3.6 ITRS Combination Centres

3.6.1 Deutsches Geodätisches Forschungsinstitut (DGFI)

With effect from January 1st, 2015 the Deutsches Geodätisches Forschungsinstitut has become an institute of the Technische Universität München (TUM). It is now called Deutsches Geodätisches Forschungsinstitut at TU Munich (DGFI-TUM).

In 2014, the focus of the work of the ITRS Combination Centre (CC) at DGFI-TUM was on the ITRS realization DTRF2014. DGFI-TUM is one of three ITRS Combination Centres which will provide a new ITRS realization in 2015. First data series from DORIS and VLBI were provided by the Technique Centres and analysed by the CC in 2014.

DGFI combination strategy for DTRF2014

The ITRS realization strategy of DGFI-TUM is based on the combination of datum free normal equations which are reconstructed from the input SINEX series provided by the Technique Centres. The ITRS realization consists of two main parts: (1) the technique-wise analysis of the input data and the generation of one combined NEQ per technique and (2) the combination of the technique NEQs (Fig. 1). In 2014 the first step was performed for the first iterations of VLBI and DORIS input data series.

In ITRF computation many correction models are applied considering tidal-related effects on station positions. The ITRF2014 will be the first ITRF that considers non-linear signals in station position time series which are mainly caused by non-tidal loading. DGFI-TUM plans to apply loading data provided by the GGFC and derived from atmospheric, hydrologic and oceanic models. The DGFI-TUM combination strategy is based on the combination of datum-free normal equations which are corrected for loading signals directly after their reconstruction from the SINEX files. Beside the application of loading corrections, the identification and consideration of discontinuities in station position time series and the analysis of datum parameters are important steps of the first part.

Analysis of VLBI data

VLBI data are provided as datum-free session NEQs by the IVS. The VLBI series is the longest in ITRF2014 and includes 35 years of data from 1980 – 2015. The NEQs contain daily station positions, pole coordinates and rates, LOD, UT1–UTC and nutation offsets. Altogether 159 stations are included from which 52 are reduced because of too short or sparse observation time series. The analysis of the station positions provided 43 discontinuities mainly caused by earthquakes.

The VLBI scale is analysed in detail as it is planned to use it for DTRF scale realization. Figure 2 shows the scale time series

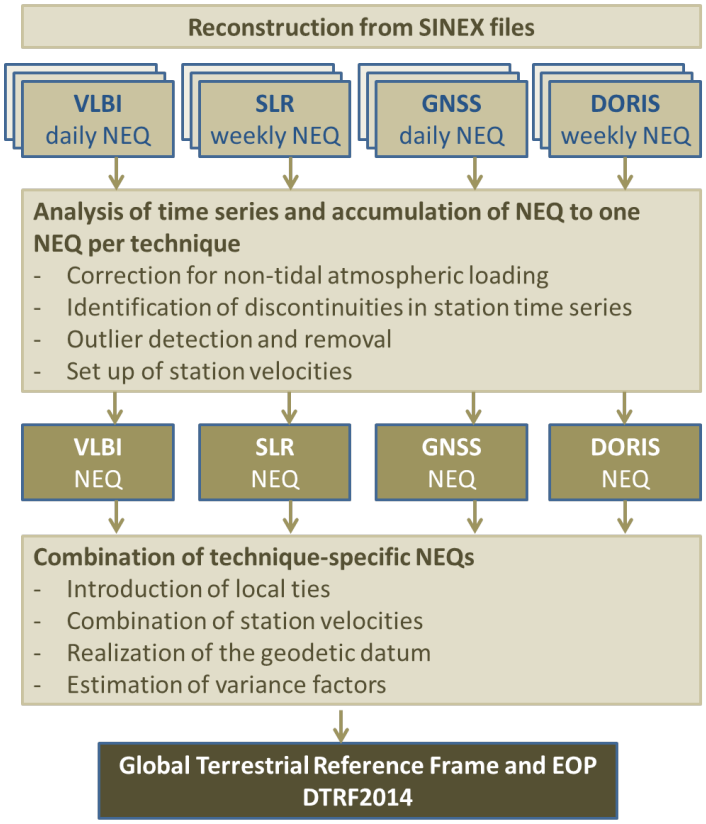

Fig. 1: Combination strategy applied by ITRS CC DGFI-TUM.

derived from similarity transformations of the session solutions to the VLBI-TRF solution. Except for the first years, which are characterised by large standard deviations, no long-term signals, offsets or trends are found. Therefore, the complete VLBI series can be used for scale realization.

The transformation of the VLBI-TRF solution to DTRF2008 shows a good agreement providing a difference for the scale of –1.2 ± 0.3 mm and for the scale rate of –0.04 ± 0.09 mm/yr.

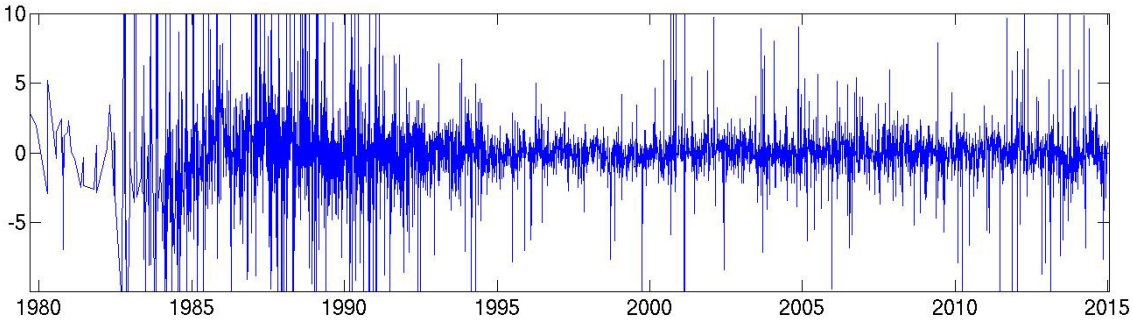

Fig. 2: VLBI scale time series derived from similarity transformations of VLBI session solutions to the VLBI-TRF solution.

Analysis of DORIS data

The DORIS data are provided as weekly solutions together with the full statistical information. However, the applied datum-related constraints are not given in the SINEX files and therefore seven parameters of a similarity transformation have to be set up for each NEQ. It should be mentioned that – compared to the solution level – all stations have to be considered for these similarity transformations at NEQ level.

The DORIS data covers the time span 1993–2015 (22 years). The solutions contain weekly station positions and daily pole coordinates. IDS provided three iterations of the input series which are all analysed by DGFI-TUM. Significant improvements of the weekly solutions are reached which lead to smaller RMS values of the parameter time series. In total 160 stations are included in the DORIS data from which 14 are reduced because of short time series. The analysis of the station position time series provided a list of 55 discontinuities, which was iterated and discussed with the IDS Combination Centre.

Even if the datum provided initially by the DORIS observations is not used to realize the DTRF datum, the scale parameter series is shown in Figure 3 as it very nicely represents the large improvement of the DORIS data compared to ITRF2008. The large drift in the input series for ITRF2008 of –1.8 mm/yr could be removed. The increasing scale values at the end of the ITRF2014 input data might be related to some new DORIS satellites launched at this time.

References

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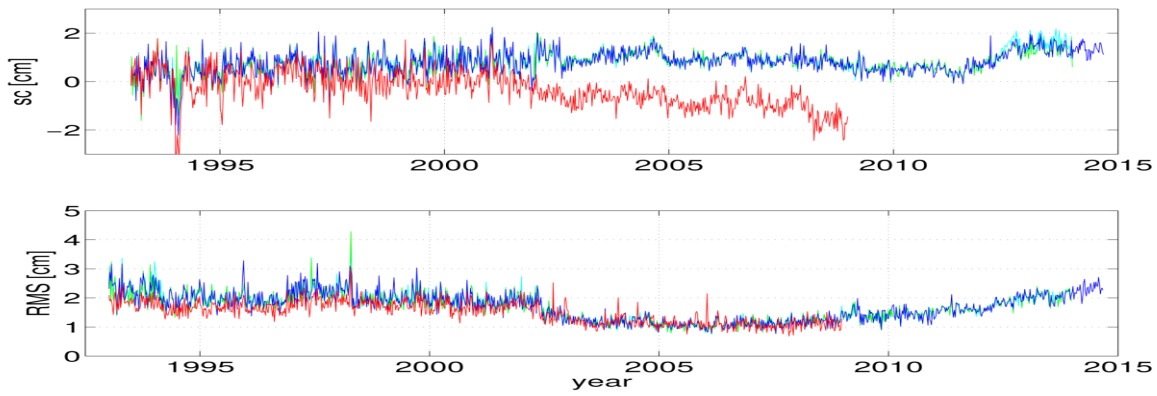

Fig. 3: DORIS time series derived from similarity transformations of weekly DORIS solutions to the DORIS-TRF solution (Blue, green: two DORIS input series for DTRF2014, red: DTRF2008).

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