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Analysis of local tie information and biases

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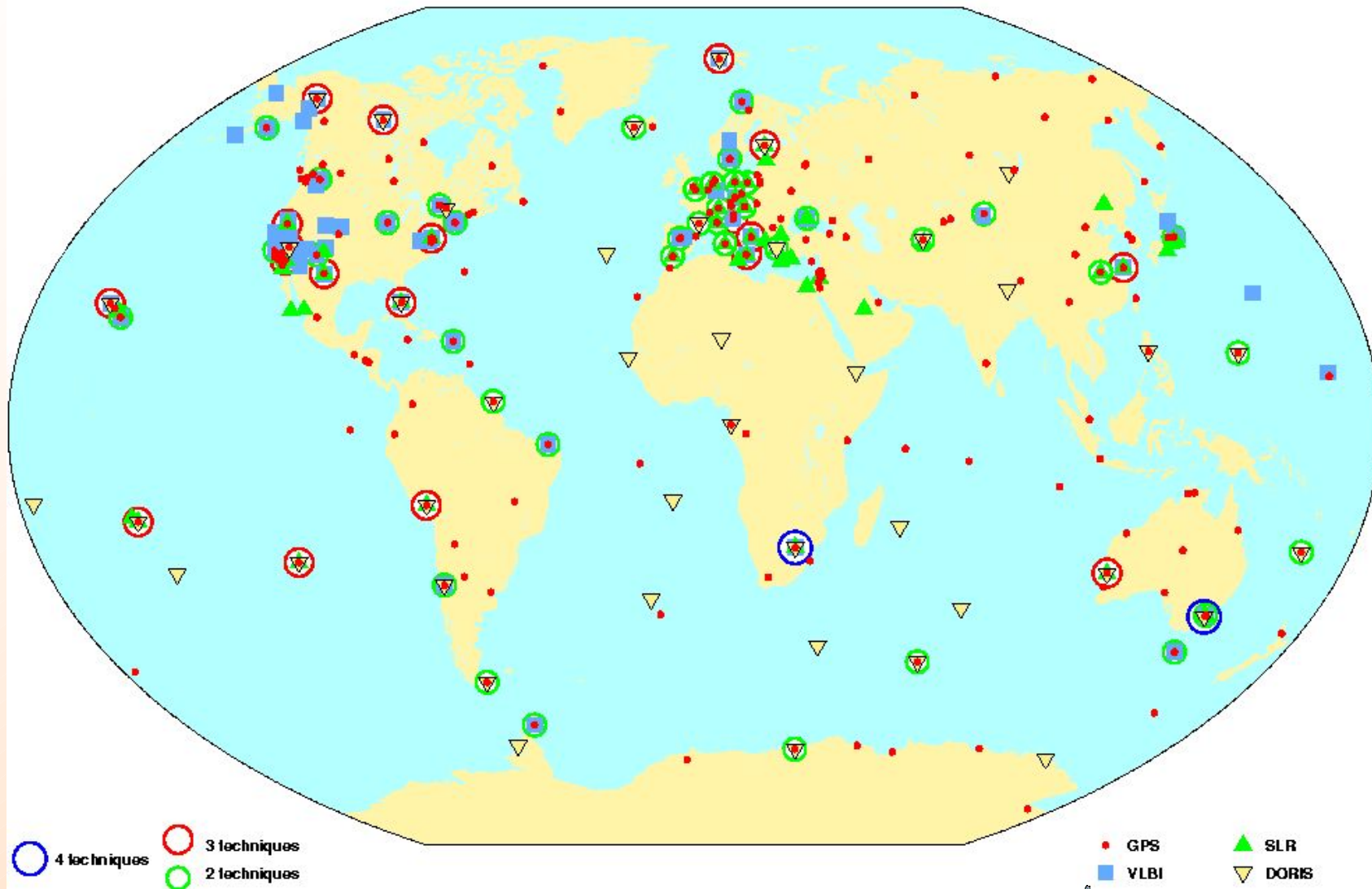
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Outline

- Comparison of space geodetic solutions and local ties
- Different solutions and strategies applied:
 1. TRF realization 2003 of DGFI (multi-year solutions)
 2. TRF computation (1999-2004) based on weekly data
 3. CONT02 data combination studies
- Summary and recommendations

TRF realization 2003 (multi-year solutions)

Co-location Sites



TRF validation: 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 2003, 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 !!!



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Comparison at co-location sites

Results for „high quality“ co-location sites:
Differences between space geodetic solutions and local tie measurements

Co-location sites	Techniques	Differences between ties and solutions [mm]			Differences in velocities [mm/yr]		
		$\Delta \varphi$	$\Delta \lambda$	Δh	$\Delta \varphi$	$\Delta \lambda$	Δh
Wettzell, Germany	GPS-VLBI	-0.0	-0.8	3.7	0.2	0.0	0.8
Mauna Kea, USA	GPS-VLBI	-1.5	-4.8	1.3	-0.1	-0.7	1.9
North Liberty, USA	GPS-VLBI	-1.7	-2.9	-2.0	-0.8	-0.5	2.2
Potsdam, Germany	GPS-SLR	2.8	1.7	-2.8	0.2	-0.0	0.3
Graz, Austria	GPS-SLR	3.6	-0.2	1.8	-0.0	-0.4	0.8
Yarragadee, Austr.	GPS-SLR	-1.2	0.6	-3.1	0.8	-0.9	0.5

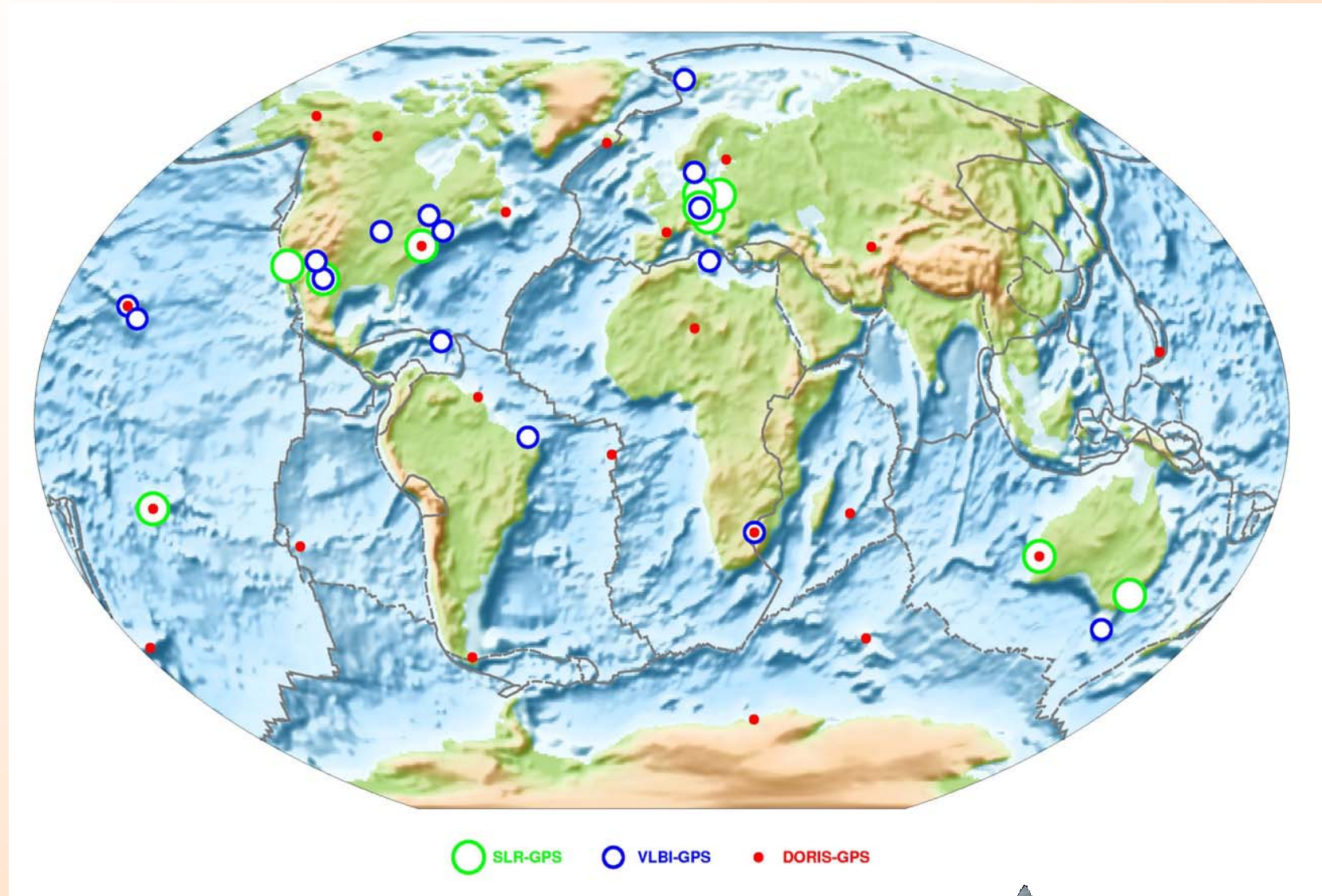


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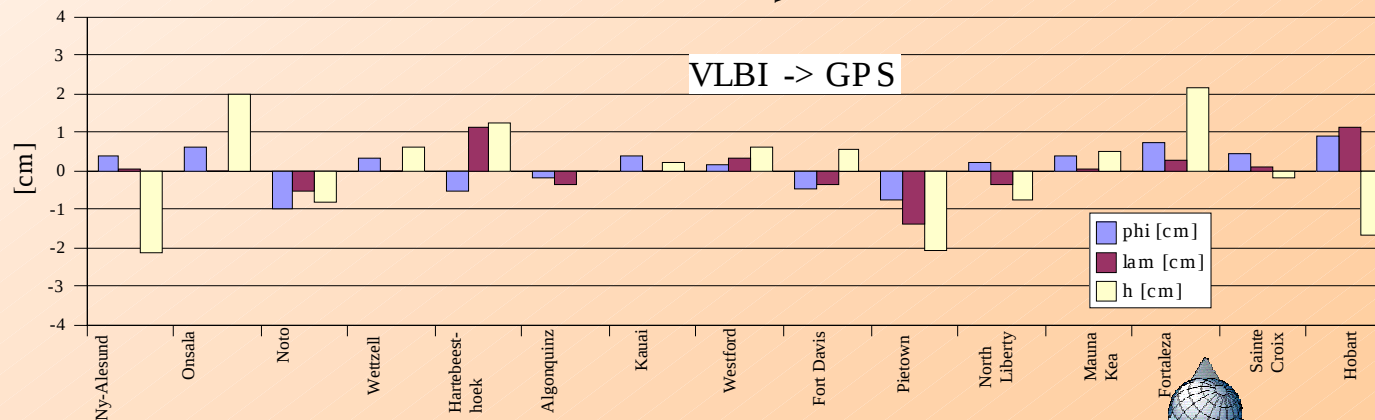
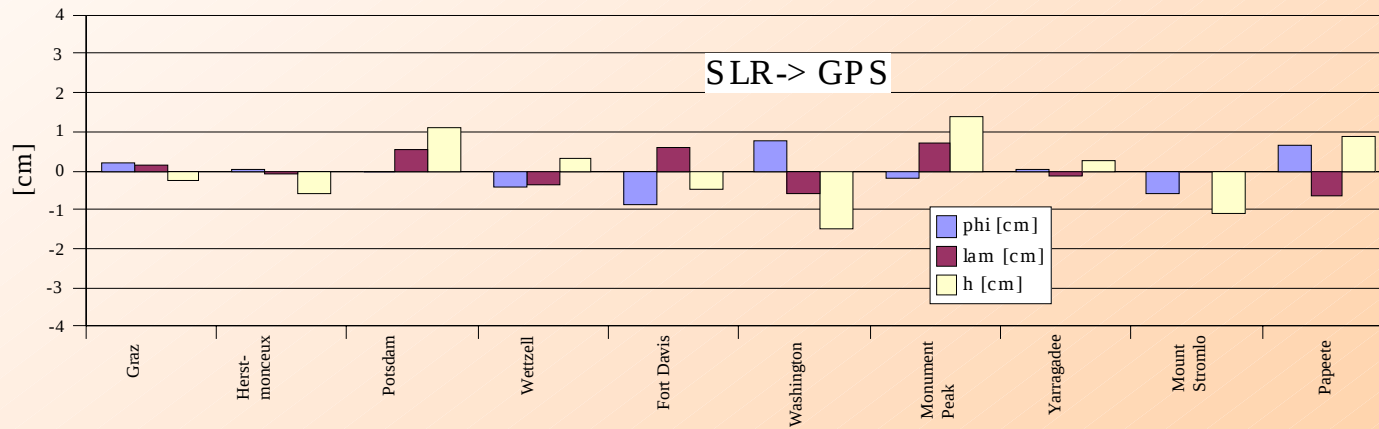
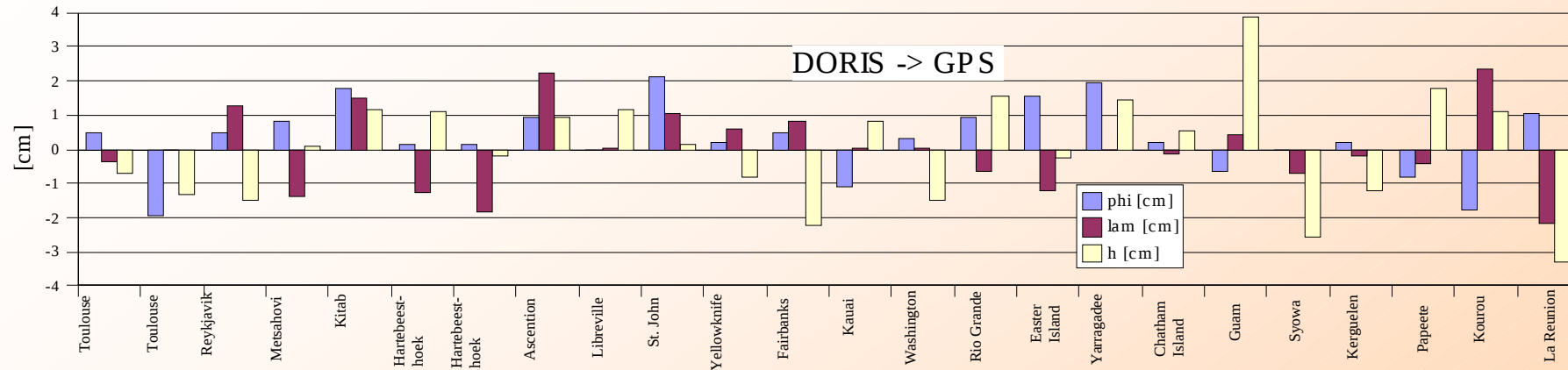


„First“ TRF realization (weekly input data)

Local Ties to GPS stations



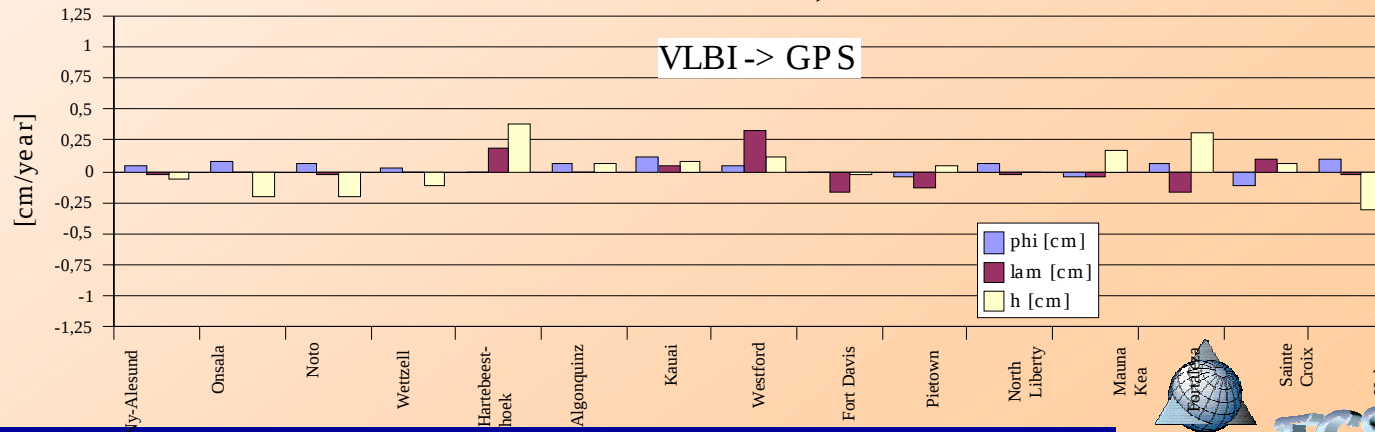
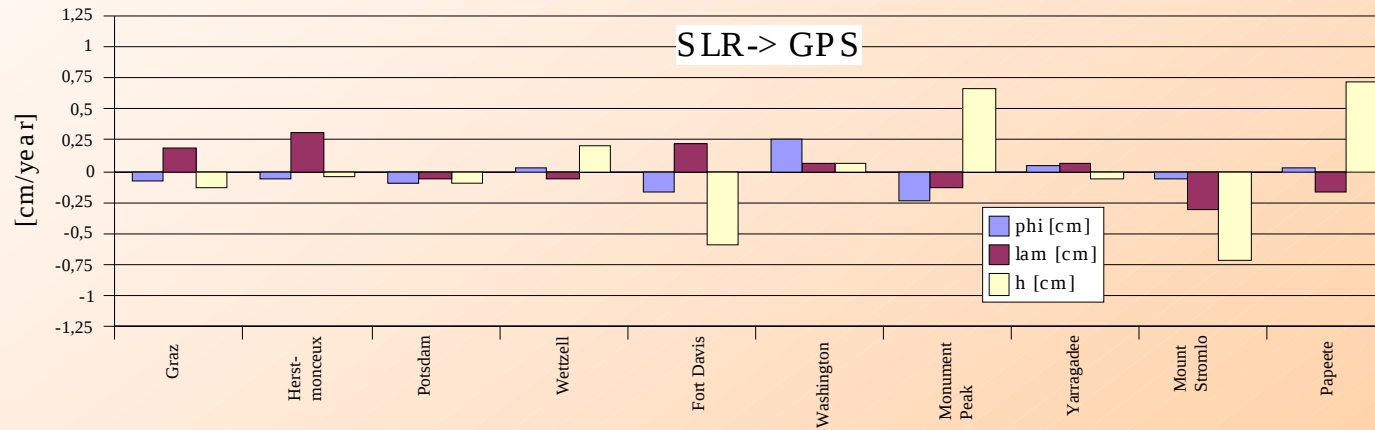
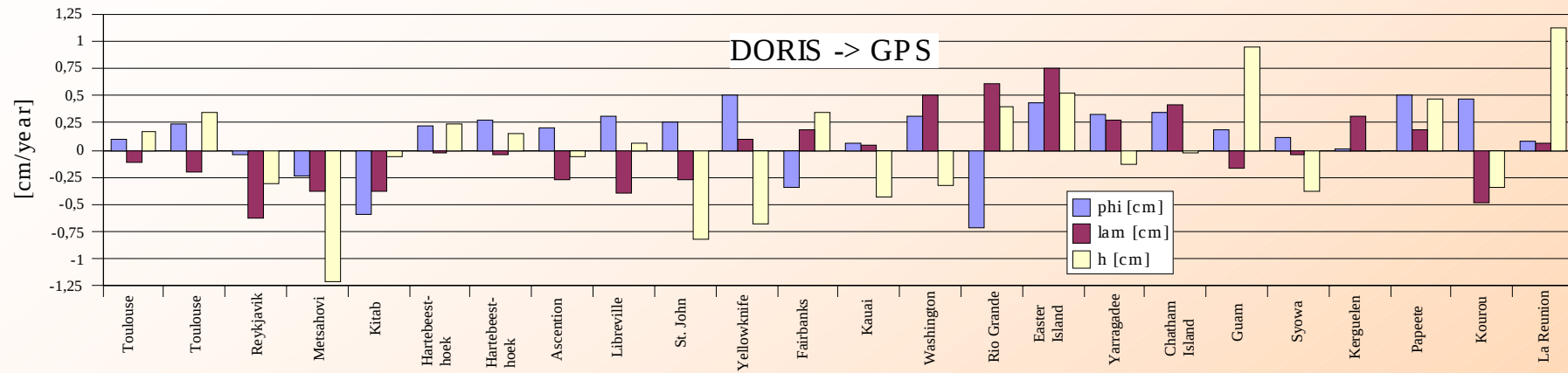
Comparison at Co-location Sites (Positions)



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Comparison of Velocities at Co-location Sites



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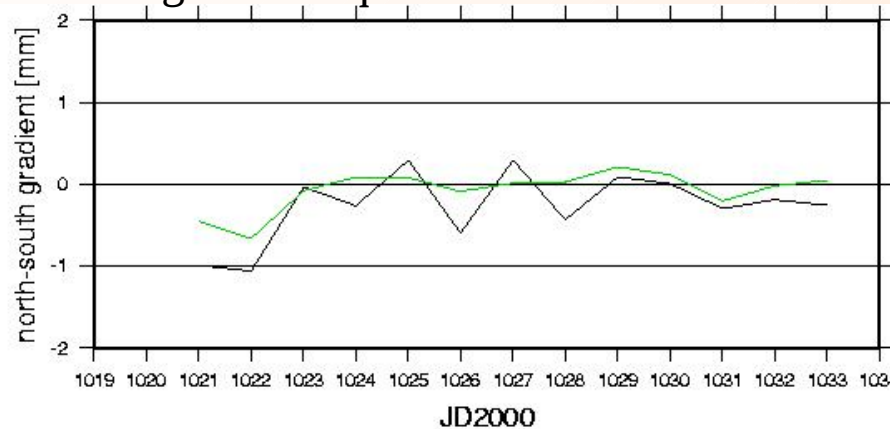
CONT02 results

- Comparison at eight co-location sites (VLBI-GPS)
- Effect of problematic ties on positions was shown (Examples: Westford, Fairbanks)
- The combination of VLBI and GPS tropospheric parameters is an alternative to the height component of local ties
- Tropospheric gradients can be considered as indicator for local tie problems

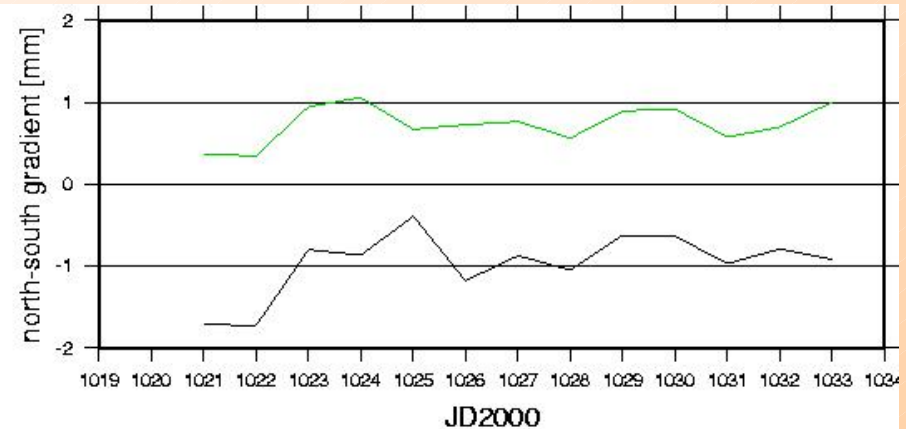
Local ties and tropospheric gradients

Tropospheric gradients from VLBI ■ and GPS ■ for Fairbanks

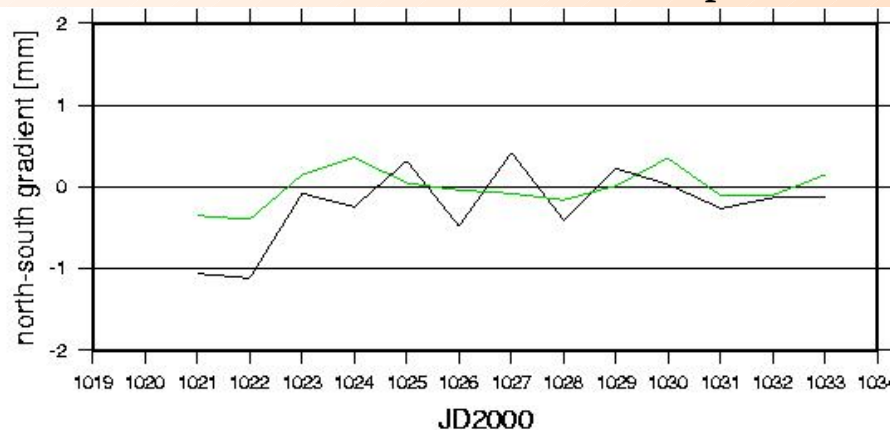
Single technique solutions



Combination with all tie information



Combination without north component



tropospheric gradients can be used as indicator for local tie problems

Summary and recommendations

- Distribution of co-location sites and quality of local tie information is **not** satisfying
- Separation of technique-specific biases and local tie errors is difficult
- The accuracy requirement for local ties is 1 mm (recommendation of the IERS Workshop in Matera), unique (and updated) local tie information is required
- Common parameters of different techniques should be considered as additional ties (e.g., EOPs, troposphere)