

Fundamentalstation Wettzell - 20m Radiotelescope

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Abstract

The 20m Radiotelescope in Wettzell, Germany contributed very successfully and strongly to the IVS observing program again in 2007. Technical changes, improvements, and upgrades have been done 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:

- WLRS (Wettzell Laser Ranging System), a laser ranging system designed for Satellite Laser Ranging (SLR) and Lunar Laser Ranging (LLR) being involved in ILRS; at present, a new laser Satellite Observing System (SOS-W) for low orbiting satellites 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 to monitoring 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 superconducting 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. Water vapor observations are carried out continuously with a Radiometrix radiometer. 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, for improvement of all devices, and for development of new systems. Within the responsibility of the Fundamentalstation Wettzell are also the:

- TIGO systems (see TIGO report in this volume), operated in Concepción, Chile by 3 BKG experts jointly with a Chilean partner consortium (support staff: 11 engineers).
- O’Higgins station (see O’Higgins report in this volume) in Antarctica, jointly operated with the German Space Center (DLR) and the Institute for Antarctic Research Chile (INACH).



Figure 1. 20m Radiotelescope in the rural environment

The staff operating RTW is summarized in table 1. At the end of October Richard Kilger retired; nevertheless he continued to support the TWIN-project, improved the cooling system, and participated in the O'Higgins observations. Dr. Alexander Neidhardt will take over his position in May 2008. Alexander has background as an IT Engineer and currently works for the control system of the new Laser Ranging System SOS-W, which is in its final stage to become operational.

Table 1. Staff - members of RTW

Name	Affiliation	Function	Working for
Wolfgang Schlüter	BKG	head of the FSW	RTW, TIGO, O'Higgins, T&F,...
Richard Kilger	FESG	group leader RTW, retired October	RTW
Erhard Bauernfeind	FESG	mechanical engineer	RTW
Ewald Bielmeier	FESG	technician	RTW
Gerhard Kronschnabl	BKG	electronic engineer	RTW, TIGO and O'Higgins (partly)
Christian Plötz	BKG/FESG	electronic engineer	O'Higgins, RTW (partly)
Raimund Schatz	FESG	software engineer	RTW
Walter Schwarz	BKG	electronic engineer	RTW, O'Higgins and WVR (partly)
Reinhard Zeitlhöfler	FESG	electronic engineer	RTW
Daniel Helmbrecht	FESG/BKG	student	RTW

3. Observations in 2007

The 20m RT-Wetzell has supported geodetic VLBI activities for 25 years. All successfully observed sessions in the year 2007 are summarized in table 2. According to the IVS 2007 Master

Schedule, RTW ran more 24-hour geodetic VLBI sessions than any other IVS network station, as it has for the last eight years. In addition to the 24-hour sessions, RTW continued to run the daily one-hour INTENSIVE sessions in order to determine UT1-UTC. At the beginning of 1984, RTW observed together with Westford, since 1995 with Greenbank and since 1999 with Kokee Park. These sessions are called INT1 and are performed every weekday. The correlation is done at the Washington Correlator (WACO). On Saturday and Sunday RTW participates in the INT2 sessions together with Tsukuba, Japan, filling the weekend gap with data from Sunday morning to Monday evening. Since August 2008, INT3 sessions were set up on Monday morning, in order to shorten the weekend gap. INT3 includes the network stations Wettzell, Tsukuba and Ny-Ålesund. INT2 data are correlated at the VLBI correlator in Tsukuba; INT3 data are correlated in Bonn. Both VLBI correlators in Tsukuba and Bonn have a fast internet connection and are able to receive the data from the observing stations via e-VLBI in near real time. INT2 and in particular INT3 provide regular UT1-UTC results with the shortest latency. Some efforts to shorten the latency, which is affected mostly by the data transfer between the stations and the correlator, have been made. RTW has strongly improved its internet connection in 2007 from 34 Mbit/sec to 622 Mbit/sec. Today the data transfer via Internet is extended to all correlators which already have fast internet connections (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.

Table 2. RTW observations in 2007

program	number of 24h-sessions
IVS R1	52
IVS R4	52
IVS T2	4
IVS R&D	10
EUROPE	6
RDV/VLBA	6
in total	132

program	number of 1h-sessions
INT1(Kokee-RTW)	213
INT2(Tsukuba-RTW)	83
INT3(Tsukuba-RTW-Ny Al)	16
in total	312

In addition to the routine observations, some measurements were carried out to test the 1 Gbps recording capabilities and to test the observation modes for the upcoming SELENE observations, which are requested by the National Astronomical Observatory of Japan. SELENE is a Lunar Project to improve the determination of the gravity field of the moon.

4. Technical Improvements and Maintenance

VLBI observations require high reliability at 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 on a high technical standard and has to be improved according to technological advancement.

In 2007 the following actions were carried out:

- Implementation of an EVN PC for the data transmission to the Bonn correlator:
 - Combining the EVN PC via VSIC-System with Mark 5A,

- Extension of the Fieldsystem PC with software to record the data in parallel with Mark 5A and the EVN PC System,
- The EVN PC transfer is operationally employed for the INT3 data,
- Improvement of the Internet connection:
 - Upgrading from 34 Mbps to 622 Mbps,
 - Testing to verify the usable bandwidth, which shows best values of 500 Mbps,
 - Installation of an additional backup server to improve the reliability,
 - Installation of 6 TB storage capabilities for intermediate data handling of INT data and R1 data,
- Development of a test bed for the RTW motor drives:
 - for testing the status of the motors,
 - for optimizing the drive units,
- Integration of the Digital Baseband Converters (DBBC):
 - replacement of the analog baseband converters,
 - improvement of RTW towards VLBI 2010 requirements,
- Implementation of the hardware to support the Japanese SELENE Project:
 - collaboration with the National Astronomical Observatory of Japan (NAO),
 - test observations and preparation for tracking the Lunar Orbiter RStar and VStar,
- Fieldsystem Upgrade from Version FS 9.9.2 to FS 9.10.2
- Contributions to VLBI 2010:
 - releasing the specifications for the new VLBI 2010 compatible telescope (TWIN-Telescope Wettzell TTW),
 - requesting bids and contracting a company to manufacture the TWIN-telescopes,
 - considering a broadband feed capable of receiving a frequency band from 1 to 18 GHz.

5. Plans for 2008

During 2008, plans are to maintain the standards in observing quality and quantity. Some dedicated items will be:

- Final integration of the digital baseband converters (DBBC)
- Final integration of the Mark 5B-units
- Proceeding towards the realisation of the VLBI 2010 TWIN-Telescope.