Federal Agency for Cartography and Geodesy

ITRS realizations in the framework of ITRF2014: impact of different TRF parameterizations on VLBI combined products

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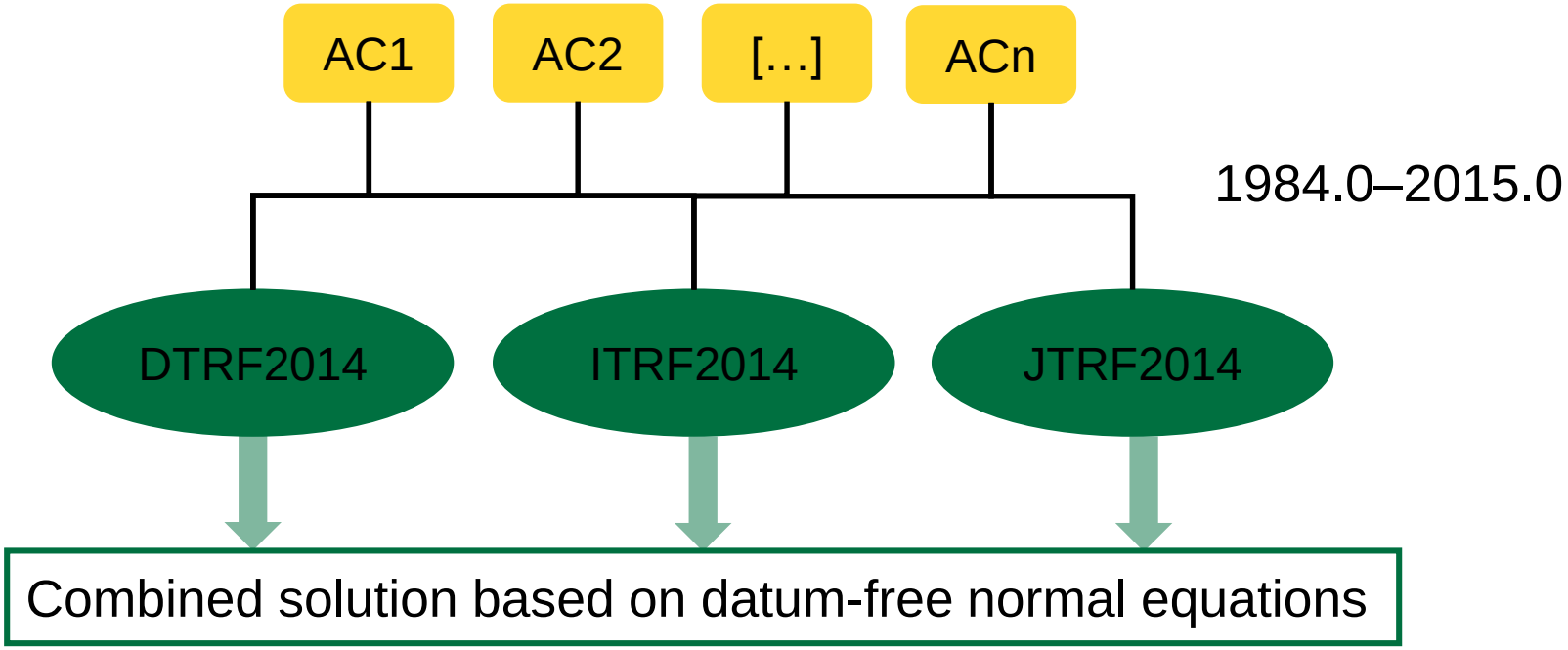
Background

Three TRF solutions:

- DTRF2014
  - piece-wise linear station model
- ITRF2014
  - piece-wise linear station model with additional post-seismic deformation model
- JTRF2014
  - weekly solution

→ Station coordinates and scale

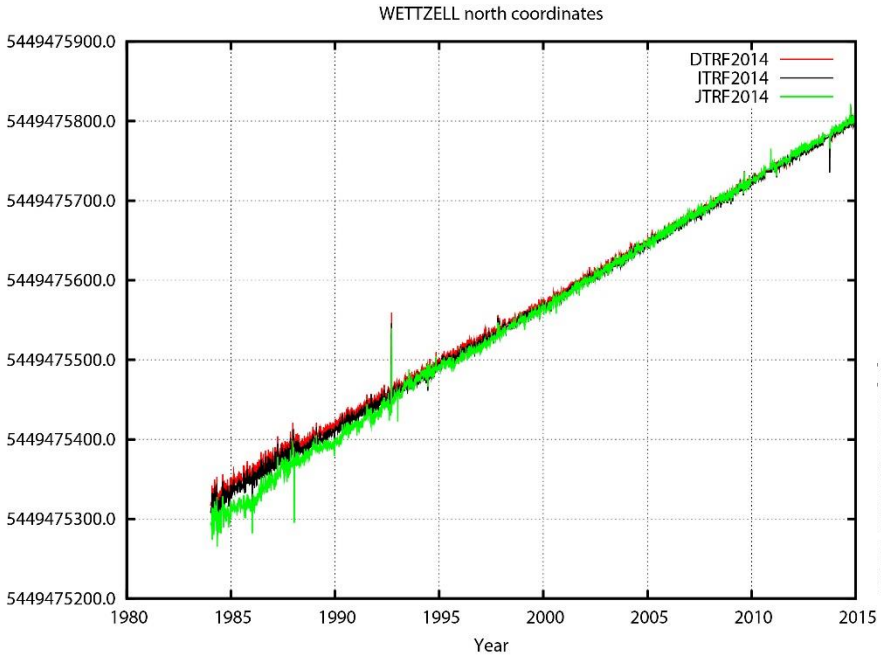
Input contributions

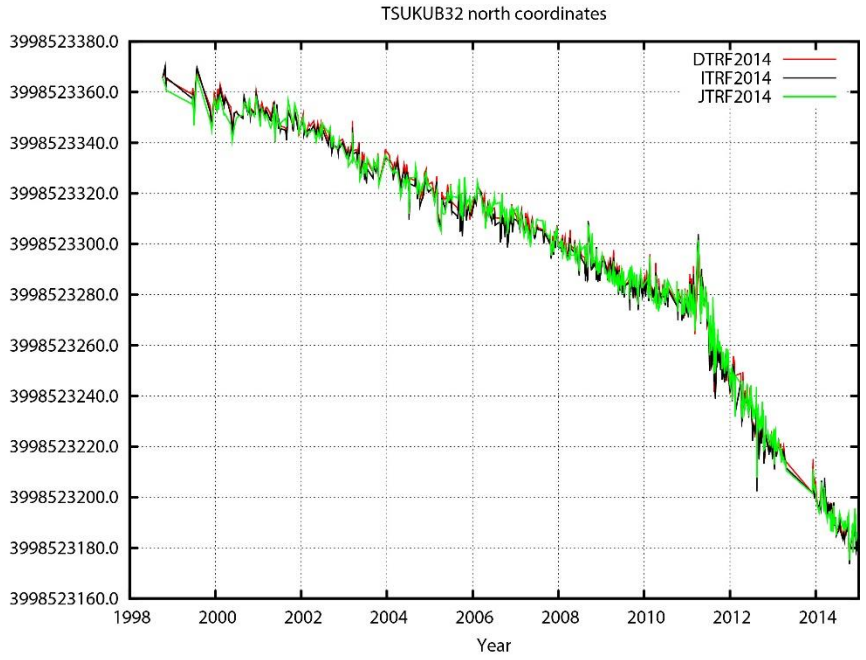


- ftp://ivs.bkg.bund.de/pub/vlbi/ivsproducts/daily_sinex/
- SINEX file format

Station coordinates

Comparison of the three ITRS-realization





Station coordinates

Only stations with > 30 equal sessions for all ACs

WRMS and RMS for combined solution:

	WRMS over all stations [mm]			RMS over all stations [mm]		
	N	E	H	N	E	H
DTRF2014	3.4	4.3	7.7	4.7	5.8	11.8
ITRF2014	3.1	3.7	7.6	4.7	5.8	11.8
JTRF2014	2.6	3.1	6.6	4.5	6.9	11.3

→Tendency can be generalized to all focused stations.
~50% of these stations don't show differences in the (W)RMS

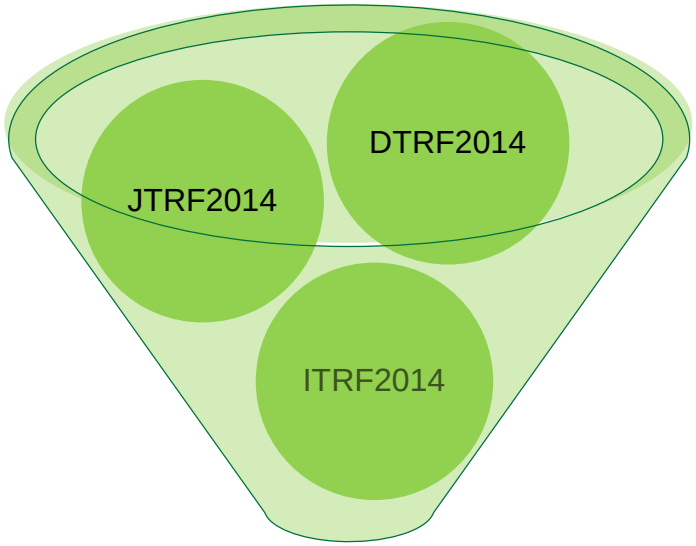
Station coordinates

WRMS AC solutions differences w.r.t. combined solution

Transition situation:
some ACs started using ITRF2014 as station a priori, others use different TRFs

	WRMS over all stations [mm]								
	DTRF2014 (considering 24 stations)			ITRF2014 (considering 21 stations)			JTRF2014 (considering 19 stations)		
	N	E	H	N	E	H	N	E	H
AC1	2.0	2.5	4.6	2.1	2.5	4.7	2.0	2.4	4.6
AC2	1.3	1.6	2.8	1.3	1.6	2.8	1.3	1.5	2.8
AC3	1.7	2.0	4.1	1.7	2.0	4.0	1.7	2.0	4.0
AC4	2.9	3.2	5.9	2.9	3.1	5.8	3.0	3.2	5.9
AC5	1.5	1.7	3.1	1.4	1.7	3.0	1.5	1.7	3.1
AC6	4.4	5.0	9.8	4.3	4.9	9.8	4.4	4.9	9.8
AC7	1.8	1.9	3.2	1.7	1.8	3.1	1.7	1.8	3.2
AC8	1.8	2.0	4.0	1.8	2.0	4.0	1.8	2.0	4.0

Scale comparison

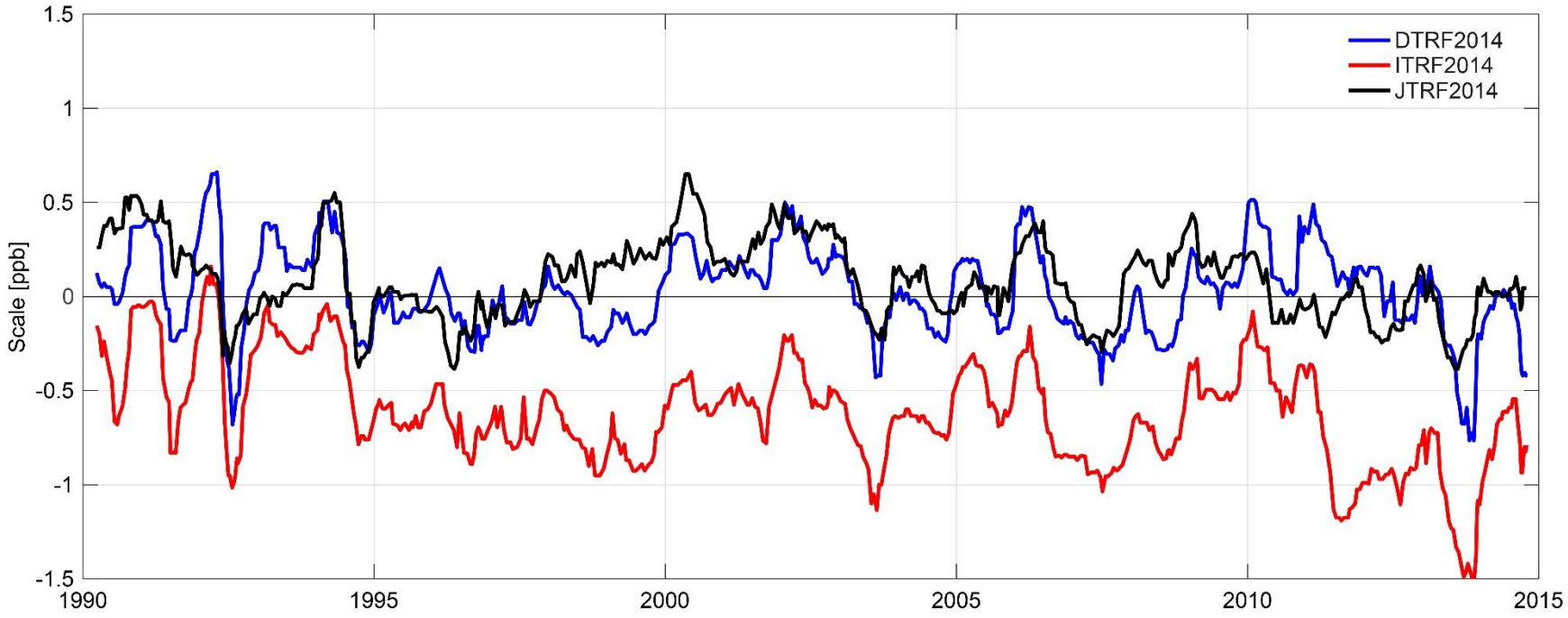


Session-wise scale comparison w.r.t. routine quarterly combined solution

- 7-parameter Helmert transformation
- 1990.0 – 2015.0
- Discontinuity stations excluded from datum definition

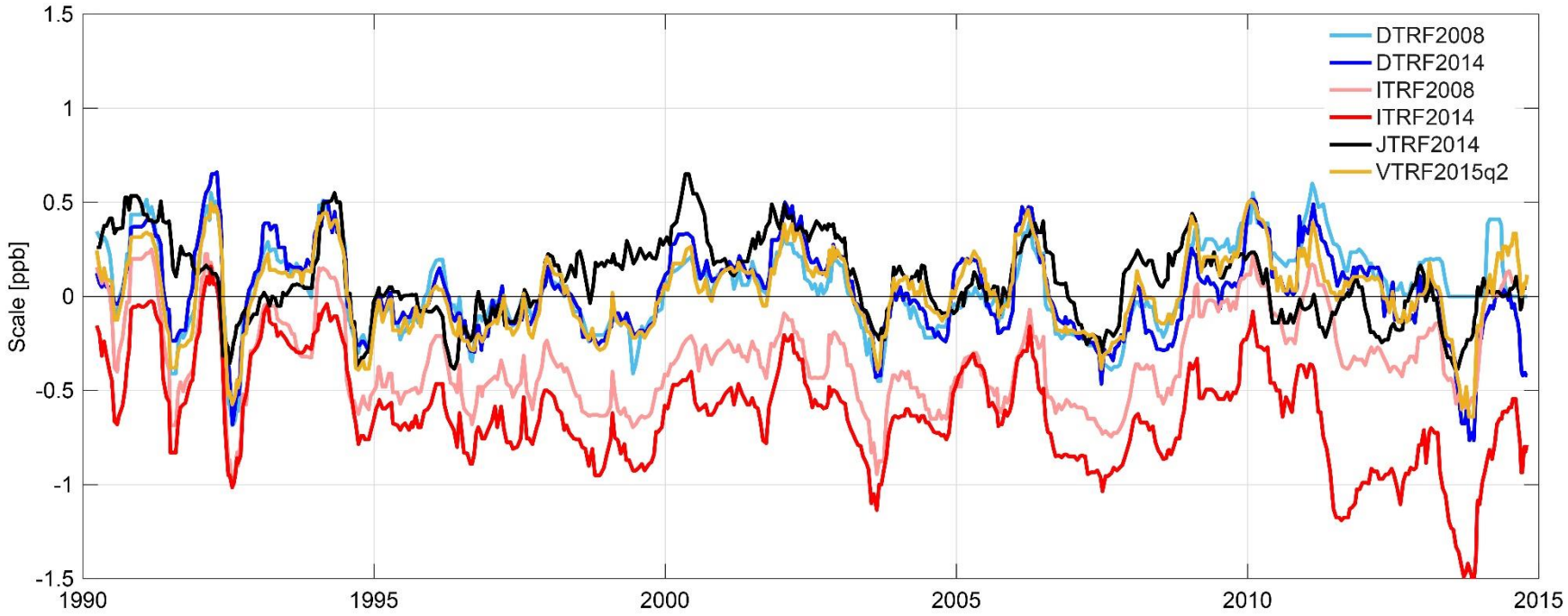
Scale comparison

Session-wise smoothed scale time series of the three ITRS-realization



Scale comparison

Session-wise smoothed scale time series of the three ITRS-realization + ITRS2008 realization and routine quarterly combined VTRF

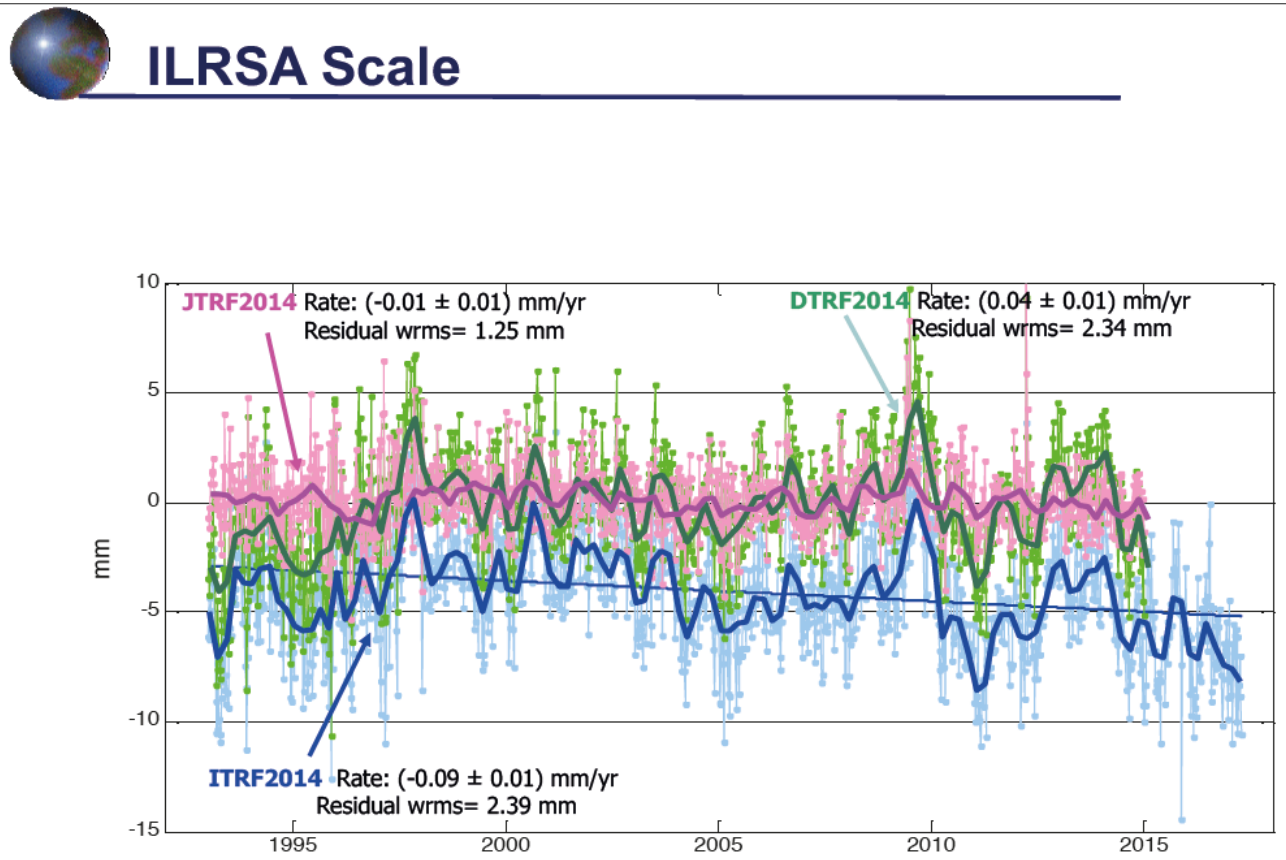


Scale comparison

Statistics

	Weighted Mean	WRMS [ppb]	RMS [ppb]
DTRF2014	-0.01 ±0.01 ppb (-0.1 mm)	0.88	2.37
ITRF2014	-0.59 ±0.02 ppb (-3.8 mm)	0.95	2.69
JTRF2014	0.19 ±0.01 ppb (1.2 mm)	0.78	2.23
VTRF	0.01 ±0.01 ppb (-0.1 mm)	0.91	2.21
DTRF2008	0.02 ±0.02 ppb (0.1 mm)	0.98	6.44
ITRF2008	-0.38 ±0.02 ppb (-2.4 mm)	1.02	8.21

ILRSA scale



- Scale offset comparable to VLBI (scale factor VLBI-SLR of 1.37 ppb [Altamimi et al. 2016])

Source: V. Luceri (ILRS combination)

Conclusion

- All 3 TRFs agree very well in terms of station coordinate estimation and repeatabilities (WRMS/RMS)
- “Tild” in some position components compared DTRF2014/ITRF2014 and JTRF2014 still unclear
- Scale factor between VLBI and SLR differ for the three ITRS-realization still unclear.(inter-technique combination issue)

Possible sources of impact:

- Equating station velocities
- Treatment of Local ties
- Parameter estimation

Thank you for your attention!

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References:

Altamimi et al.(2016), ITRF2014: A new release of the International Terrestrial Reference Frame modeling nonlinear station motions, J. Geophys. Res. Solid Earth, 121, doi:10.1002/2016JB013098.

V. Luceri et al. (2017) ASI AC & CC report, ILRS ASC Meeting, 22 April 2017, Vienna