

Fundamentalstation Wettzell - 20m Radiotelescope

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Abstract

The 20m-radiotelescope at Wettzell, Germany again contributed very successfully and strongly to the IVS observing program in 2008. Technical changes, improvements, and upgrades were made to increase the reliability of the entire VLBI observing system.

1. General Information

The 20m-Radiotelescope in Wettzell (RTW) was designed in the years 1980/81 as a project of the former “Sonderforschungsbereich 78 Satellitengeodäsie”. RTW is an essential component of the Fundamentalstation Wettzell (FSW) and is jointly operated by Bundesamt für Kartographie und Geodäsie (BKG) and Forschungseinrichtung Satellitengeodäsie (FESG) of Technical University Munich. In addition to the 20m RTW at the Fundamentalstation Wettzell (FSW), the following geodetic space technique systems are co-located:

- laser ranging systems involved in ILRS: WLRS (Wettzell Laser Ranging System) and a new implementation called Satellite Observing System Wettzell (SOSW) is under construction.
- GPS receivers involved in global network IGS, in the European network EUREF, in the national network GREF, and in time transfer experiments.
- G, a large lasergyroscope or ringlaser dedicated for monitoring of daily variations of Earth rotation.

A time and frequency system (T&F) is established for the generation of the timescale UTC(IfAG) and for the provision of very precise frequencies needed for VLBI, SLR/LLR and GPS observations. Cs-clocks, H-Masers and GPS time receivers are employed. The time scale UTC(IfAG) is published in the monthly Bulletin T of BIPM. Additional in situ observations are carried out, such as gravity observations with a super conducting gravity meter, recording of earthquakes with a seismometer, and meteorological observations to monitor pressure, temperature and humidity including wind speed, wind direction and rain fall. Continuously water vapour observations with a Radiometrix radiometer are carried out. Periodically conventional geodetic control measurements are performed to tie the reference points of the space geodetic systems RTW, WLRS, GPS, and “G” to the local terrestrial coordinate system and to investigate the local stability.

2. Staff

The staff of the Fundamentalstation Wettzell consists in total of 35 members for operations, maintenance and repair issues and for improvement and development of the systems. Within the responsibility of the Fundamentalstation Wettzell are also the TIGO systems (see report in this volume), operated in Concepción, Chile by three BKG experts jointly with a Chilean partner consortium (support staff: 11 engineers), and the O’Higgins station (see report in this volume) in Antarctica, jointly operated with the German Space Center (DLR) and the Institute for Antarctic Research Chile (INACH).

The staff operating RTW is summarized in table 1. In July 2008 Dr. Alexander Neidhardt took over the position of group leader and VLBI station chief at the RTW. He is also still involved in the developments at the Satellite Observing System Wettzell (SOSW), where he develops the new automated and remotely accessible control system together with the SOSW team. The former, now retired head of the RTW team, Richard Kilger, still supports the TWIN-project as an adviser, and he took part in the VLBI campaign at the German Antarctic Receiving Station O'Higgins in January and February 2008.



Figure 1. The Wettzell VLBI crew (from left to right): C. Plötz, E. Bauernfeind, G. Kronschnabl, R. Schatz, W. Schwarz, R. Zeitlhöfler, A. Neidhardt (missing from picture: E. Bielmeier).

Table 1. Staff - members of RTW

Name	Affiliation	Function	Working for
Wolfgang Schlüter	BKG	head of the FSW (until July 2008)	FSW
Johannes Ihde	BKG	interim head of the FSW (since August 2008)	FSW
Alexander Neidhardt	FESG	group leader and VLBI station chief RTW	RTW, SOSW (partly O'Higgins)
Erhard Bauernfeind	FESG	mechanical engineer	RTW
Ewald Bielmeier	FESG	technician	RTW
Gerhard Kronschnabl	BKG	electronic engineer	RTW (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
Daniel Helmbrecht	FESG/BKG	student	RTW
Alexander Bauer	FESG/BKG	student	RTW

3. Observations in 2008

The 20m-RT-Wettzell has supported geodetic VLBI activities for over 25 years. All successfully observed sessions in the year 2008 are summarized in table 2. According to the IVS 2008 Master Schedule, RTW was the station that was scheduled for the most 24-hour geodetic VLBI sessions, which has been true for nine years. The daily one-hour INTENSIVE sessions (INT) were continued

in addition to the 24-hour sessions in order to determine UT1-UTC. These sessions, observed together with Kokee Park Observatory since 1999, are called INT1 and are performed every weekday. The correlation is done at the Washington Correlator (WASH). On Saturday and Sunday RTW is scheduled for the INT2/K sessions together with Tsukuba, Japan, filling the weekend gap from Sunday morning to Monday evening. Since August 2008, INT3/K has been set up on Monday morning, in order to shorten the weekend gap. INT2/K and in particular INT3/K provide regular UT1-UTC results with shortest latency. INT3/K includes the network stations Wettzell, Tsukuba and Ny-Ålesund. INT2/K data are correlated at the VLBI correlator in Tsukuba; INT3/K data are correlated in Bonn. Both VLBI correlators have a fast internet connection and are able to receive the data from the observing stations via e-VLBI in near real time via e-transfer. RTW now routinely uses the increased internet connection capacities of 622 Mbit/sec for the e-transfers to Bonn, Tsukuba and Haystack. The data transfer via Internet to the Washington Correlator is still organized via a center in the Washington area. The last mile problem is solved by car transport to the correlator.

In the year 2008 the RTW also took part in the Continuous VLBI Campaign 2008 (CONT08) where a continuous measurement over 15 days from August 12, 2008 until August 26, 2008 was run successfully. Except for a short gap of three hours caused by an IT problem, the RTW was fully operative during the whole observation period.

Table 2. RTW observations in 2008

program	number of 24h-sessions	program	number of 1h-sessions
IVS R1	49	INT1(Kokee-RTW)	234
IVS R4	51	INT2/K(Tsukuba-RTW)	100
IVS T2	6	INT3/K(Tsukuba-RTW-NyAl)	41
IVS R&D	9	total (in hours)	375
RDV/VLBA	6		
EUROPE	5	special program	number of experiments
CONT08	15	SELENE	19
total	141	total (in hours)	92
total (in hours)	3384		

In addition to the routinely done observations, Wettzell also supported the SELENE mission done by the National Astronomical Observatory of Japan with 92 hours of observation. SELENE is a Lunar Project to improve the determination of the gravity field of the moon.

According to the implementation of a Field System extension for remote control of the system, eleven INT2/INT3 experiments were done by remote control. In addition to that, the weekend observations are partly done unattended at Wettzell.

4. Technical Improvements and Maintenance

VLBI observations require high reliability of all participating stations; therefore careful servicing of all components is essential to ensure successfully performed VLBI measurements through the year(s). Additionally the 20m-RTW has to be kept to a high technical standard and has to be improved according to technological advancement.

In 2008 the following actions were carried out:

- Integration of a testbed for the new digital baseband converter (DBBC) with:

- installation of the hardware with the core1 boards and reception of the core2 DBBCs
- first recording and correlation tests in cooperation with the correlator at Bonn
- first software implementation for an integration of the DBBC control into station specific Field System modules
- Establishment of a new e-VLBI storage buffer as a RAID6 system with effectively 60 TBytes of space containing:
 - the installation of a test system with 16 TBytes of space
 - a highly available storage area network based on two servers, with a RAID system of 96x 750 GByte SATA-drives
 - NFS-mount via the EVN-PC installation to stream data to the storage area (including the first complete recording of CONT08)
- Establishment of Mark 5B with:
 - an update of the formatter as VSI4 to support Mark 5B
 - installation of Mark 5B hardware and first recording tests
- Improvement of the replacement dewar (done by the retired Richard Kilger) with:
 - reorganization of the interior with a stable framework
 - improvement of the thermal shield for the 20K level
- Software implementations for a remotely controllable extension for the Field System and first remote control tests with Wettzell and O'Higgins and TIGO
- Reference point determination with laser tracker and a new mathematical model done by Michael Lösler (Uni Karlsruhe)
- Cleaning and fixing of the antenna tower and panel framework
- Operating the SELENE hardware
- Regular tasks and maintenance days (obtaining replacements for the hardware, 8-pack repair, gear maintenance, Field System updates)
- Planning of the new TWIN radiotelescope Wettzell:
 - final project design and design review with finalization of the construction
 - design of the operation building
 - construction of an additional gravimetry building as a replacement during the TWIN construction phase
 - ideas for the realization of the VLBI2010 broadband suggestions

5. Plans for 2009

During 2009, dedicated plans are:

- Integration of the digital baseband converters (DBBC)
- Extension of the software developments for remote control and Field System extension
- Construction phase for the towers of the VLBI2010 TWIN-telescope.