

3.6.2.2 Deutsches Geodätisches Forschungsinstitut (DGFI)

Background and research activities

Within the Forschungsgruppe Satellitengeodäsie (FGS), DGFI co-operates with GIUB (Geodätisches Institut, University Bonn, Germany) and FESG (Forschungseinrichtung Satellitengeodäsie, Technical University of Munich, Germany) in a joint IERS Combination Research Centre (CRC). The work is done in close cooperation with the GFZ (GeoForschungsZentrum Potsdam, Germany). The major activities are being funded by the Geotechnologien-Projekt of the German BMBF (Bundesministerium für Bildung und Forschung), Verbundprojekt: FE: IERS, Forschungsvorhaben: 03F0336C. The work of the CRC at DGFI is closely related to the ITRS Combination Centre (see 3.6.1.1, this issue).

The research activities of the CRC at DGFI during the year 2002 can be divided into four major topics:

- o Investigations related to ITRF relevant issues
- o Studies related to variance component estimation
- o Intra-technique combination within ILRS
- o Contributions for the IERS SINEX Combination Campaign

ITRF related investigations

In relation with the ITRS Combination Centre at DGFI we performed various investigations related to ITRF relevant issues, including:

- o Analysis of individual multi-years solutions on station coordinates and velocities with regard to several aspects (e.g. constraints, rank deficiencies, datum definition);
- o Reviewing and studying systematic differences between different solutions to understand their origin (e.g. software-related aspects, model differences, parameterisation, processing strategies, etc.);
- o Analysis of station position time series with respect to non-linear effects, periodic signals and systematic differences and comparison of the results obtained by different techniques at collocation sites;
- o Concerning the datum definition of the ITRF we analysed time series of the scale and origin obtained from different space technique solutions. For the definition of the kinematic datum of the ITRF we propose to use kinematic models based on geodetic observations (e.g. APKIM2000) instead of geophysical models (e.g. NNR NUVEL-1A) to ensure that the no net rotation condition is more accurately fulfilled;
- o Investigations related to the weighting for the intra- and inter-technique combination (e.g. variance component estimation, see below) and to the handling of local ties.

Variance component estimation

Within the inter-technique combination it may be useful to apply the variance component estimation for the weighting of the heterogeneous input solutions from the different space geodetic observations, such as VLBI, SLR, GPS and DORIS. From various applications in different fields of geodesy it is well known that this quadratic estimation method may lead to useless results. Hence intensive investigations for the feasibility of this method have started under the specific conditions of the inter-technique combination. First results proof that at least three input solutions have to be inserted to the variance component estimation in order to obtain convergence. The investigations have to be continued.

Combination of SLR solutions for ILRS

In response to the call for participation „Positioning & Earth Orientation“ of the ILRS, DGFI expressed the willingness to contribute as analysis and combination centre. The role of an ILRS combination centre is to perform a quality control of the individual SLR solutions (daily earth orientation parameters and 28-day global station coordinates) and to provide a single combined solution on a weekly basis. For this purpose DGFI has developed software and tools to get the input solutions from the global ILRS data centres (CDDIS and EDC), to analyse and to combine them, and to put the final solution back to the data centres, within an automated process. Only those input solutions are included in the combination which pass an eigenvalue analysis and which fulfil rms difference criteria to internal and external parameter values. Because the official SLR input solutions are not yet available, solutions of ILRS pilot projects and of the data pool of the IERS SINEX Combination Campaign are used within a first test phase. The necessary fine-tuning will follow when getting the official SLR solutions from individual ILRS analysis centres.

IERS SINEX Combination Campaign

DGFI has provided SLR, VLBI and GPS solutions and/or free normal equations and concentrates on the analysis of combination strategies. In view of the goals of the SINEX Combination Campaign the available solutions were checked concerning various aspects, such as format and suitability for a rigorous combination. The scientific studies include:

- o Assessment of the quality of local tie information and the impact of local ties on the combination
- o Investigations related to the weighting of solutions in the intra- and inter-technique case
- o Study datum definition issues for individual space-techniques and combined solutions
- o Study systematic biases between the techniques

*Detlef Angermann, Hermann Drewes, Michael Gerstl,
Rainer Kelm, Manuela Krügel, Barbara Meisel*