

Status report on ITRF 2004 Combination

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**IERS WG on Combination:
ITRF2004 and Combination Pilot Project**

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Technical University of Vienna

Status report on ITRF 2004 Combination

Outline

1. Analysis of input data
2. Accumulation of epoch data to multi-year solutions and analysis of time series
4. Selection of co-location sites
5. Remaining questions and recommendations

Analysis of input data

<i>Technique</i>	<i>Institution</i>	<i>Time span</i>	<i>Parameter</i>
GPS	NRCan	1996-2004 from June 1999 from March 1999	station coordinates EOP (pole+rates, LOD) geocenter
	GFZ	1996-2004	station coordinates EOP (pole,UT1+rates)
	SIO	1991-2004	station coordinates EOP (pole,UT1+rates)
SLR	ILRS	1993-2004	station coordinates EOP (pole, LOD)
VLBI	IVS	1984-2004	station coordinates EOP (pole,UT1+rates)
DORIS	IGN	1993-2004	station coordinates EOP (pole,UT1+rates)
	INA	oct 1992-jun 2004	station coordinates EOP (pole,UT1+rates)
	LCA	1993-2004	station coordinates EOP (pole)

Analysis of input data

<i>Technique</i>	<i>Institution</i>	<i>Constraints</i>	<i>Constraints removed?</i>	<i>STATISTICS ?</i>
GPS	NRCan	unknown?	no	no
	GFZ	loose	not necessary	yes
	SIO	loose	yes	yes
SLR	ILRS	loose (*)	not necessary	yes
VLBI	IVS	free NEQs		
DORIS	IGN	loose(*)	not necessary	yes
	INA	loose(*)	not necessary	number of obs. is missing
	LCA	loose	not necessary	yes

(*) : Constraints not documented, but a posteriori sigmas show, that loose constraints are used

Analysis of input data

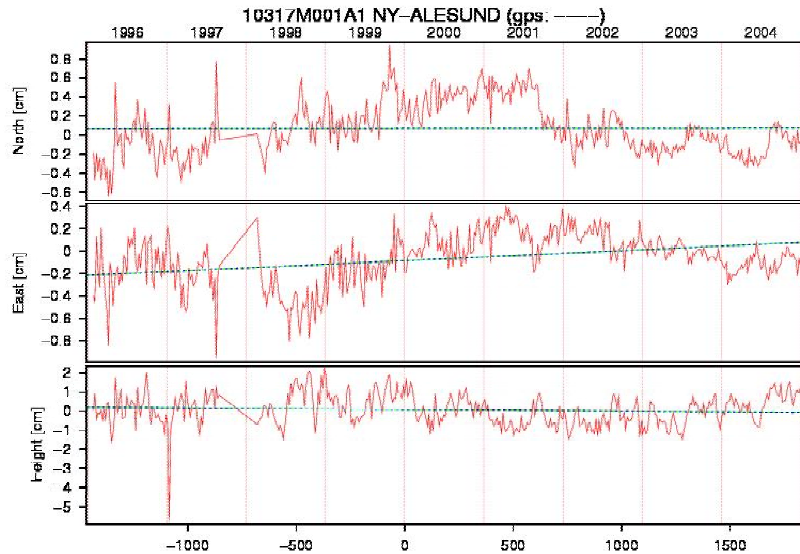
Analysis of the datum information:

<i>Technique</i>	<i>Institution</i>	<i>Datum information</i>		
		<i>Translations[m]</i>	<i>Rotations[m]</i>	<i>Scale[m]</i>
GPS	NRCan	x=0.0004 y=0.0004 z=0.0007	rx=0.0009 ry=0.0009 rz=0.0002	sc=0.0003
SLR	ILRS	x=0.001 y=0.001 z=0.003	rx=0.25 ry=0.25 rz=0.6	sc=0.0008
VLBI	IVS	x=5.1 y=6.5 z=7.0	rx=3.3 ry=3.7 rz=2.7	sc=0.001
DORIS	IGN	x=0.002 y=0.002 z=0.007	rx=0.7 ry=0.7 rz=0.7	sc=0.001
	INA	x=0.002 y=0.002 z=0.007	rx=1.8 ry=1.8 rx=1.8	sc=0.001
	LCA	x=0.001 y=0.001 z=0.007	rx=0.1 ry=0.1 rx=0.1	sc=0.001

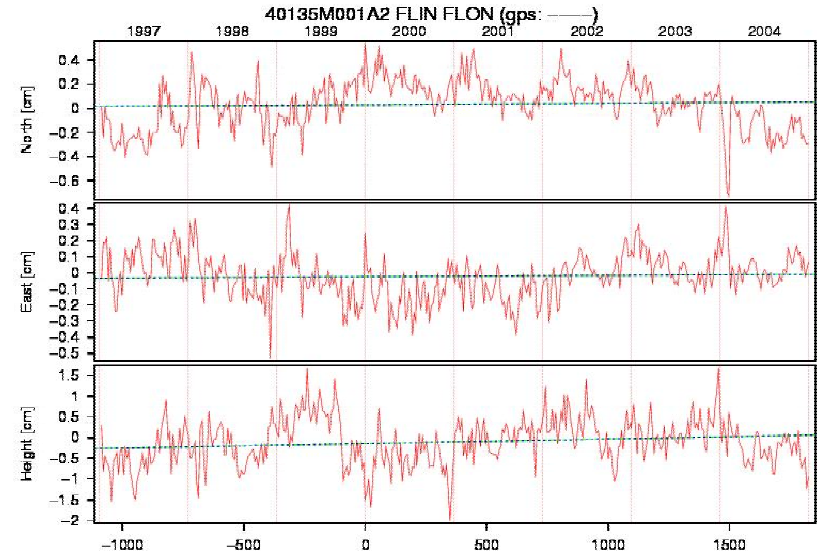
Accumulating epoch normal equations

GPS- IGS Additional discontinuities?

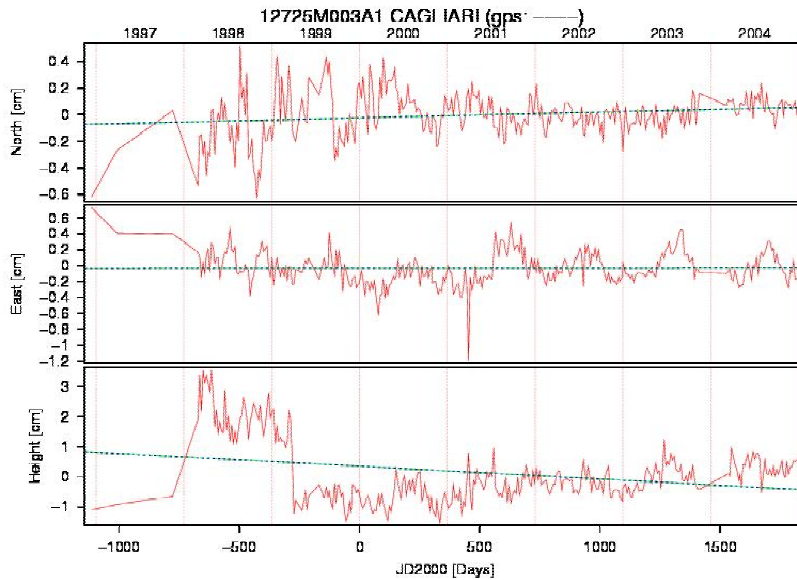
Ny-Alesund



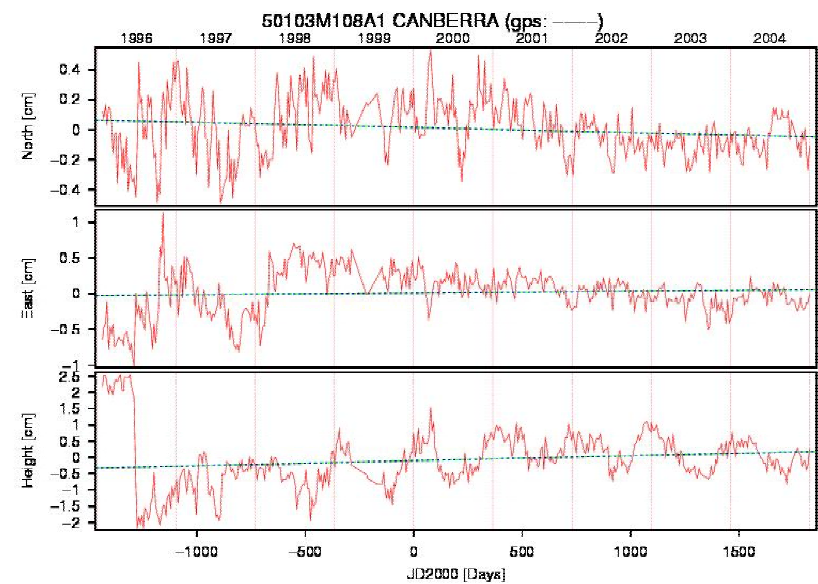
Flin Flon



Cagliari



Canberra



Accumulating epoch normal equations

Does estimating annual signals influence the velocities?
(example: 5 years of GPS-IGS)

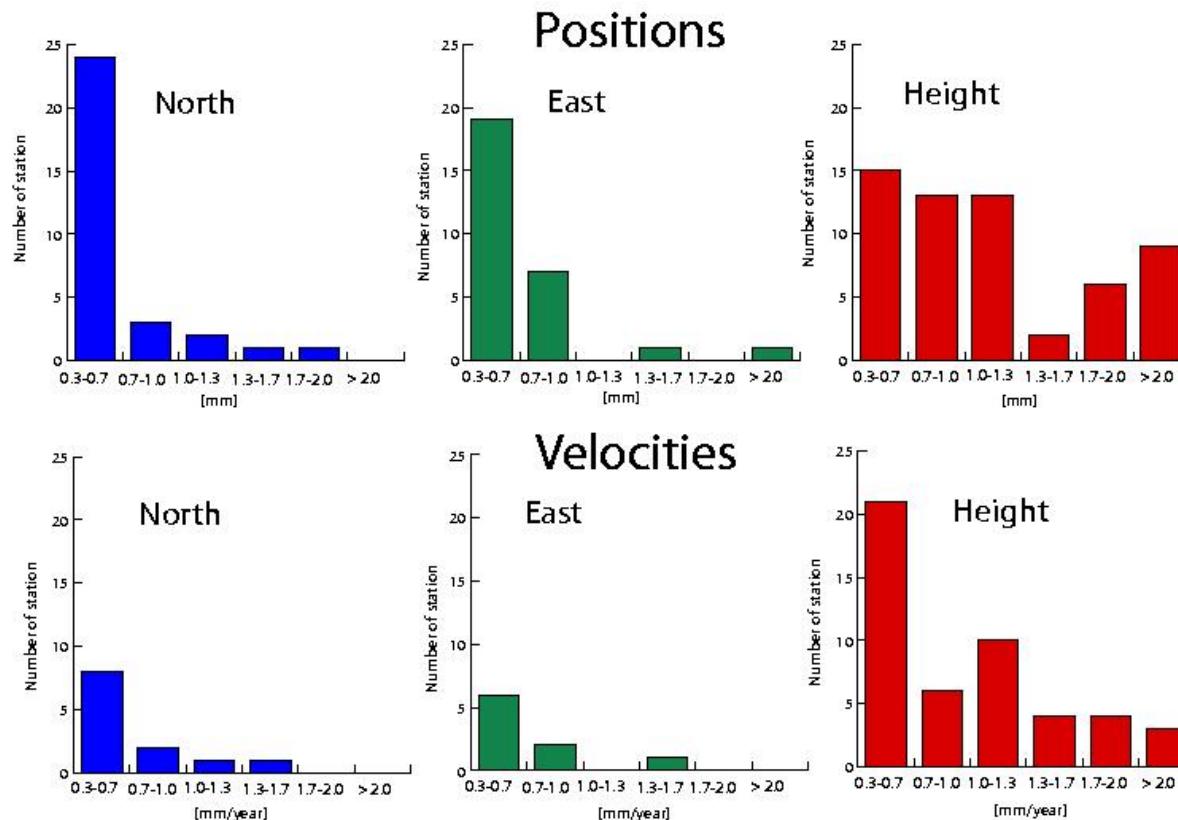


Figure 5: Differences of a GPS solution with estimated annual signals to a solution without estimated annual signals at the 99 IGS reference stations. Shown are the residuals that exceed 0.3 mm resp. 0.3 mm/ year.

-> see Poster: Influence of time variable effects on the reference frame in Session G1

Selection of co-location sites

based on multi year solutions

two criteria have to be fulfilled:

1. the consistence of the realised reference system should be maximized
→ offset between the pole coordinates of combined station networks should be minimal
2. the deformation of the networks should be minimized
→ RMS of the transformation of single technique solutions to the combined solution should be minimal

selection was performed for co-locations between GPS and VLBI

conclusion: the „best“ results were obtained using only a few consistent ties

see Poster: Strategies for the analysis and implementation of local tie information within inter-technique combination (Krügel and Angermann),
Session G1, Thursday

Remaining questions and recommendations

Input data:

- which input solution should be used for the inter-technique combination? (GPS: IGS, *SIO*?, *GFZ*?; DORIS: three individual solutions?)
- additional solutions for validation (combined SLR solution from DGFI?)
- official IERS file for local ties information
- discontinuity information (provided by the services, format, update?)

ITRF combination:

- intra technique co-locations: ties should be introduced by the Combination Centers not by the Technique Centers?
- time span individual for the techniques?
- EOP also for the time before mid of 1999 (without GPS contribution)?
- reference epoch: 2000.0?
- what are the official ITRF products?

die folgenden Folien könnten sind die ausführliche Variante von Folie 4

Analysis of input data

<i>Technique</i>	<i>Institution</i>	<i>Constraints</i>	<i>Constraints removed?</i>	<i>STATISTICS ?</i>
GPS	NRCan	Translat: xy=0.4mm,z=0.8mm Rotation: xy=10mm,z=2mm Scale: 0.3mm	no	no
	GFZ	loose stat.coord: 0.2-0.7m pole: > 50 mas, rates:150mas/d UT1: ~30 ms, LOD: ~15ms	not necessary	yes
	SIO	loose station coordinates: 1 m pole: 100 mas pole rates: 10 mas/d UT1: 6.6 ms LOD: 1ms	yes	yes
SLR	ILRS	loose (*) Sigma stat.coord: 0.2m pole: 4 mas LOD: 0.02ms	not necessary	yes

(*) : Constraints not documented, but a posteriori sigmas show, that loose constraints are used

Analysis of input data

<i>Technique</i>	<i>Institution</i>	<i>Constraints</i>	<i>Constraints removed?</i>	<i>STATISTICS ?</i>
VLBI	IVS	free NEQs		
DORIS	IGN	loose(*) Sigma stat.coord: 0.2-0.7m pole: 20 mas, rates:2mas/d UT1: 0.02 mus, LOD: 2ms	not necessary	yes
	INA	loose(*) Sigma stat.coord: > 1m pole: 60 mas, rates:2mas/d UT1: 0.02 mus, LOD: 2ms	not necessary	number of obs. is missing
	LCA	loose station coordinates: 10 m pole 10 mas	not necessary	yes