DGFI Analysis Center Annual Report 2010

Robert Heinkelmann, Manuela Seitz, Michael Gerstl, Hermann Drewes

Abstract

This report summarizes the activities of the DGFI Analysis Center in 2010 and outlines the planned activities for 2011.

1. General Information and Component Description

The German Geodetic Research Institute (Deutsches Geodätisches Forschungsinstitut, DGFI) is an autonomous and independent research institute hosted at the Bavarian Academy of Sciences (BADW) located in Munich. It is run by the Free State of Bavaria, and it is evaluated every four years by a scientific advisory board consisting of four international experts nominated by the International Association of Geodesy (IAG) and of three professors working at German universities nominated by the German Geodetic Commission (Deutsche Geodätische Kommission, DGK). The research covers all fields of geodesy and includes the participation in national and international projects as well as functions in international bodies (see also http://www.dgfi.badw.de).

In November 2010 the research activities of DGFI were reviewed by the scientific advisory board for the first time. In their expertise the scientific board pointed out positively the proposed work in the context of IVS enabling the IVS AC at DGFI to carry on its work for another four-year period (2011-2014). On the 28th of October 2010 the scientific geodetic institutions in Munich and Bavaria—namely the Institute of Astronomical and Physical Geodesy (IAPG) and the Forschungseinrichtung Satellitengeodäsie (FESG) including the personnel at the Geodetic Observatory Wettzell (both at Technical University Munich (TUM)), the Bayerische Kommission für die internationale Erdmessung and the Deutsches Geodätisches Forschungsinsitut of the Deutsche Geodätische Kommission (both at the Bavarian Academy of Sciences)—have signed a cooperation agreement to establish the Center for Geodetic Earth system Research (Centrum für Geodätische Erdsystemforschung), CGE[1]. The CGE's mission is the research of global change through the measurement of changes in the solid Earth, the oceans, the ice caps, and the atmosphere, as well as the analysis of these changes with regards to the triggering physical processes.

2. Staff

The DGFI IVS AC[2] is operated by Robert Heinkelmann and Manuela Seitz. The recent developments and numerical optimizations of our VLBI analysis software were almost completely carried out by Michael Gerstl. Our activities are managed by Hermann Drewes, who retired at the end of 2010. We regret to lose Hermann's expertise; but, nevertheless, we wish Hermann a joyful retirement.

3. Current Status and Activities

- IVS Operational Analysis Center at DGFI

---

[1]http://www.badw.de/aktuell/pressemitteilungen/archiv/2010/PM_28_2010/index.html
[2]http://www.dgfi.badw.de/index.php?id=126&L=2

DGFI routinely processes the standard IVS sessions (currently the two IVS rapid turnaround networks IVS-R1 and IVS-R4) and additional sessions of the geodetic and astrometric program run by IVS and delivers datum free normal equations in SINEX format. The duty to process and submit sessions within 24 hours after the availability of the database (DB) version 4 (or higher) demands the full automation of the analysis. A small but important step towards decreasing the product latency could be achieved with the help of the Institute of Applied Astronomy (IAA), St. Petersburg, that provided a routine enabling the output of correlator information from DB in ASCII format. In this context, we want to thank Igor Surkis and colleagues from IAA for the preparation of FORTRAN routines.

- Automation of the VLBI analysis

  The main task during 2010 was the automation of VLBI analysis at the 'post-post-processing' level, i.e., starting with DB version 4 (or higher). IVS folders containing DB files are routinely checked for new files. In case of a new file, the highest DB version available is downloaded onto a local Linux PC and transformed to NGS format. Applying the routines provided by IAA an ASCII text file is then created in addition to the transformation from DB to NGS format. The ASCII text file contains the correlator comments including those on real clock breaks. The clock breaks mentioned by the correlator are then automatically detected and removed by an algorithm developed at DGFI. After a first least-squares adjustment, clock breaks and offsets are considered, and a second robust adjustment is performed, eliminating possible outliers. The outlier-free group delays corrected for clock breaks and for offsets are then transformed into normal equations and written to SINEX format via the DOGS-CS software.

- Re-arrangement of the VLBI software used and developed at DGFI

  The VLBI software used at DGFI got completely rearranged and is now part of the DGFI Orbit and Geodetic Parameter Estimation Software DOGS (Gerstl et al., 2000; Heinkelmann and Gerstl, 2010).

  - The new code enables running on 32bit and 64bit operating systems.
  - The explicit declaration of all variables increases the reliability.
  - '8byte real' instead of 'DOUBLE PRECISION' types of variables allow machine independence.
  - 'COMMON' blocks are replaced by modules, increasing the reliability.
  - Arrays are allocated dynamically, saving memory space.
  - Avoidance of 'EQUIVALENCE' statements allows optimization.
  - Binary files were shortened or completely removed.

  The program body is modular, and thus modules which are in common in VLBI and SLR analyses are now identical for both techniques. The software migration thus increases the consistency between the VLBI and SLR solutions provided by DGFI and reduces the time and effort for maintenance. The program language is FORTRAN2003, compatible with FORTRAN95.

4. Future Plans

At DGFI IVS AC we want to continue and deepen our investigations concerning the atmosphere, i.e., the neutral atmosphere and the ionosphere. Besides, the inclusion of the DOGS VLBI software into routine processes will be one of our main goals in 2011. For the operational VLBI analysis we want to further automate the analysis procedure and to extend our product portfolio. The Linux PC, which currently runs the automated procedures, is located at the Institute of Geodesy and Geophysics, TU Vienna, Austria so far. In 2011 we want to migrate those processes to a PC maintained at our institute.

References

[1] Gerstl M., R. Kelm, H. Müller, W. Ehrnsperger: DGFI Orbit and Geodetic Parameter Estimation Software. Combination and Solution. Deutsches Geodätisches Forschungsinstitut, Interner Bericht Nr. MG/01/1995/DGFI, in German, 2000.

[2] Heinkelmann R. and M. Gerstl: OCCAM - LSM for LINUX: new developments at DGFI (poster). 6th International VLBI Service for Geodesy and Astrometry General Meeting, 7-13 February 2010, Hobart, Australia, 2010.