IDS Plenary Meeting, 3.-4. May 2004, Paris, France

Comparison and combination of DORIS data with other space techniques

B. Meisel, D. Angermann, M. Krügel

Deutsches Geodätisches Forschungsinstitut, München
E-Mail: meisel@dgfi.badw.de

Overview

- Results of a TRF solution from multi-year station position and velocity normal equations (DGFI-TRF-2002)
  - Local Ties
  - Comparison to ITRF 2000
- First results from a TRF computation from weekly normal equations
  - Time series of Translation parameters
  - Comparison at Co-location Sites / Local Ties
  - Seasonal Signals

Comparison at Co-location Sites

		GPS – VLBI	GPS – SLR	SLR – VLBI	P/R/L – DORIS
# co-locations (missing local ties)		33 (5)	28 (6)	11 (2)	24 (1)
3-D pos. differences local ties – TRF sol.	< 5 mm	8	6	1	-
	5 – 20 mm	10	8	2	3
	> 20 mm	10	8	6	20
3-D vel. differences of co-located techn.	< 1 mm/yr	5	2	1	-
	1 – 5 mm/yr	17	19	3	10
	> 5 mm/yr	11	7	7	14

Source: TRF computation 2002, DGFI

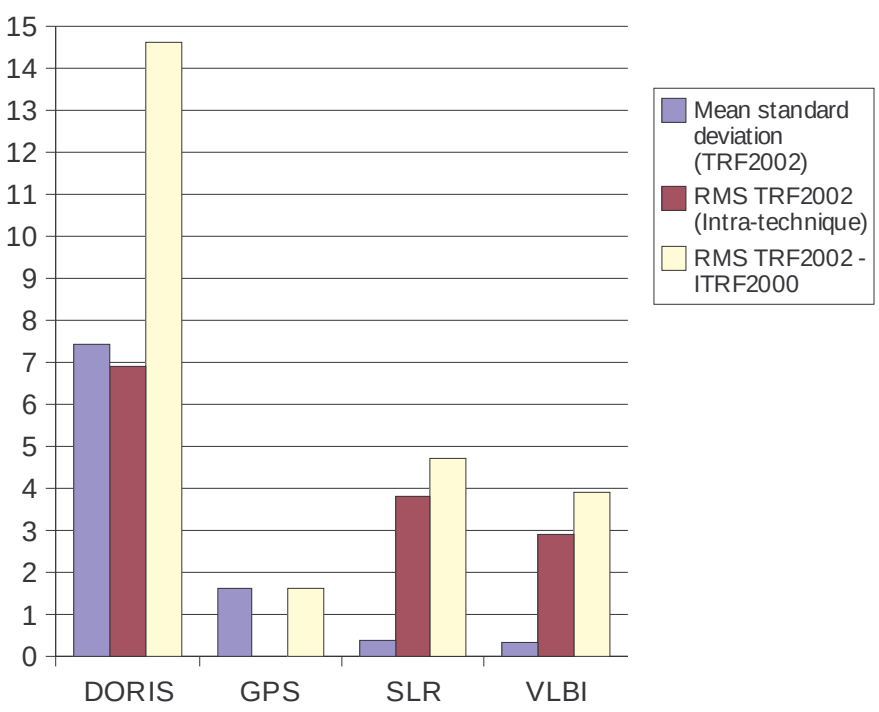
Possible reasons for discrepancies at co-location sites, e.g.:

- Systematic biases between techniques
- Remaining inconsistencies of datum definition
- Local site effects (e.g. different motions of co-located instruments)
- Errors (uncertainties) in local tie measurements

→ Separation of these effects is difficult !!!

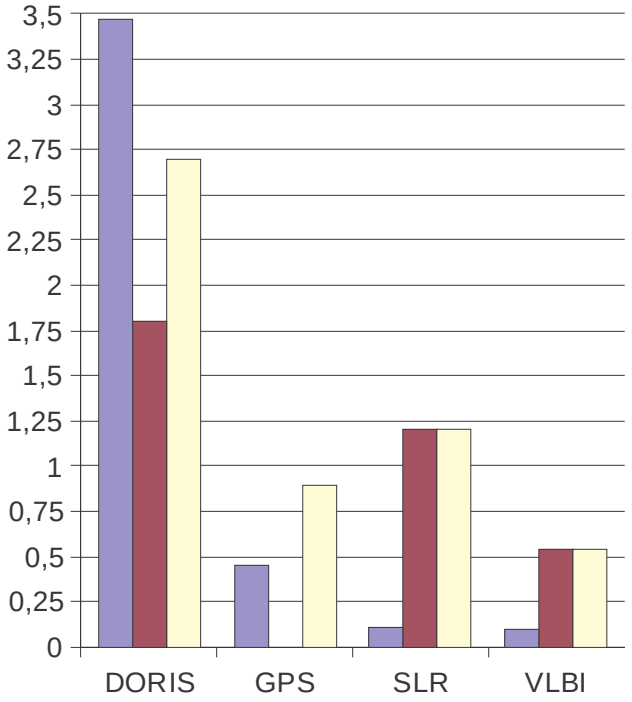
TRF Combination from multi-year solutions (Accuracy)

Positions



3-D Differences [mm]

Velocities



3-D Differences [mm/yr]

DGFI FGS GEOTECHNOLOGIEN

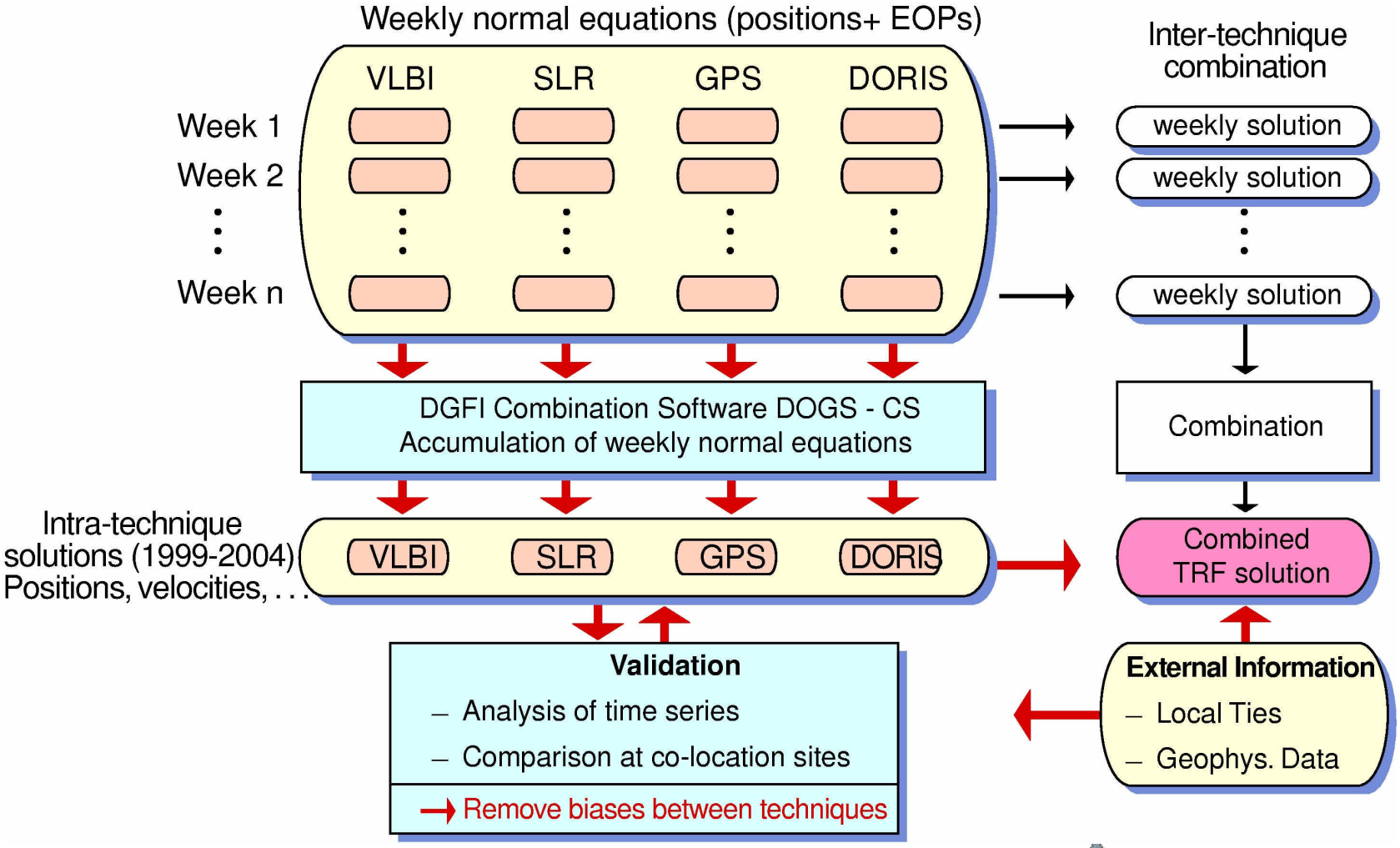
Goals of a TRF combination from weekly normal equations

- Improve the stability over time in station positions and the datum.
- Investigate effects that can't be seen in multi-year solutions (e.g. annual signals, jumps, non-linear motion after earthquakes)
- Achieve consistent products with other parameters (e.g. EOPs)

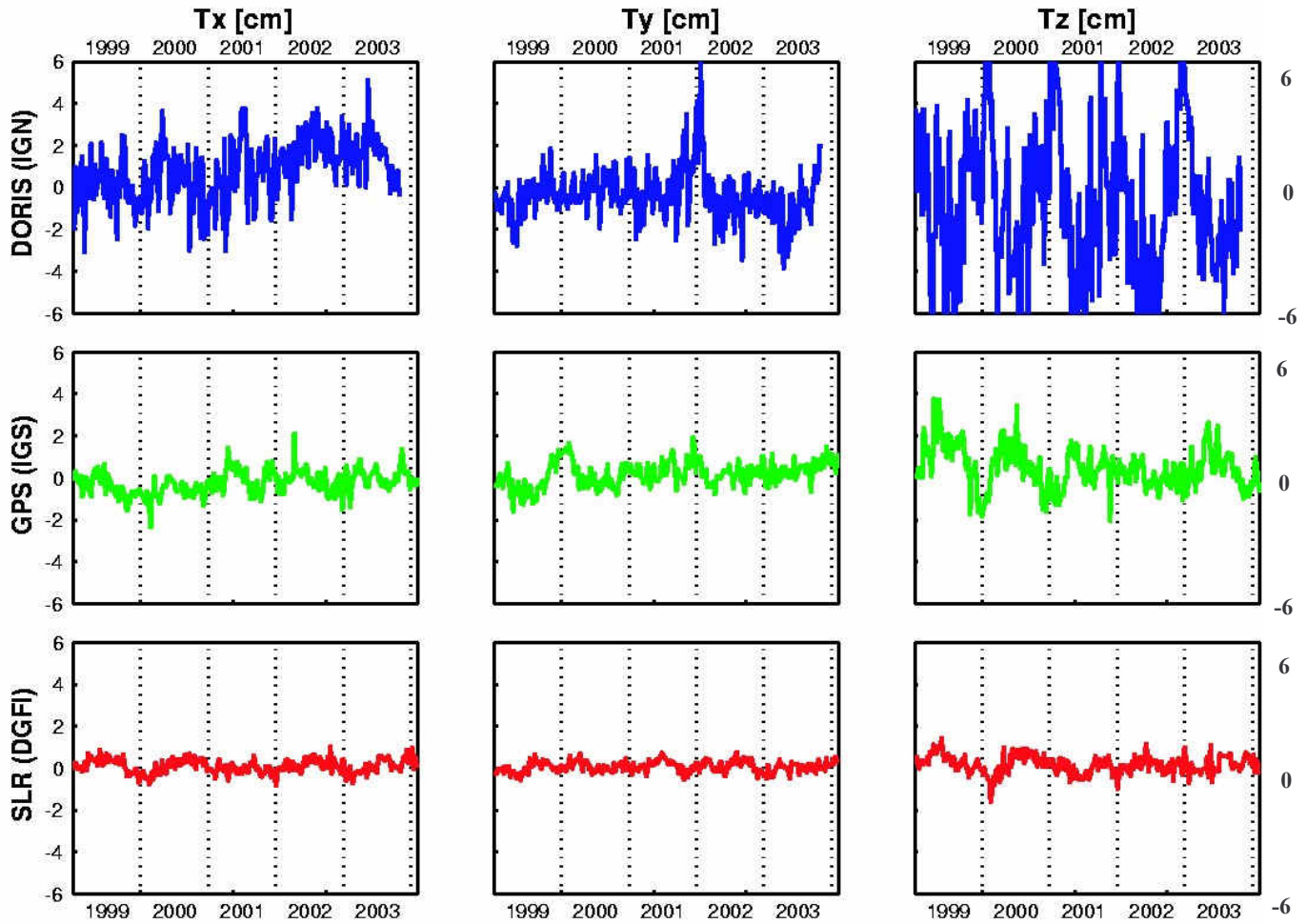
Datasets

Techn.	AC / TC	Software	Data period	# Stations	Characteristics
DORIS	IGN/JPL	GIPSY/OASIS	1999.0 –2003.8	50	Weekly solutions
GPS	IGS/NRCan	SINEX-Comb.	1999.0 –2004.2	179	Weekly solutions
SLR	DGFI	DOGS	1999.0 –2004.3	36	Weekly NEQs
VLBI	GSFC	CALC/SOLVE	1999.0 –2003.5	33	Daily NEQs

Processing Flow



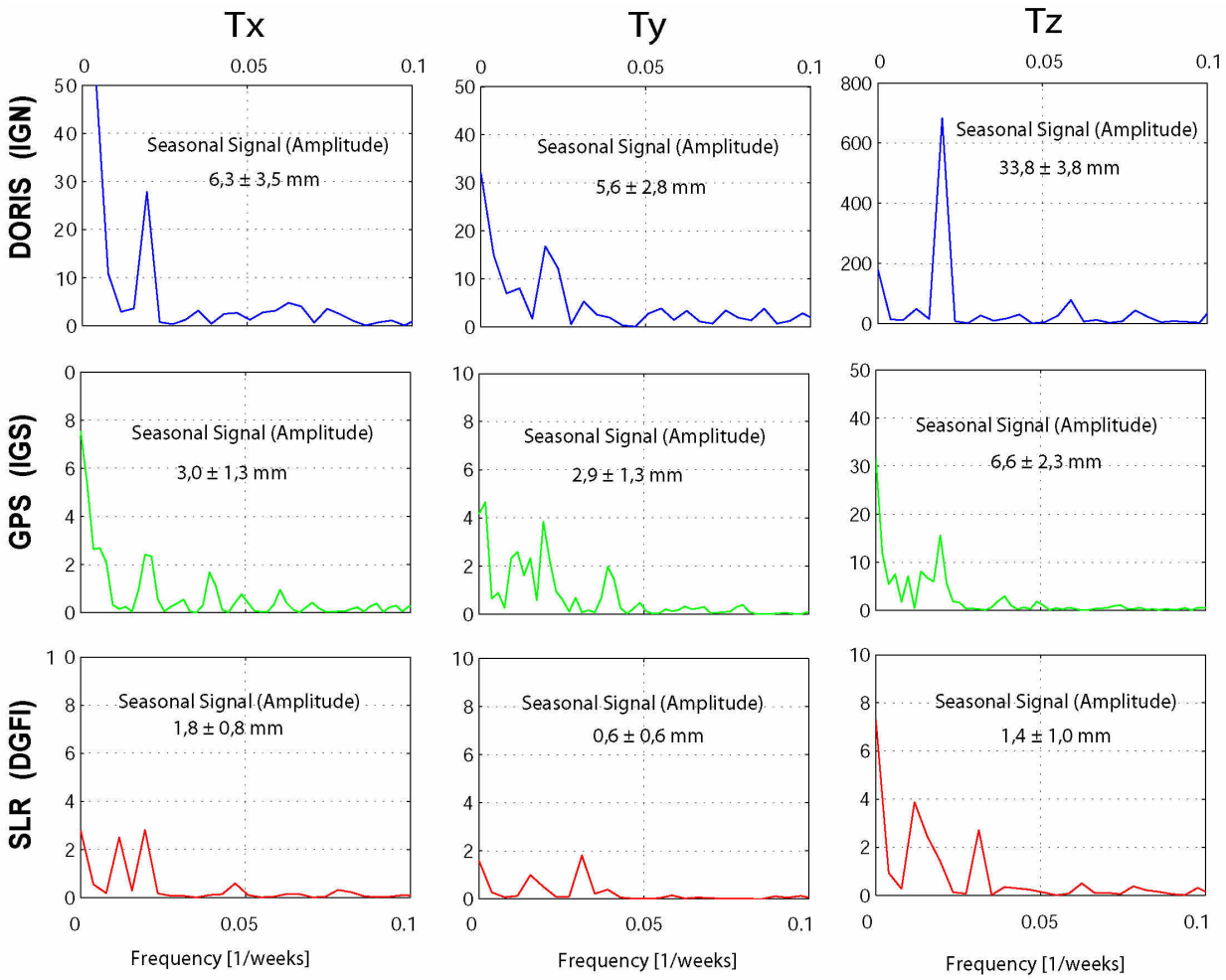
Helmert transformations (Translations)



Remark: VLBI is not sensitive to estimate the TRF origin

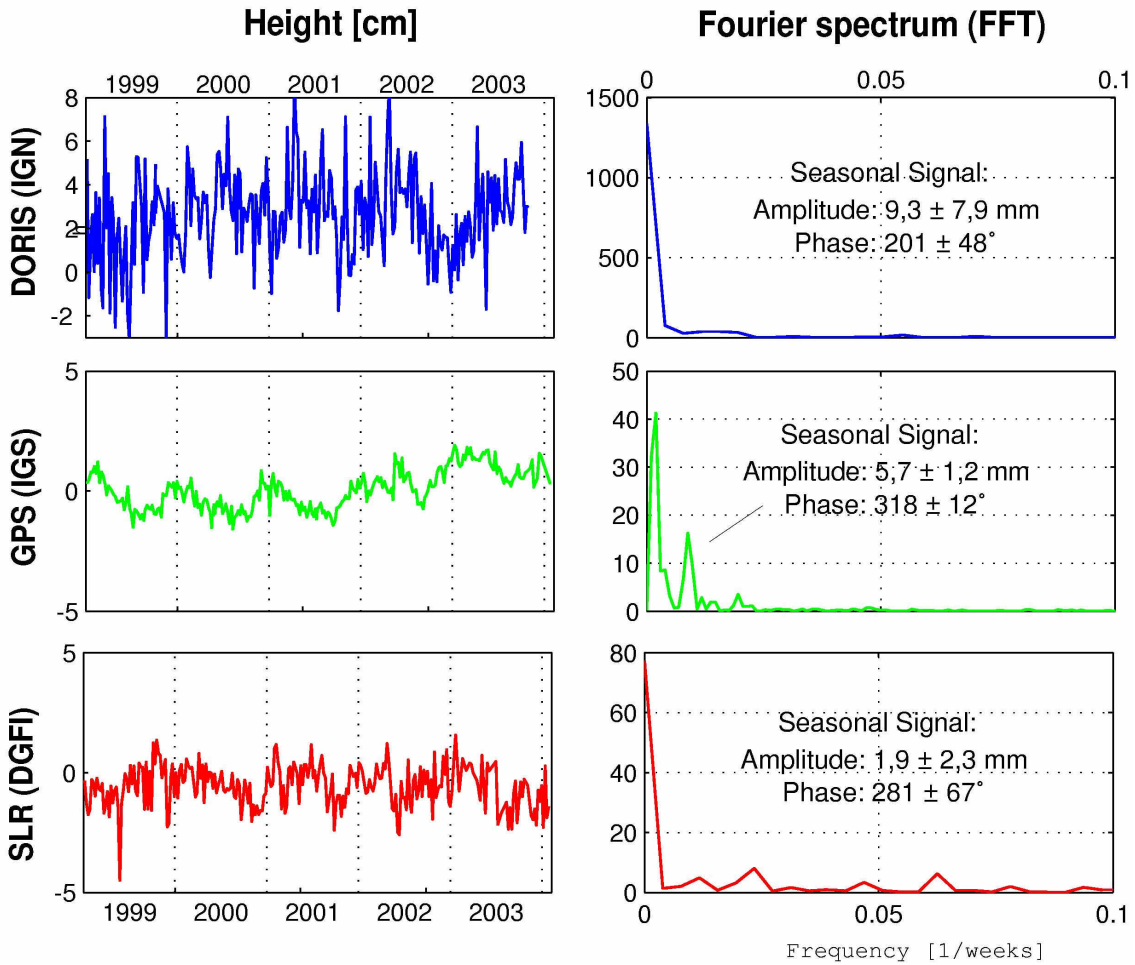
DGFI FGS GEOTECHNOLOGIEN

Fourier Spectrum of Translation Parameters



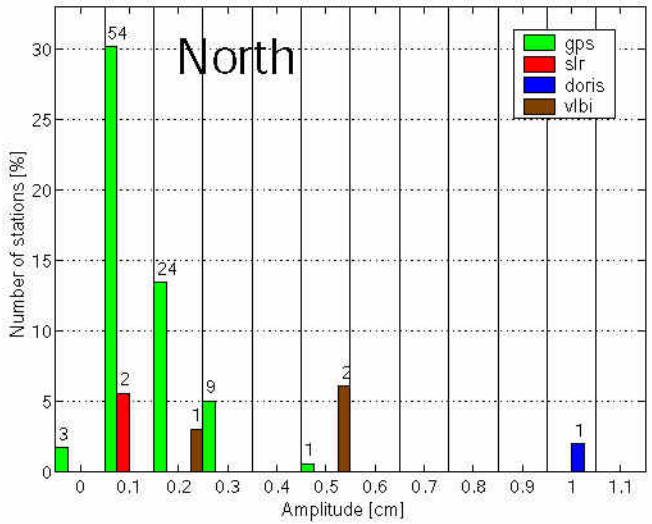
DGFI FGS GEOTECHNOLOGIEN

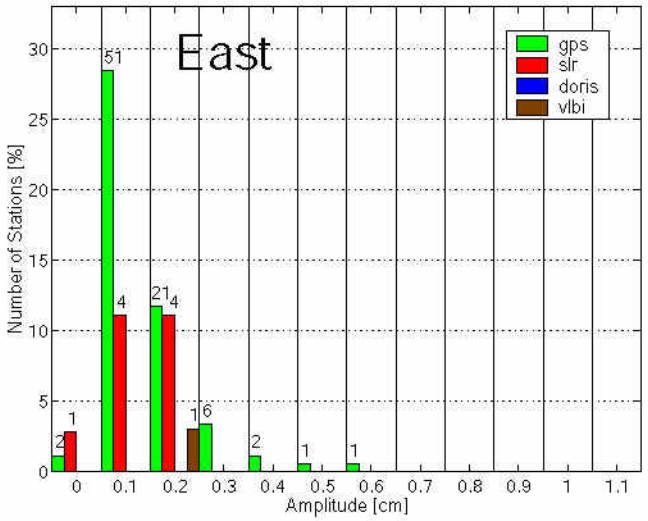
Comparison at Co-location Sites (Yarragadee)

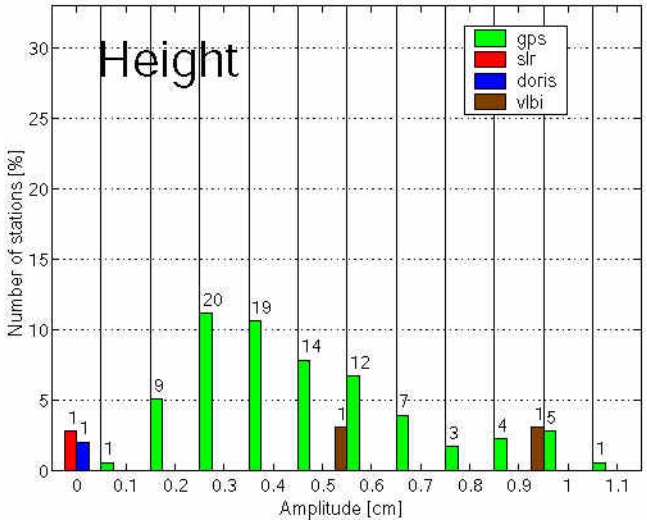


DGFI FGS GEOTECHNOLOGIEN

Seasonal Signals in Station Positions



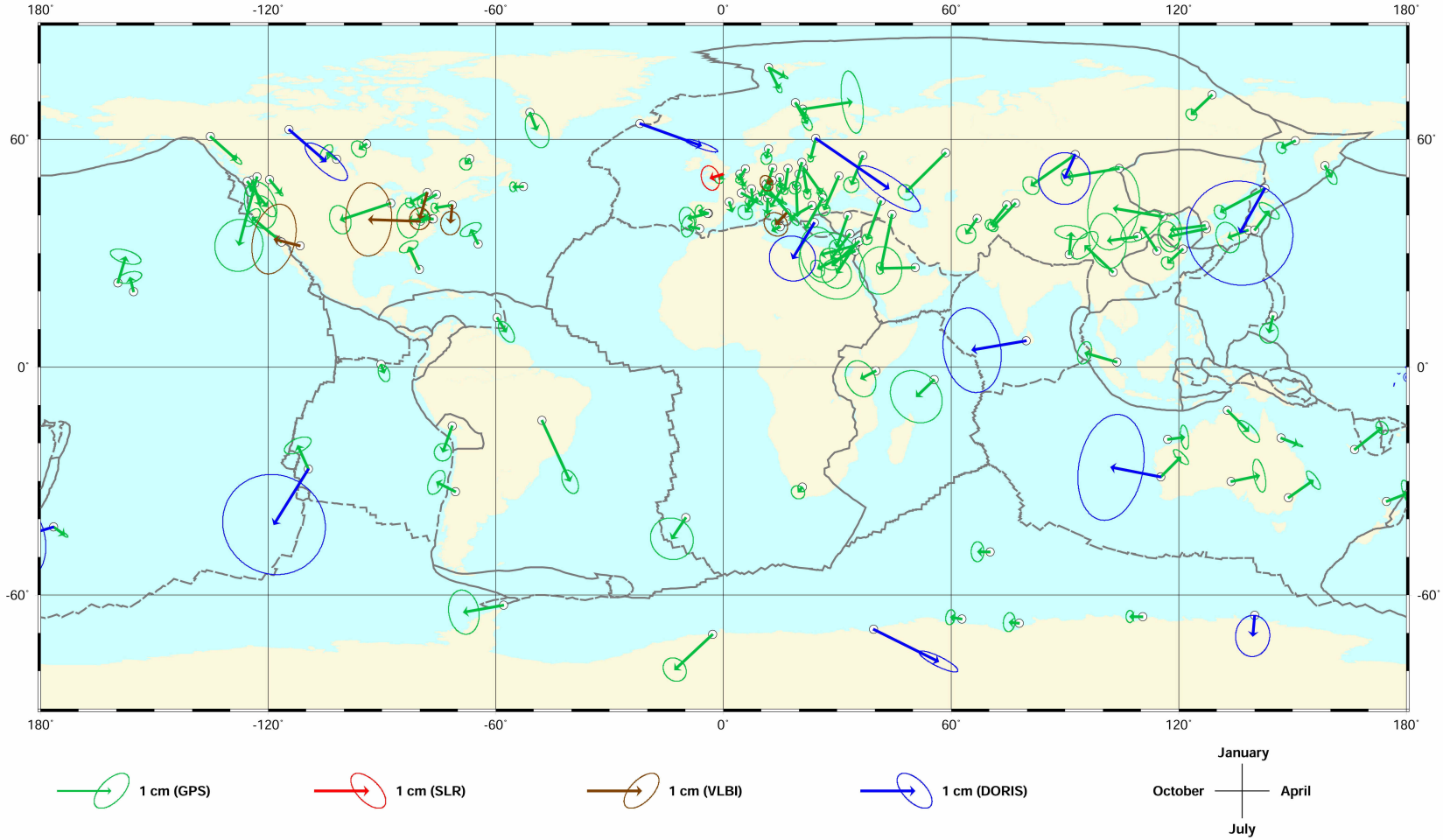




	Number of stations	Number of significant (>2s) seasonal signals		
		North	East	Height
GPS	179	91	84	97
SLR	36	2	9	0
DORIS	50	11	1	0
VLBI	33	3	1	1

DGFI FGS GEOTECHNOLOGIEN

Seasonal signals in station heights



DGFI FGS GEOTECHNOLOGIEN

Local Ties: Transformation on GPS

	DORIS	SLR	VLBI
# stations	22	10	20
Tx [cm]	0.31 ± 0,40	0,17 ± 0,27	-0,23 ± 0,31
Ty [cm]	-0,28 ± 0,40	-0,10 ± 0,26	0,00 ± 0,32
Tz [cm]	-0,58 ± 0,40	0,11 ± 0,26	0,34 ± 0,30
Rx [cm]	-0,65 ± 0,49	-0,02 ± 0,34	-0,09 ± 0,40
Ry [cm]	-1,02 ± 0,46	-0,22 ± 0,32	0,31 ± 0,34
Rz [cm]	-1,49 ± 0,52	0,04 ± 0,34	-0,02 ± 0,34
Sc [cm]	-1,79 ± 0,40	0,37 ± 0,25	-0,29 ± 0,29

Conclusions

- DORIS standard deviations represent the position accuracy well (≈ 7 mm), velocities are rather better than this standard deviation (≈ 2,25 mm/year)
- Seasonal signals (IGN solution): only a few seasonal signals exist, usually not consistent with other techniques
- Jumps: No additional jumps introduced (→ good list of site events)
- Improves noise level since 2000 (≈ 2 cm RMS)
- Annual signal of about 3 cm in z-component of translation parameters
- When comparing local ties (calculated <-> measured) in the ITRF 2000 datum, the DORIS ties show an offset of about 3 cm
- In the TRF combination from weekly normal equations the local ties fit to the calculated excentricities to about 4-5 mm for the best stations