

Geodetic Observatory Wettzell - 20m radio telescope and Twin telescope

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Abstract

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

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 first fully VLBI2010 compliant Twin telescope is built up on location of the GOW. 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" (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 interships.

3. Observations in 2011

The 20m-RTW supports the geodetic VLBI-activities of the IVS and partly for other partners, as the EVN, since over 25 years. All successfully observed sessions in the year 2011 are summarized in table 2. After the repair of the bearings 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 was laid to participate

Table 1. Staff - members of RTW

Name	Affiliation	Function	Mainly working for
Johannes Ihde	BKG	interim head of the GOW (till 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 VWR)
Reinhard Zeitlhöfer	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

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 now for the e-transfers to Bonn, Tsukuba and Haystack. 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 the 15 CONT11 sessions of the IVS within the network of 15 stations on September 2011. During the CONT11 campaign all stations run observations continuously during the 15 days of observation. Within these days the RTW had only breakdowns of a few minutes. The data were saved on Mark5A (standard) and as spare on Mark5B+ and partly on the EVN PC harddrive. 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 the Mars express spacecraft was 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 periode usual maintenance work had to be done. Regularly tasks and maintenance days (obtaining replacements for the hardware, 8-pack reparations, gear maintenance, fieldsystem updates, cryo system maintenance, servo replacements, improvments by using EVN-PCs for e-VLBI issues) were scheduled for such work. Especially the exchange of motors in elevation and azimuth after reaching their lifetime must be mentioned. Another very important work was to derust, priming and painting the metal parts of the cabine, the feed cone and the legs of the

Table 2. RTW observations in 2011

program	number of 24h-sessions	program	number of 1h-sessions
IVS R1	50	INT1(Kokee-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		
EUROPE	6	special program	in hours
CONT11	15	VENUS Express /	
total	139	MARS Express	9
total (in hours)	3336	total (in hours)	18

subreflector support. The work was done during the observation gaps and was also a final cleanup after the large repair of the bearings. After several problems with the servo system some relays and to cleanup gear motor and break adapter. The components of the servo system are overaged and on the market not available anymore. Similar changes had to be done in the Mark4 data acquisition rack.

A first change from Mark5A to Mark5B and Mark5B+ was possible, by changing the Mark4 formatter to support the new VSI-interface. Within a student project a Mark4-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 is tested during integration tests and during CONT11. Parallel to this development all Mark5 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 forced. They should replace the existing analog video converters and formatter of the Mark4-rack. It should also offer the fundamentals for a higher data rate with better data quality in a fully digital way especially also for the VLBI2010 systems. Wettzell is one of the main test sites for the DBBC. In cooperation with the developers at HATLab, the Max-Planck-Institute for Radio astronomy (MPIfR) and the INAF new DBBC components were tested, calibrated and adjusted. Several test data were correlated at the correlator Bonn to check the functionality and quality. 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 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 from remote during the night shifts. The development is funded in task 3 of work package 5 of the NEXPreS project and is performed in cooperation with the 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 Wettzells realization of a complete VLBI2010 conformity. While the last years design and construction was on main focus such buildings could be finished in 2011. Therefore at the beginning of 2011 a lot of factory approvals were made (e.g. of

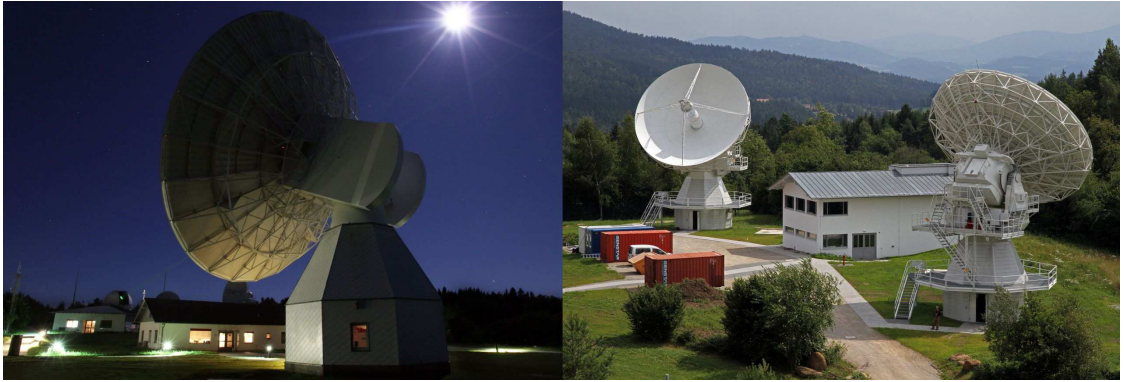


Figure 1. The telescopes of Wettzell: the 20m radio telescope during CONT11 and the new TWIN radio Telescope Wettzell (TTW)

the sub-reflector and servo systems). Also the construction of the control building was finished (coordinated by the Staatliche Bauamt Regensburg).

In detail the following items were performed:

- A photogrammetric survey of the reflector surface was made on June. It included the adjusting of the sub-reflector at an elevation of 58 degree. The adjusting optimizes the wave-length error.
- The TWIN is now in the geodetic survey of the observatory
- All mechanical installations and assemblies were finished successfully on 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 fitting dewar is in the final state at the company Mirad (feed) and Callisto (dewar). Also 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 the water cooled racks.
- The development of the new receivers is under progress in Wettzell. Several student projects to implement single parts of them were arranged very successfully.

6. Plans for 2012

During 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