3.6.1.1 Deutsches Geodätisches Forschungsinstitut (DGFI)

In 2011, the focus of the work of the ITRS Combination Centre at DGFI was on research regarding a common realization of the ITRS and ICRS. ITRF and ICRF are computed separately and by different institutions today. Hence, the two frames and the respective EOP series are not fully consistent (see Fig. 1).

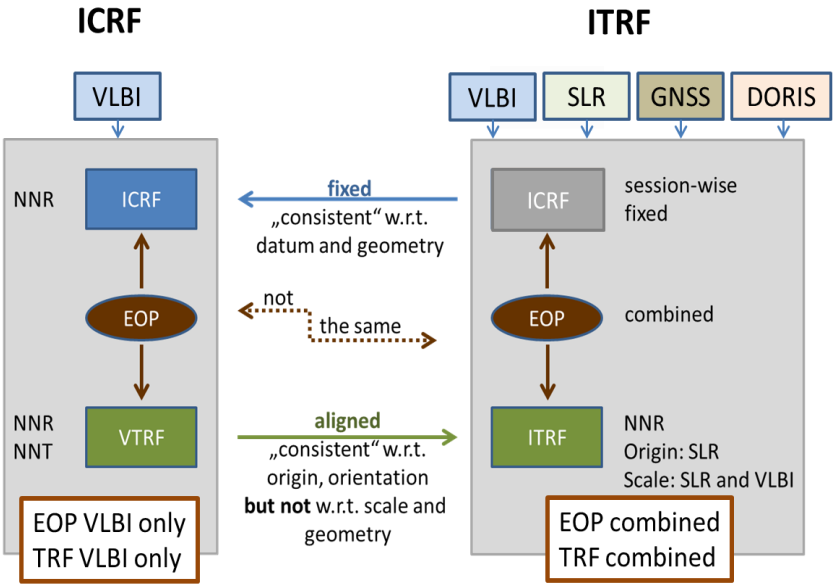

Fig. 1: Current situation for the realization of the ITRS and ICRS.

DGFI realizes for the first time the ITRS and the ICRS consistently in one common adjustment (see Fig. 2). Input data are time series of weekly or session-wise normal equations derived from the observation of VLBI, SLR and GNSS. Table 1 gives an overview of the input data. The parameters, which are included in the solution, are station coordinates, source coordinates and the EOP, i.e. the coordinates of the terrestrial and the celestial pole, UT1-UTC and the time derivatives of these parameters. Altogether, about 45,000 parameters are solved. The geodetic datum of the reference frames is realized according to the IERS Conventions: the origin is realized from SLR observations and the scale as a weighted mean of the SLR and the VLBI scale. The orientation of the CRF is realized by a no-net-rotation condition w.r.t. ICRF2 and the orientation of the TRF by no-net-rotation conditions w.r.t. DTRF2008.

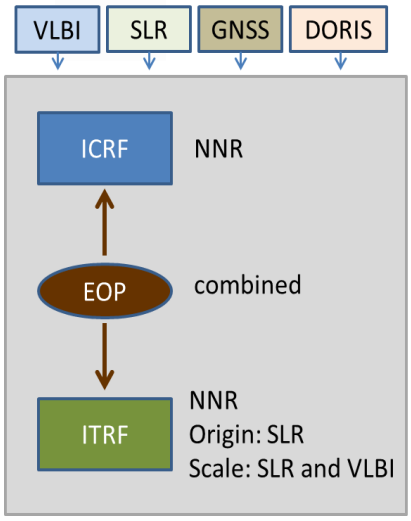

Fig. 2: Consistent realization of the ITRS and ICRS performed at DGFI.

Tab. 1: Input data for the consistent computation of TRF and CRF.

	time span	resolution	institution
VLBI	1984-2007	session-wise (24 h)	Combined: IGG+DGFI
GNSS	1997-2007	daily	GFZ/TUM
SLR	1993-2007	weekly	DGFI

ITRF solutions and the IERS C04 series demonstrate that the terrestrial reference frame and the EOP benefit from a combination of different space geodetic techniques. Thus, also an improvement for the CRF could be expected. Our investigations focused on the effect of the combination of space techniques on the CRF, which has not been investigated so far. Two different impacts on the CRF can be distinguished: (i) the effect of the combination of the terrestrial reference frames (station coordinates) introducing local ties and (ii) the effect caused by the combination of the EOP. While the combination of the station coordinates has only a very small impact (< 40μas), the combination of the EOP shows a clear effect on the CRF.

Figure 3 shows the differences between the standard deviations of the declination of the sources resulting from a combined and a VLBI-only solution. The standard deviations decrease in general due to the combination. In particular, the standard deviations of the VCS sources (sources observed by so called VLBA Calibrator Survey (VCS) sessions only) become smaller. This could be expected, because the standard deviations of the VCS source positions are larger than of the non-VCS sources. The reason is, that the VCS sources are observed by the VLBA network (a regional network) only and most of the VCS sources are observed in only one session.

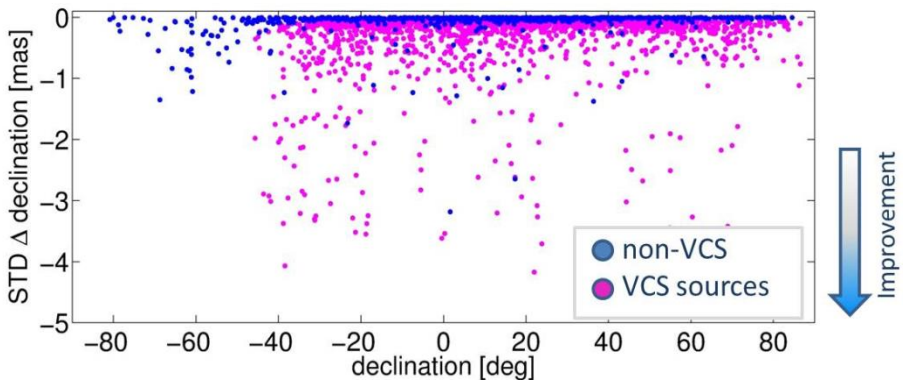

Fig. 3: Change of standard deviation of declination angles due to the combination (combined minus VLBI-only).

In Fig. 4 the source positions resulting from the CRF-TRF solution are compared to the VLBI-only solution. For both, declination and right ascension, it comes out that the position changes are larger for VCS sources than for non-VCS sources. In the right ascension, a systematic effect was found for some of the VCS sources between +30° and -40° of declination. It can be related to the combination of LOD (see Fig. 5). However, even if the effect is systematic, it is not significant w.r.t. the standard deviation of a single source position (0.4 mas or larger).

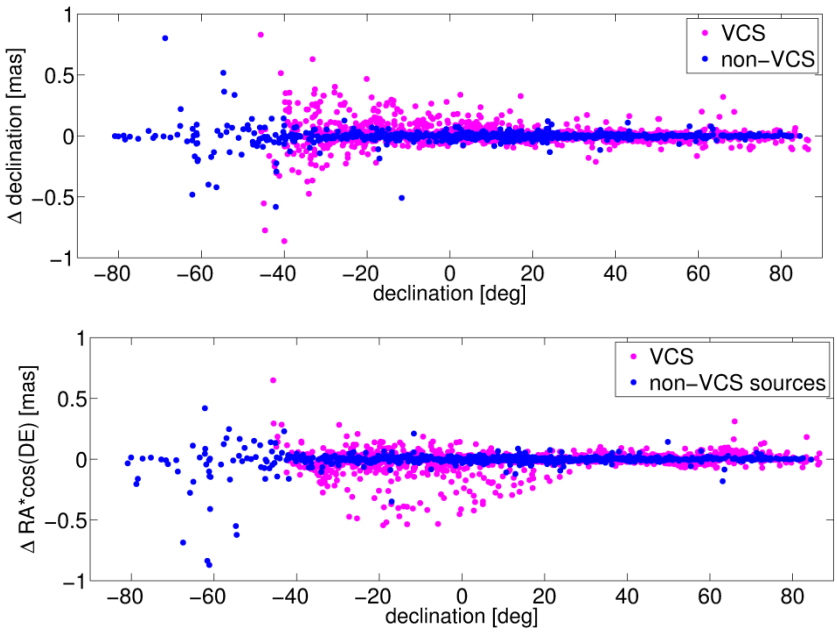

Fig. 4: Change of sources positions due to the combination.

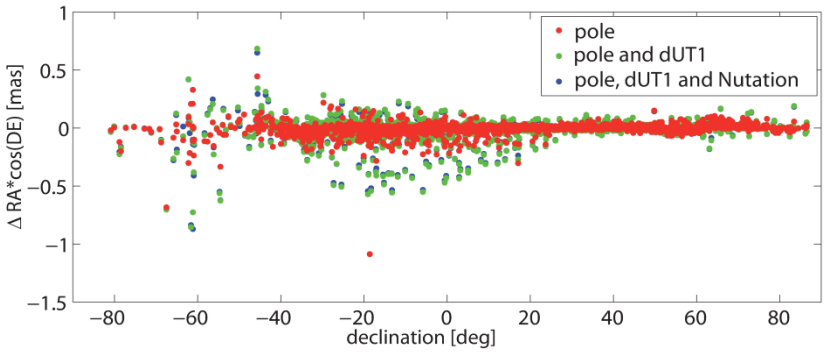

Fig. 5: Change of right ascension due to different kinds of EOP combination: only terrestrial pole coordinates are combined (red), terrestrial pole coordinates and UT1-UTC parameters are combined (green), all EOP, i.e. coordinates of the terrestrial and the celestial pole and UT1-UTC are combined (blue).

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