3.6.2.5 Institute of Geodesy and Geoinformation of the University of Bonn (IGGB)

The Institute of Geodesy and Geoinformation of the University of Bonn has been operating an IERS Combination Research Center (CRC) since 2001 in cooperation with the Deutsches Geodätisches Forschungsinstitut (DGFI) in Munich. The CRC and its efforts are closely linked to the tasks of the Analysis Coordinator of the International VLBI Service for Geodesy and Astrometry (IVS) hosted by IGGB.

In 2007, combination research has again been devoted to the combination of the IVS Analysis Center's contributions to the regular IVS products. This research lead to a new combination process for the two IVS EOP series (rapid and quarterly solutions) which has been made operational on January 1, 2007. Routine combinations of IVS are now being made exclusively on the basis of datum-free normal equations in SINEX format. In 2007, five IVS Analysis Centers (BKG, DGFI, GSFC, IAA and USNO) contributed to the IVS combined products by providing input in the form of datum-free normal equations. 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 the five IVS Analysis Centers are available. For the quarterly solution, updated every three months, almost all available data of 24-hour sessions from 1984 onwards are used. Since this series is designed for EOP determinations, those sessions are excluded which are observed with networks of limited extension or which are scheduled for a different purpose like radio source monitoring.

The advantage of the new combination strategy is that one common terrestrial reference frame (e.g. ITRF2005) is applied after the combined datum-free normal matrix is generated. Thus, it is guaranteed that an identical datum is used in the combination process for all input series. After datum definition, the combined system of normal equations is solved (inverted) and the full set of EOP (pole components, UT1–UTC, and their time derivatives as well as two nutation offsets in dpsi, depsilon w.r.t. the IAU2000A model are extracted. These results are added to the two EOP time series in the IVS EOP Exchange format, the rapid solution file (ivs07r1e.eops) and the quarterly solution file (ivs07q4e.eops). Companion files containing the nutation offsets in the X, Y paradigm are routinely generated through a standard transformation process (ivs07r1X.eops, ivs07q4X.eops). At the same time the combined SINEX files (datum-free normal equations) are also available on the web for further combination with other techniques. The weighted RMS differences between the individual IVS Analysis Centers and the combined products have been reduced from roughly 80 – 100 μas to 50 – 60 μas in all components.

As part of the quality assessment of the combination process, long-term time series of station positions of each individual IVS Analysis Center, derived from the submitted normal equations, have been compared with each other. Through this, systematic offsets in the height component of up to 1 cm have been detected between solutions analysed with the VLBI analysis software packages OCCAM and CALC/SOLVE. In order to find the reason for these discrepancies several models used in both software packages have been compared in close cooperation with the VLBI group at DGFI. It turned out that the systematic offsets were mainly caused by differences in the pole tide model. In the CALC/SOLVE solutions, a model for the annual mean pole was used, basically setting the mean pole coordinates to zero, which was not in agreement with the IERS Conventions 2003. Therefore, all analysis centers using CALC/SOLVE reprocessed their solutions with the conventional pole tide model according to the IERS Conventions 2003 and most of the discrepancies disappeared. Since the IVS input to ITRF2005 was affected by the same inconsistency, the ITRF2005 may be affected by this oversight, though not to the full extent.

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