (obtaining replacements for the hardware, 8-pack repair, gear maintenance, Field System updates, cryo system maintenance, servo replacements, and improvements by using EVN-PCs for e-VLBI issues) were scheduled for this work. Especially the exchange of motors in elevation and azimuth after reaching their lifetime must be mentioned. Another very important work was to

Table 2. RTW observations in 2011.

program	number of 24h-sessions	program	number of 1h-sessions
IVS R1	50	INT1(Koike-RTW)	229
IVS R4	49	INT2/K(Tsukuba-RTW)	153
IVS T2	7	INT3/K(Tsukuba-RTW-NyAl)	40
IVS R&D	7	total (in hours)	422
RDV/VLBA	5	special program	in hours
EUROPE	6	VENUS Express /	
CONT11	15	MARS Express	9
total	139	total (in hours)	18
total (in hours)	3336		

derust, prime, and paint the metal parts of the cabin, the feed cone, and the legs of the subreflector support. The work was done during observation gaps and the final cleanup of the large repair of the bearings. After several problems with the servo system, it became necessary to work on some relays and to clean up the gear motor and the break adapter. The components of the servo system are dated and not available on the market anymore. Similar changes had to be done to the Mark IV data acquisition rack.

A first change from Mark 5A to Mark 5B and Mark 5B+ was possible, by changing the Mark IV formatter to support the new VSI-interface. Within a student project, a Mark IV VSI version of the formatter was programmed, developing VHDL for a Xilinx-FPGA using the Xilinx-Software “ISE”. The developed software runs on a specially designed VSI-formatter board. It was tested during integration tests and CONT11. Parallel to this development all Mark 5 systems were upgraded and updated.

The usage of the EVN-PC for e-transfer was continuously extended. In addition, the installation and test usage of the new Digital Baseband Converters (DBBC) were advanced. They should replace the existing analog video converters and formatter of the Mark IV-rack. They should provide the basis for a higher data rate with better data quality in a fully digital way, in particular for the VLBI2010 system. Wettzell is one of the main test sites for the DBBC. In cooperation with the developers at HATLab, MPIfR and INAF, new DBBC components were tested, calibrated, and adjusted. Several test data were correlated at the Bonn Correlator to check the functionality and quality. The development is still under way.

The remote control software “e-RemoteCtrl” was also extended mainly by the TUM. In close cooperation with the developers of the NASA Field System and with other test sites, new features were established. Some sites (e.g., the new AuScope network in Australia) already use the software routinely. During CONT11 the software was used to control the TIGO VLBI telescope remotely by the night shifts. The development is funded in Task 3 of Work Package 5 of the NEXPreS Project and is performed in cooperation with MPIfR. An appropriate authentication, a dedicated role management for different user types, different remote access states to shared telescopes, system monitoring, and sophisticated graphical user interfaces are under development.

5. The TWIN Radio Telescope Wettzell (TTW)

The Twin Telescope Wettzell project is Wettzell’s realization of a fully VLBI2010-compliant radio telescope. With the design and construction being the main focus, the buildings could be



Figure 1. The telescopes of Wettzell: the 20-m radio telescope during CONT11 and the new TWIN radio Telescope Wettzell (TTW).

finished in 2011. Therefore, at the beginning of 2011 a lot of factory approvals were made (e.g., of the sub-reflector and servo systems). Also the construction of the control building was completed (coordinated with the Staatliche Bauamt Regensburg).

In detail the following items were performed:

- A photogrammetric survey of the reflector surface was made in June. It included the adjustment of the sub-reflector at an elevation of 58 degrees. The adjusting optimizes the wavelength error.
- The TWIN is now in the geodetic survey of the observatory.
- All mechanical installations and assemblies were finished successfully in August. Therefore the telescopes are now fully maneuverable.
- An optimization of the servo system was started according to the local conditions.
- The construction of the multiband coaxial horn for S-, X-, and Ka-band and the corresponding dewar is in the final stage at the companies Mirad (feed) and Callisto (dewar). The second feed of the Eleven feed type for 2 to 14 GHz is under development at the company Omnisys.
- The computer and server room was populated with water cooled racks.
- The development of the new receivers is in progress in Wettzell. Several student projects to implement single parts of them were carried out very successfully.

6. Plans for 2012

For 2012, dedicated plans are:

- Regular usage of the digital baseband converters (DBBC)
- Continue NEXPreS
- Develop the front end parts of the Twin telescopes
- Finalize one of the Twin telescopes