Fundamentalstation Wettzell - 20m Radiotelescope

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Abstract

The 20m-radiotelescope at Wettzell/Germany contributed 2008 again very successful and strongly to the IVS observing program. 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) 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 Technical University Munich. In addition to the RTW following geodetic space technique an local systems are collocated at the GOW:

- laser ranging systems involved in ILRS: WLRS(Wettzell Laser Ranging System) and a new inplementation called Satellite Observing System Wettzell (SOS-W) is under construction.
- GPS receivers involved in gloabl 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.
- local techniques, as time and frequency, meteorology, super conducting gravity meter, water vapour observations and a regularly local survey

Within the responsibility of the GOW are also the TIGO systems at Concepción/Chile together with the Universidad de Concepción and the GARS O'Higgins at Antarctica together with the German Space Center (DLR).

2. Staff

The staff of the GOW consists in total of 35 members for operations, maintenance and repair issues and for improvement and developement of the systems. The staff operating RTW is summarized in table 1. On Juli 2008 Dr. Alexander Neidhardt took over the position as head of the radio telescope group and VLBI station chief at the RTW. He is also still invloved in the developements at the Satellite Observing System Wettzell (SOSW).

3. Observations in 2009

The 20m-RTW supports the geodetic VLBI-activities of the International VLBI Service for Geodesy and Astrometry and partly for other partners since over 25 years. All successfully observed sessions in the year 2009 are summarized in table 2. According to "'masterplan 2009"', RTW was the most engaged network station with 24h-geodetic-VLBI-sessions. The daily one-hour INTENSIVE-sessions (INT) in order to determine UT1-UTC were continued in addition to the

Table 1. Staff - members of RTW

Name	Affiliation	Function	Working for
Johannes Ihde	BKG	interim head of the GOW (till June 2009)	GOW
Ullrich Schreiber	BKG	head of the GOW (since July 2009)	GOW
Alexander Neidhardt	FESG	head of the RTW group and VLBI station chief	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 VWR)
Reinhard Zeitlhöfler	FESG	electronic engineer	RTW
Daniel Helmbrecht	FESG/BKG	student	RTW
Alexander Bauer	FESG/BKG	student	RTW
Thomas Guggeis	FESG/BKG	student	RTW

24h-sessions. For these sessions the complete data transfer is done with e-VLBI techniques. RTW now routinely uses the increased internet-connection capacities of 622 Mbit/sec for the e-transfers to Bonn, Tsukuba and Haystack. According to the implementation of a field system extension for remote control of the system weekend INTENSIVEs were done by remote attendance or completely unattended. In addition to the standard sessions RTW was also active for the IYA09, which was an astrometric session in the International Year of Astronomy 2009.

Table 2. RTW observations in 2009

program	number of 24h-sessions
IVS R1	49
IVS R4	51
IVS T2	7
IVS R&D	9
RDV/VLBA	6
EUROPE	6
IYA09	1
total	**129**
total (in hours)	**3096**

program	number of 1h-sessions
INT1(Kokee-RTW)	237
INT2/K(Tsukuba-RTW)	104
INT3/K(Tsukuba-RTW-NyAl)	49
total (in hours)	**394**

special program	number of experiments
VENUS	4
total (in hours)	**4**

4. Technical Improvements and Maintenance

VLBI-observations requires high reliability of all participating stations. Therefor careful service of all components is essential to ensure successfully performed VLBI-measurements through the year. Additionally the 20m-RTW has to be kept on a high technical standard and has to be improved according to technological advancement.

In 2009 the following developments and maintenance tasks have been done:

- Establishment of a new eVLBI buffer storage as RAID6-system with effective 60TByte volume containing
  - the installation of a test system with 16 TByte volume

  - a two server based, highly available storage area network with a RAID-system of 96x 750 GByte SATA-drives
  - NFS-mount via the EVN-PC installation to stream data to the storage and first complete recording of C ONT08
- Establishment of Mark5B with
  - updating of the formatter as VSI4 to support Mark5B
  - installation of Mark5B hardware and first recording tests
- Improvement of the replacement dewar with
  - reorganisation of the interior with a stabile framework
  - improvement of the thermal shield at the 70K level
- Test setup of the new Digital Baseband Converter (DBBC)
  - running of test schedules and data acquisitions
  - writing of controlling code to run the DBBC via Ethernet
- Software implementations for a remotely controlable extension for the NASA field system
  - writing a stable Remote Procedure Call based software
  - first regular uses with RTW
  - first remote control tests with O'Higgins and TIGO
  - preparing a official release to offer the basic software also for other telescopes

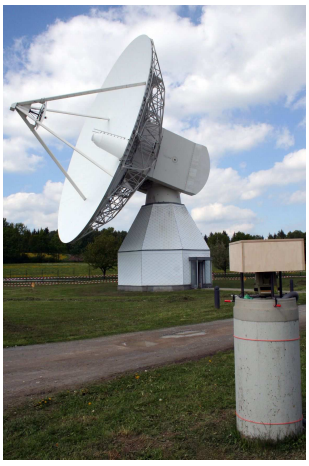

Figure 1. The permanent reference point determination

- Permanent reference point determination with laser tracker, tachymeter and nivel on the basis of a new mathematical model done by Michael Lösler (Uni Karlsruhe)
  - installation of a tachymeter for 3 month to monitor the movements of the reference point permanently

- installation of a scintillometer for refraction calibration
- collecting additional information e.g. meteorological data or Invar cable measurements
- experiments with additional equipment as laser tracker and nivel while moving the telescope determined
- an internal report shows a reference point stability of about 15/100 mm over one day

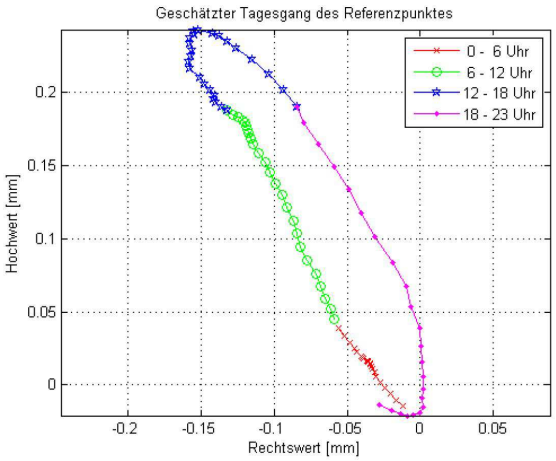

Figure 2. Estimated daily variation of reference point

- Calculation of orbits for Global Navigation Satellite Systems satellites for observations at partner telescopes
- Plans to replace the existing radar system at the laser ranging system with a VLBI2010 conform solution
- 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)
- First plans for the integration of a monitoring system at the RTW
- IVS VLBI2010 Workshop on Future Radio Frequencies and Feeds (FRFF)
  - 60 international scientists discussed the new developments for VLBI2010 at Wettzell/Höllenstein on March 2009
  - Discussions about the new eleven feed from Prof. Kildal (Chalmers University Göteborg/Schweden)
  - Presentations of the new design of the TWIN radio telescopes Wettzell
  - Results offered guidelines for the future developments (frequencies, bands, developments, digital backends and so on)
- Building the new TWIN radiotelescope Wettzell (TTW)
  - final project design and design review with fixation of the constructions
  - design of the operation building

– construction of the new towers started on September 2009
– construction of the control building has started

Figure 3. Construction of the concrete tower

5. Plans for 2010

During 2010, dedicated plans are:

- Usage of the digital baseband converters (DBBC)
- Extension of the software developements for remote control and the NASA field system extension
- Continuous construction for the VLBI-2010 TWIN-telescopes
- Extending the usage of a monitoring system at the RTW