BKG/DGFI Combination Center Annual Report 2014

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Abstract This report summarizes the activities of the BKG/DGFI Combination Center in 2014 and outlines the planned activities for 2015. The main focus in 2014 was on the generation of the IVS contribution to the next ITRF, the inclusion of additional Analysis Centers into the combined solution and the design and set up of a new Combination Center's homepage.

1 General Information

The BKG/DGFI Combination Center was established in October 2008 as a joint effort of the Federal Agency for Cartography and Geodesy (Bundesamt für Kartographie und Geodäsie, or BKG) and the German Geodetic Research Institute (Deutsches Geodätisches Forschungsinstitut, or DGFI). The participating institutions, as well as the tasks and the structure of the IVS Combination Center, are described in [1]. The tasks comprise quality control and a timely combination of the session-based intermediate results of the IVS Analysis Centers into a final combination product (e.g., Earth orientation parameters, EOP). In coordination with the IVS Analysis Coordinator, the combination results are released as official IVS products. The Combination Center is also expected to contribute to the generation of the official IVS input to any ITRF activities.

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BKG/DGFI Combination Center

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The BKG/DGFI Combination Center performs a combination of session-based results of the IVS Analysis Centers on an operational basis. The strategy for the combination is based on the combination of normal equations and was adopted from the combination process as developed and performed by the IVS Analysis Coordinator (cf. [2], [3]). At BKG, the following tasks are performed:

- Quality control of the Analysis Center results: checking the format of the results and their suitability for combination, identification, and reduction of outliers, comparison of the Analysis Centers' results with each other, and comparison of the results with external time series provided by IERS or IGS.
- Feedback to the Analysis Centers: quality control results are available at the BKG IVS Combination Center Web page [5].
- Generation of high-quality combination products and timely archiving and distribution: combination products are created by using the combination part DOGS-CS of DGFI's software package DOGS (DGFI orbit and geodetic parameter estimation software) [4].
- Submission of official IVS combination products to the IERS: the products are submitted to the responsible IERS components to be used for IERS product generation (e.g., EOP rapid products and the EOP series IERS C04).
- Generation of the official IVS input to the ITRF: the combined session products (from 1984 to present) are submitted for ITRF computation in the form of normal equations in SINEX format. This work is also supported by the staff of the IERS Central Bureau, hosted by BKG.

- Final results are archived in the BKG Data Center and mirrored to the IVS Data Centers at Observatoire de Paris (OPAR) and Goddard Space Flight Center (GSFC). This work is assisted by the staff of the BKG Data Center in Leipzig.

DGFI is in charge of the following Combination Center functions:

- DGFI is developing state-of-the-art combination procedures. This work, as well as the following item, is also related to the ITRS Combination Center at DGFI and DGFI's efforts within the IERS WG on Combination at the Observation Level (COL).
- The software DOGS-CS is updated by implementing and documenting the developed state-of-the-art combination procedures.
- Adhering to IERS Conventions: the DGFI DOGS software package is continuously updated to be in accordance with the IERS Conventions.

2 Activities During the Past Year

At BKG, the following activities were performed during 2014:

- Generation of a combined solution of IVS 24h rapid sessions twice a week.
- Generation of a combined long-term (quarterly) solution of IVS 24h sessions every three months.
- Testing and inclusion of 11 contributions to the IVS combined contribution to the ITRF.
- Ensuring an IERS2010 Conventions conform combination process.
- Generation of the IVS combined contribution to the IERS ITRS Center for the next ITRF.
- Inclusion of new Analysis Centers GFZ, Germany and CGS, Italy into the routine rapid combination.
- Design and set up of the new IVS Combination Center's Web sites [5].
- Refinements of the combination procedure and implementation of source parameter combination.
- Development of an alternative combination procedure using the Bernese GNSS Software; implementation of the basic VLBI combination functions and preprocessing routines in cooperation with the University of Bonn.
- Participation in a pilot project on digital object identifiers (DOI) for data in cooperation with R. Heinkelmann (Deutsches GeoForschungsZentrum, Germany); feasibility investigation for providing data and meta data.

A complete set of SINEX files for the ITRF contribution has been submitted to the IERS ITRS Center in the beginning of December 2014. This time, 10 institutions submitted their SINEX files in order to contribute to the combined solution. One of the main tasks in 2014 was to gather the SINEX contributions and to make sure that all contributions meet the IVS analysis specifications for ITRF contributions. In the course of the year, it turned out that the ITRF will be extended for another year, including sessions until the end of 2014 (and not only until the end of 2013 as it has been foreseen in the original ITRF call for participation). With one year of additional data, an 11st institution announced their participation. The challenge in 2014 was to ensure a consistent data quality, homogeneous data contributions and the set up of a combination predure meeting the IVS specifications, e.g. meeting the IERS2010 standards.

In figure 1 the data contribution for the next ITRF is shown. Comparing the institutions that are shown in the figure with the ACs contributing to the routine combination listed in section 4 illustrate the effort coming along with the ITRF contribution comparing to the routine rapid combination. The final deadline for all IERS Technique Services for the (extended) ITRF contribution is February 28, 2015.

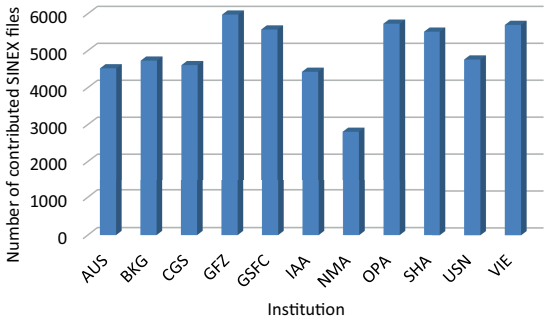

Fig. 1 SINEX files contribution for the IVS combined solution for the next ITRF.

Within the past year, the IVS Combination Center web sites have been newly designed and set up [5]. The IVS Combination Center manage a stand-alone homepage, to inform IVS users about VLBI combination details like the structure, basics, organization and the current combination results. The content of these pages are being adapted regularly. To use the technical progress on a best, we did some scale and structure changes. The basic is now a professional Content Management System (CMS), which was developed for this purpose. Many functions and extensions are already disposed in the CMS and will simplifies the future administration. Now the users are able to fill in an evaluation form about the web page content, to search for keywords, to look at glossary entries or to print out all page information. An automatically view about the recent combination status and many other tools were added to the existing data. Due to these changes and the new design we will increase the IVS interest. A screenshot of the newly designed web sites is shown in figure 2.

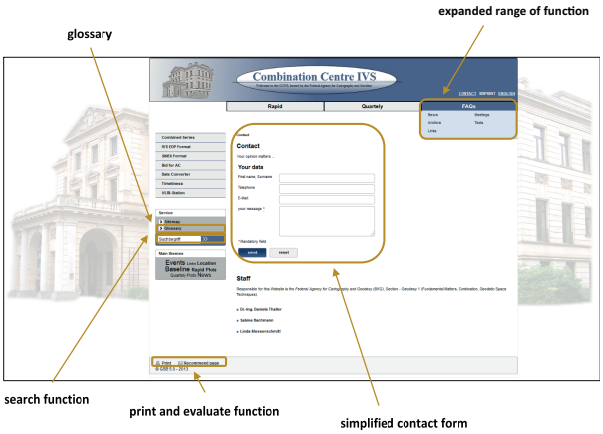

Fig. 2 Screenshot of the new designed BKG Combination Center's web sites.

At DGFI the following activities were performed during 2014:

- Application of tidal corrections to UT1 according to IERS Conventions (2010) by DOGS-CS.
- Development of an EOP routine to switch between piecewise linear (offsets at 0h) and offset+drift representation.
- Improved realization of observation epochs in DOGS-CS with 8-byte precision.
- Handling of radio source position parameters with DOGS-CS.

3 Staff

The list of the staff members of the BKG/DGFI Combination Center in 2014 is given in Table 1.

More details on the IVS Combination Center at BKG can be found in an interview for the IVS Newsletter [6].

4 Current Status

In 2014, six IVS Analysis Centers (BKG, DGFI, GSFC, IAA, OPA, and USNO) contributed to the IVS combined product (see [5]). GFZ (German Research Center for Geosciences) and CGS (Centro di Geodesia Spaziale, Italy) are currently under review and will become an IVS Operational AC in the near future. The rapid solutions contain only R1 and R4 sessions, and new data points are added twice a week as soon as the SINEX files of at least four IVS Analysis Centers are available. Long-term series are generated quarterly and include every 24h session since 1984. The quarterly series include long-term EOP, station positions, and velocities. Furthermore, a VLBI TRF is generated and published. The preprocessing to read and write source positions was implemented, and the software was extended to process source parameters. The results of the combination process are archived by the BKG Data Center in Leipzig. The combined rapid EOP series, as well as the results of the quality control of the Analysis Center results, are also available directly at the BKG/DGFI Combination Center Web page [5] or via the IVS Analysis Coordinator Web site.

5 Future Plans

In 2015, the work of the BKG/DGFI Combination Center will focus on the following aspects:

- Finishing the extenden IVS contribution to the next ITRF realization: inclusion of IVS sessions of one additional year (2014).

Table 1 Staff members of the BKG/DGFI Combination Center.

Name	Affiliation	Function	E-Mail
Michael Gerstl	DGFI	Software maintenance	gerstl@dgfi.badw.de
Ralf Schmid	DGFI	Combination strategies	schmid@dgfi.badw.de
Mathis Bloßfeld	DGFI	Combination strategies	blossfeld@dgfi.badw.de
Sabine Bachmann	BKG	Combination procedure development	sabine.bachmann@bkg.bund.de
Linda Messerschmitt	BKG	Operational Combination /Web site maintenance	linda.messerschmitt@bkg.bund.de

- Inclusion of new Analysis Centers CGS and GFZ into the routine rapid and quarterly combination.
- Investigation into combination of source coordinates for time series of source coordinates and generation of a combined celestial reference frame based on VLBI intra-technique combination.
- Establish the digital object identifier (DOI) for combined VLBI products in cooperation with GFZ.

References

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