

# DGFI Analysis Center Annual Report 2013

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**Abstract** This report presents the activities of the DGFI Analysis Center during 2013. Besides the regular IVS submissions, DGFI started to reprocess 24-hour sessions including the estimation of source positions. DOGS-RI, the new VLBI analysis software to be used at DGFI, is near completion.

DGFI has been acting as an IVS AC since the establishment of the IVS in 1999. Since November 2008, DGFI has been an operational AC regularly submitting constraint-free normal equations for 24-hour sessions in the SINEX format. Since 2008, DGFI has also been involved in the BKG/DGFI Combination Center.

## 1 General Information and Component Description

The DGFI Analysis Center (AC) is located at the German Geodetic Research Institute (Deutsches Geodätisches Forschungsinstitut, or DGFI) in the city center of Munich in Germany. DGFI is an autonomous and independent research institution affiliated with the Bavarian Academy of Sciences and Humanities (BAdW) and funded by the Free State of Bavaria.

Research performed at DGFI covers many different fields of geodesy (geometric techniques, gravity field, Earth system modeling, etc.) and includes the contribution to national and international scientific services and research projects as well as various functions in scientific organizations (see <http://www.dgfi.badw.de>). DGFI closely cooperates with BAdW and the Technische Universität München (TUM, including personnel at the Geodetic Observatory Wettzell) within the framework of the Center of Geodetic Earth System Research (CGE).

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## 2 Staff

In 2013, the DGFI AC had to cope with a rather low number of personnel. After Robert Heinkelmann left DGFI in autumn 2012 to become the head of the VLBI group at the German Research Centre for Geosciences (GFZ) in Potsdam, Julian Andres Mora-Diaz joined his group in early 2013. And since spring 2013, Manuela Seitz has been on maternity leave.

**Table 1** Staff members and their main areas of activity.

Dr. Detlef Angermann	Group leader
Dr. Michael Gerstl	Development of the analysis software DOGS-RI
Mr. Julian Andres Mora-Diaz (now at GFZ)	Routine data analysis
Dr. Ralf Schmid	Routine data analysis, combination of different space geodetic techniques
Dr. Manuela Seitz (currently on maternity leave)	CRF/TRF combination, ICRF3, combination of different space geodetic techniques

As all these vacancies could not be filled in the meantime, the activities of the DGFI AC were more or less limited to the routine analysis of 24-hour sessions which has been performed by Ralf Schmid since

the end of May 2013. In addition, Michael Gerstl is engaged in the development of a new VLBI analysis software called DOGS-RI (DGFI Orbit and Geodetic Parameter Estimation Software - Radio Interferometry).

Table 1 lists the staff members and their main areas of activity.

### 3 Current Status and Activities

#### Analysis Activities

The DGFI AC tries to analyze all 24-hour sessions for which a database file of at least version 4 is available using the VLBI analysis software OCCAM. Since the end of 2012, source positions are among the estimated parameters contained in the normal equations that are submitted to the IVS Combination Center. Before, source positions were fixed to their a priori values.

In June 2013, the handling of the cable calibration data changed. Since then, the cable calibration of certain stations is turned off in case it degrades the solution. Before, the database settings were applied. Therefore, in the case of an extreme degradation, stations sometimes had to be excluded from the solution.

At the same time, the DGFI AC started to reanalyze sessions in the case in which recorrelated data considering additional stations become available. As recorrelated sessions are usually stored at the IVS Data Centers with the same name as the original database file, updated sessions are not automatically detected. If a recorrelation is announced via IVSmail, the download is started manually.

In order to have consistent SINEX files, a reprocessing was started in autumn 2013 including the estimation of source positions, the proper handling of cable calibration data, and the consideration of recorrelated observation files. At the end of December 2013, consistent DGFI normal equations were available from July 2011 to December 2013.

If operational and reprocessed solutions are summed up, in 2013 DGFI analyzed 325 sessions altogether from four different years (2008 and 2011-13) and submitted the corresponding daily SINEX files to IVS. Among them were 124 IVS-R1, 123 IVS-R4, 19 IVS-R&D, 15 CONT11, 11 EUROPE, ten VLBA, eight IVS-T2, six IVS-OHIG, five CONT08, and four APSG sessions (see Table 2).

**Table 2** Sessions analyzed in 2013.

Session type	2008	2011	2012	2013	Total
APSG	–	1	2	1	4
CONT08	5	–	–	–	5
CONT11	–	15	–	–	15
EUROPE	–	2	4	5	11
IVS-OHIG	–	1	4	1	6
IVS-R1	–	24	52	48	124
IVS-R4	–	23	52	48	123
IVS-R&D	–	3	9	7	19
IVS-T2	–	1	4	3	8
VLBA	–	3	3	4	10
Total	5	73	130	117	325

#### Software Development

In order to follow IERS 2010 Conventions, OCCAM is refined to become part of DOGS. The theoretical models for the group delay need time derivatives and, in case of the delay rate, also the second time derivatives of the input parameters. The former approach to approximate these derivatives by divided differences with a fixed time step of two seconds was superseded.

Parameter and observation models were expanded to provide analytically calculated first and second time derivatives. This conversion is complete except for some routines calculating the equinox-based transformation matrix from the nutation parameters  $\Delta\psi$  and  $\Delta\epsilon$ . Thus, only the branch based on  $X_{CIP}$ ,  $Y_{CIP}$ , and the celestial intermediate origin is operative. The correlations between  $(X_{CIP}, Y_{CIP})$  and  $(x_{pol}, y_{pol})$  are not yet theoretically modeled; condition equations to prevent subdiurnal retrograde motions are missing.

### 4 Future Plans

In 2014, we would like to keep on reprocessing 24-hour sessions backward from July 2011 besides our operational contributions to IVS. Apart from that, detailed comparisons between DOGS-RI and OCCAM will be necessary, before we can switch to the new software.

#### Acknowledgements

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