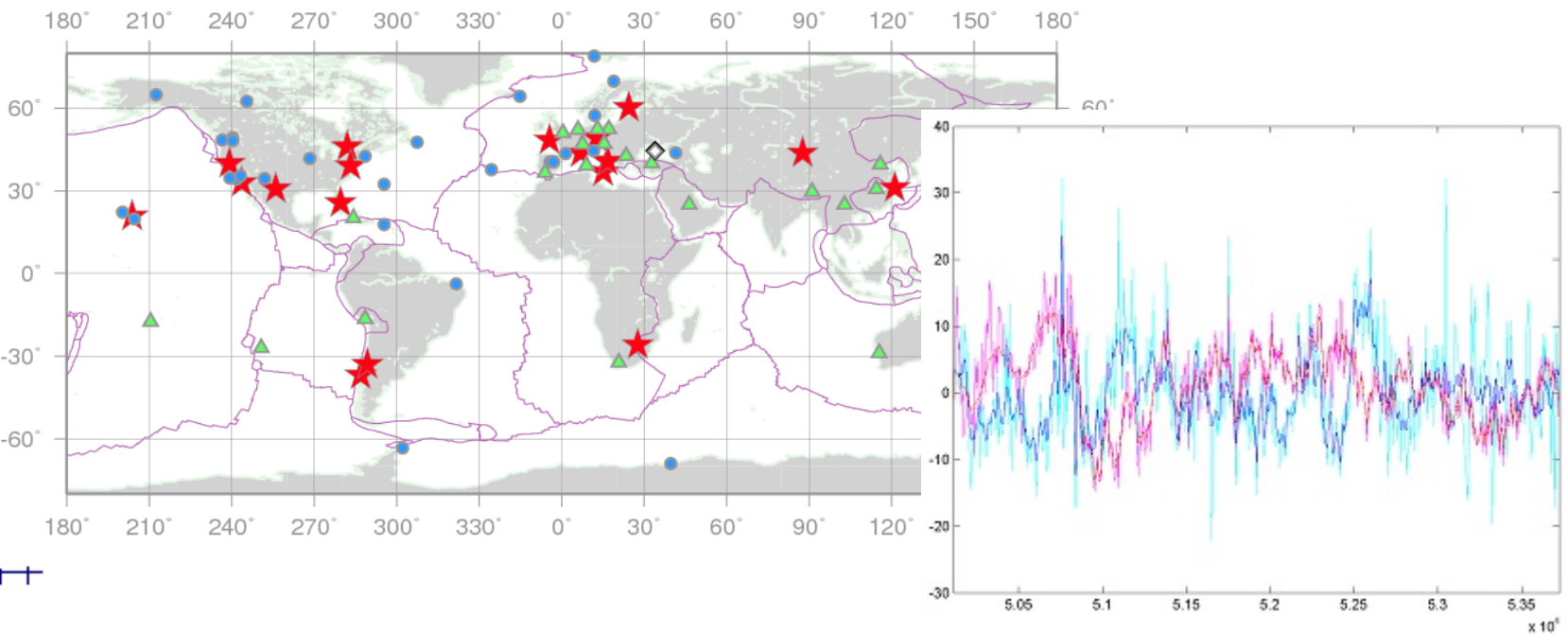


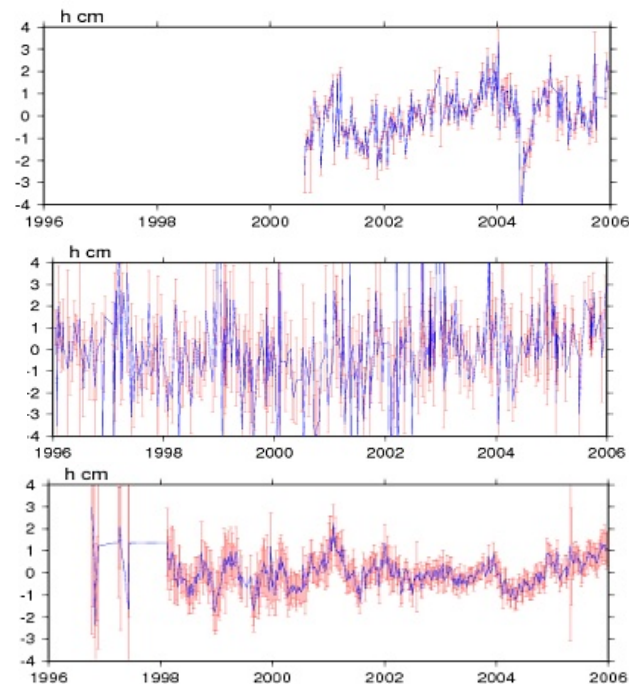
Coordinate time series comparison. Application to ITRF2005 height residuals time series



X. Collilieux, Zuheir Altamimi, David Coulot,

Acknowledgement : J. Ray, T. Van Dam, P. Sillard, I. Panet

- Outline:*
- ITRF2005 height residuals
 - Annual signal
 - Correlation
 - Network effect, preliminary results

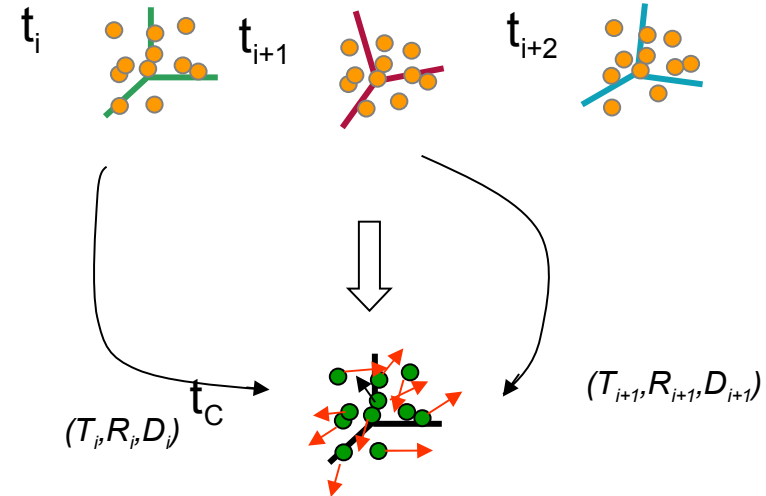


Data :

	Epoch	Nb of files	CCs	Sampling
VLBI	1980.0 – 2006.0	> 3000 <u>session</u> s	IVS	Daily and irregular
SLR	1992.9 – 2005.9	~ 650 <u>weeks</u>	ILRS	Weekly and regular
GPS	1996.0 – 2006.0	~ 500 <u>weeks</u>	IGS	Weekly and regular

Modeled	Not modeled
Solid earth tide	Atmospheric loading
Polar tide	Hydrology
Ocean tide loading	Non tidal ocean loading
	...

Time series stacking (CATREF model):



Spectral analysis Height component : GPS , VLBI, SLR

Introduction

Data

Spectral analysis

Correlation

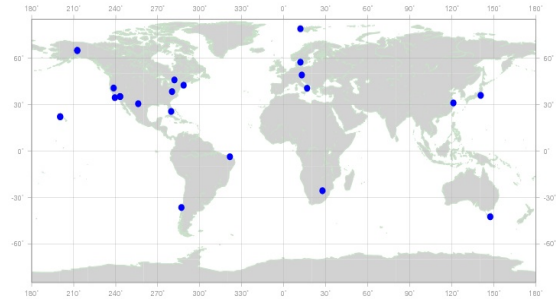
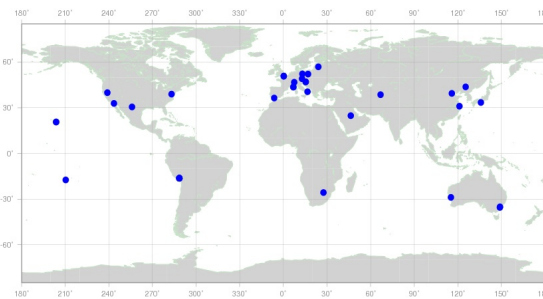
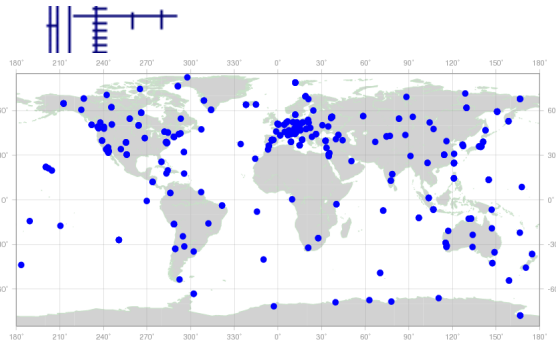
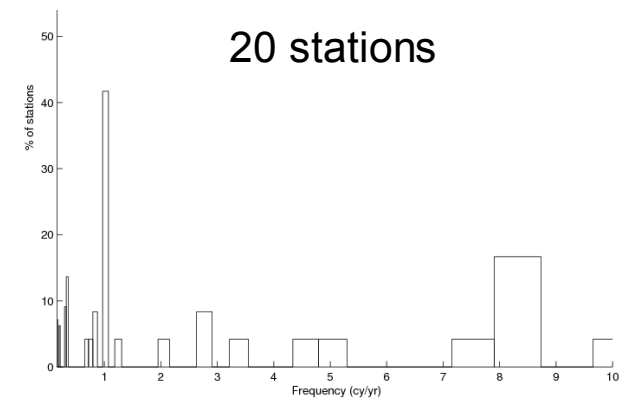
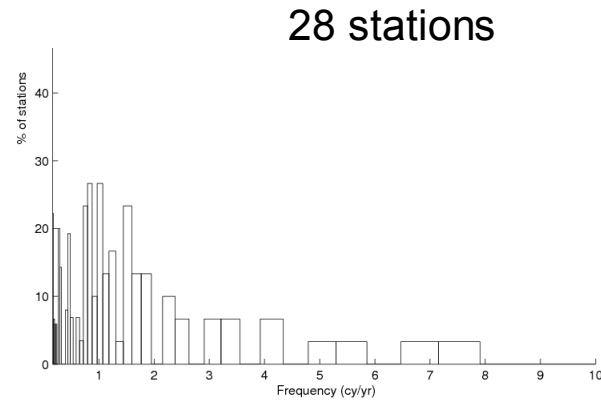
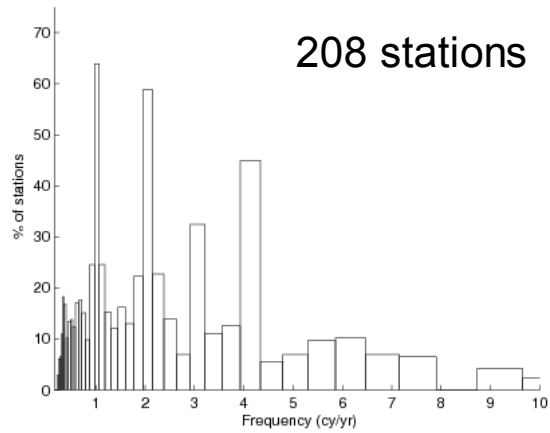
Network effect

Conclusion

IGS (GPS)

ILRS (SLR)

IVS (VLBI)



SNR > 3.5

Annual signal in height residuals (1/3)

Introduction

Data

Spectral analysis

Correlation

Network effect

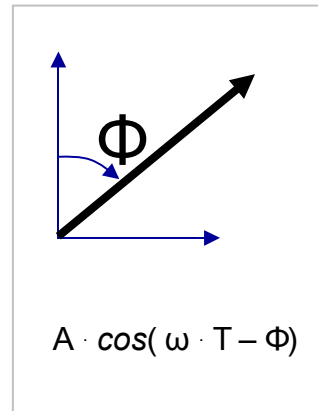
Conclusion



IGS : annual signal

$f = 1 \text{ cy/yr}$

$\text{SNR} > 3.5$



Annual signal in height residuals (2/3)

Introduction

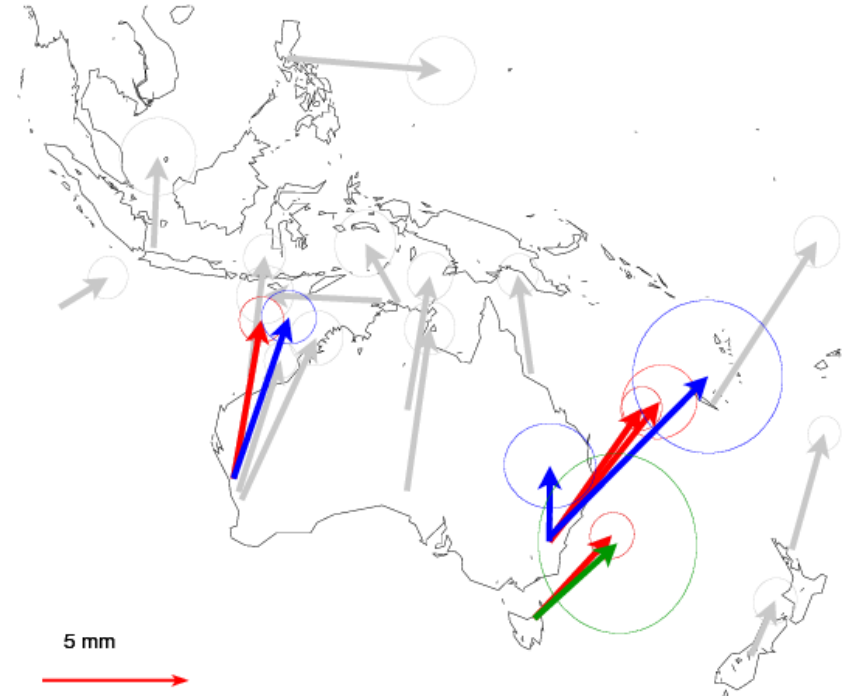
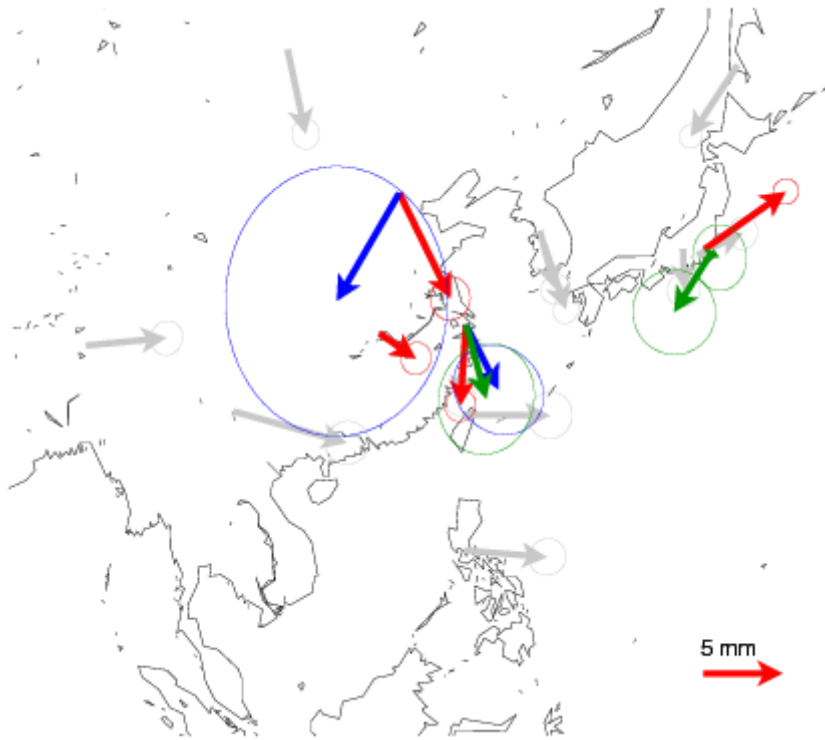
Data

Spectral analysis




Correlation

Network effect

Conclusion



co-location site :

-  IGS (GPS)
-  ILRS (SLR)
-  IVS (VLBI)

Not co-located :

-  IGS (GPS)

Annual signal in height residuals (3/3)

Introduction

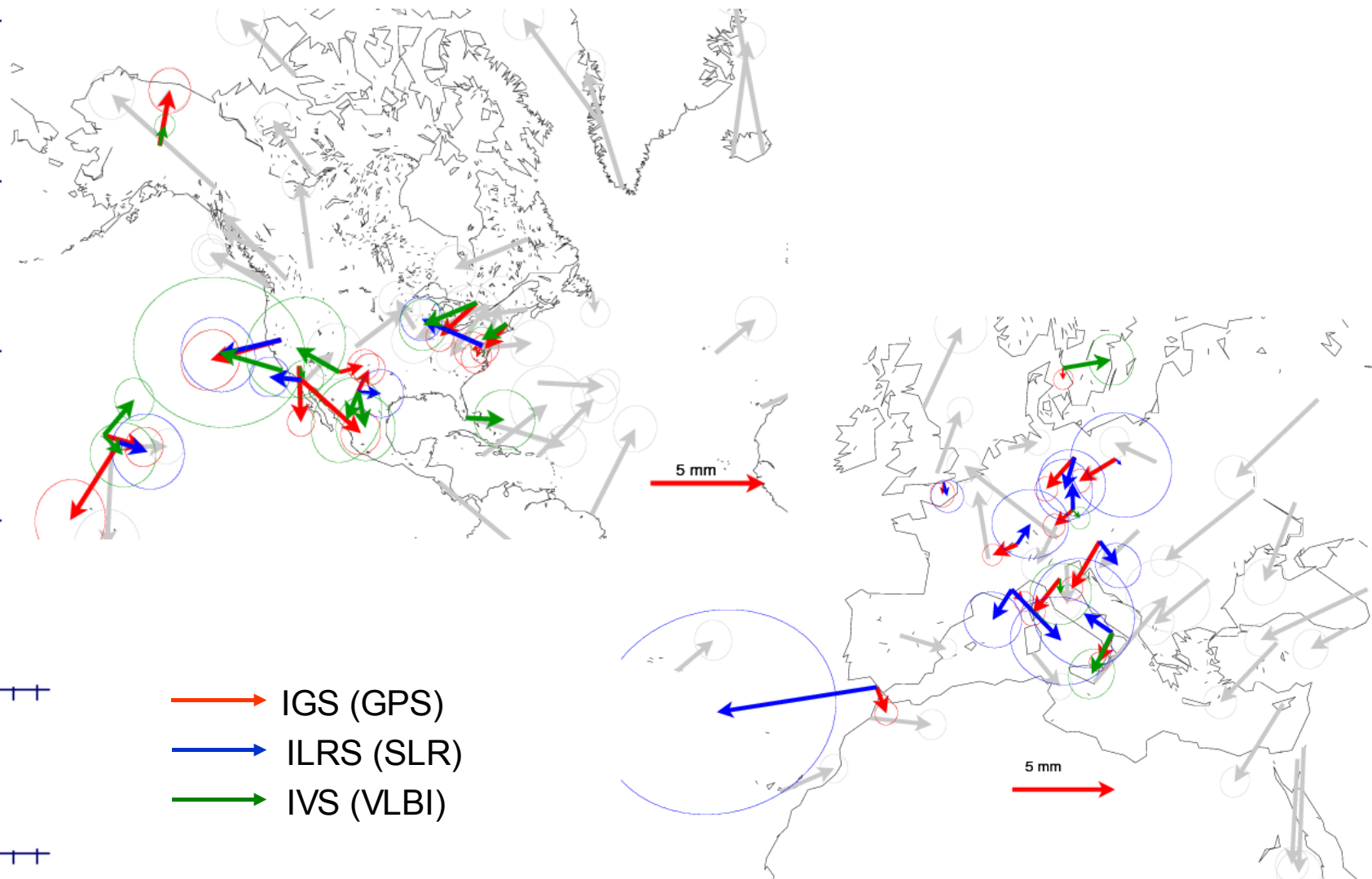
Data

Spectral analysis

Correlation

Network effect

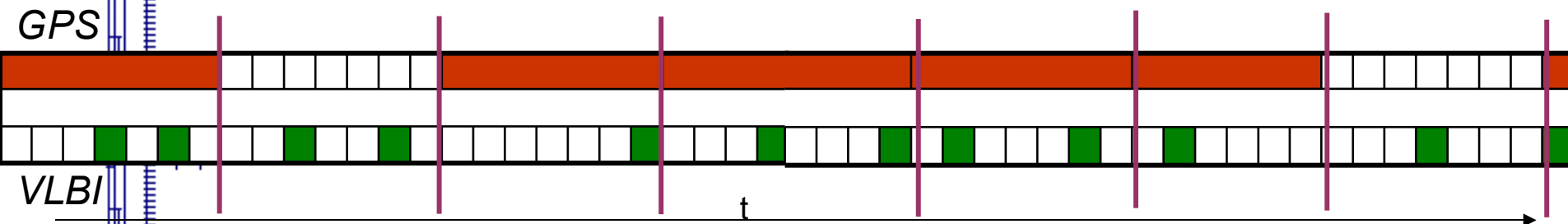
Conclusion



- Principle :

Data : Ex: VLBI and GPS data of a co-location site.

Problem : data gap, different sampling, displacements with uncertainties



- Hypothesis :

work at daily sampling. GPS and SLR measure a weekly mean of a daily process.

⇒ Add information about time evolution

$$X_{t+1} = X_t + u_t \quad \text{with } u_t \text{ white noise with unknown variance}$$

⇒ *the 2* White noises are correlated

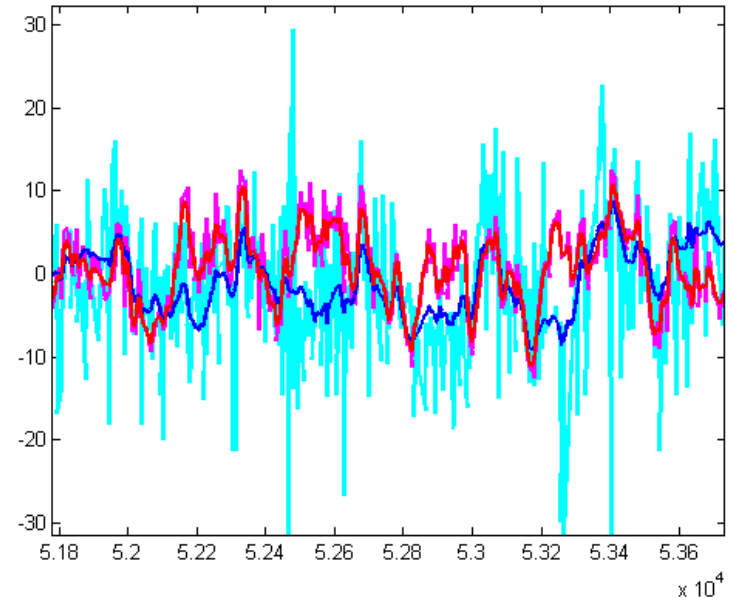
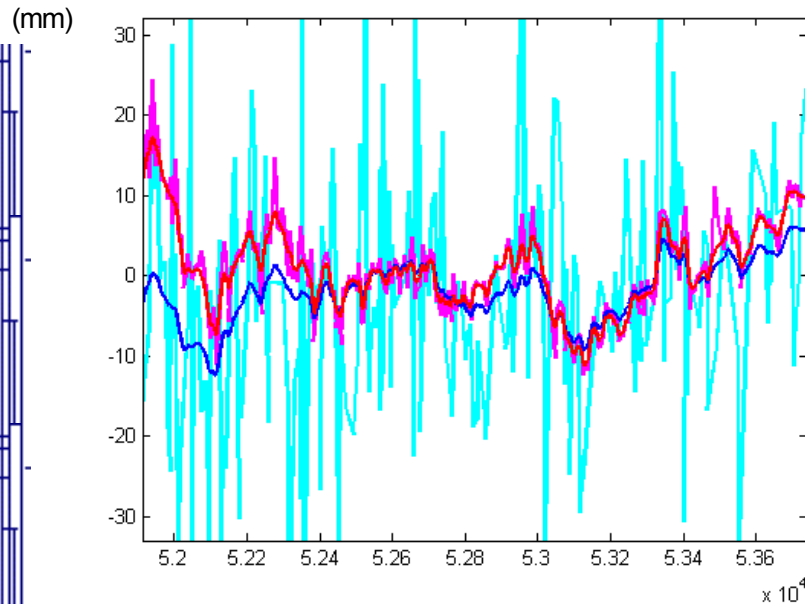
⇒ additive decorrelated noise. data uncertainties are known with unknown scaling factor

- 5 parameters to be estimated by maximum likelihood

Correlation – VLBI/GPS – Results (1/3)

Hartebeesthoek Height residual time series

Ny-Alesund Height residual time series



— VLBI
— smoothed VLBI

— GPS
— smoothed GPS

(mm)

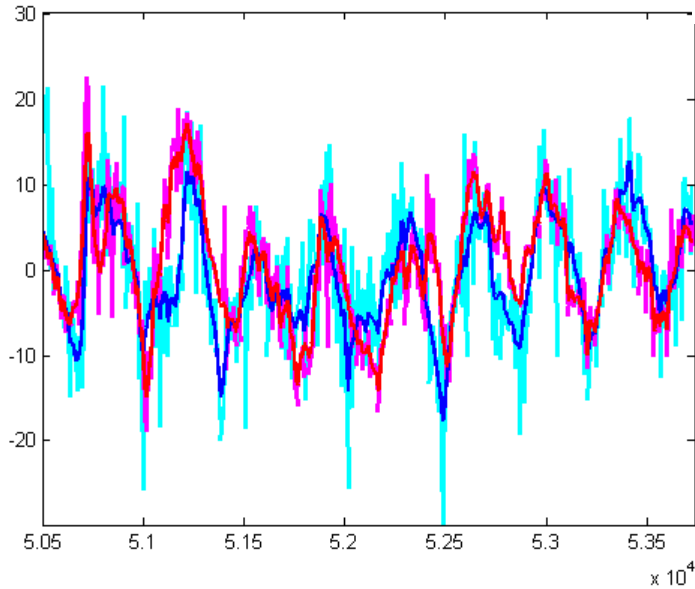
(mm)

	VLBI Code	GPS Code	$\sigma_{wv}vlbi$	$\sigma_{wv}gps$	$\sigma_{0}vlbi$	$\sigma_{0}gps$	ρ
Hartebeesthoek	7232 (386)	HRAO (413)	0.57 ± 0.14	0.79 ± 0.07	1.38 ± 0.05	0.43 ± 0.02	0.88 ± 0.09
Ny-Alesund	7331 (503)	NYA1 (394)	0.78 ± 0.15	1.03 ± 0.10	1.78 ± 0.07	0.39 ± 0.03	0.68 ± 0.13

Correlation – SLR/GPS - Results (2/3)

Yarragadee

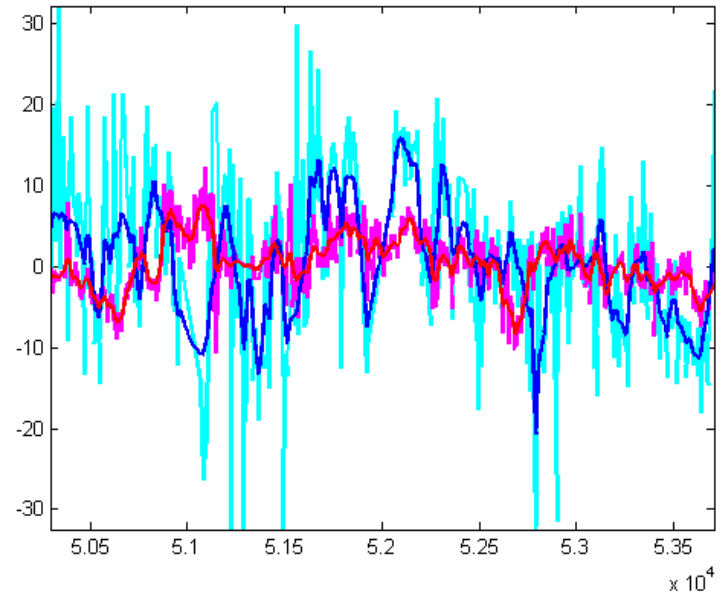
Height residual time series



— SLR
— smoothed SLR

Wetzell

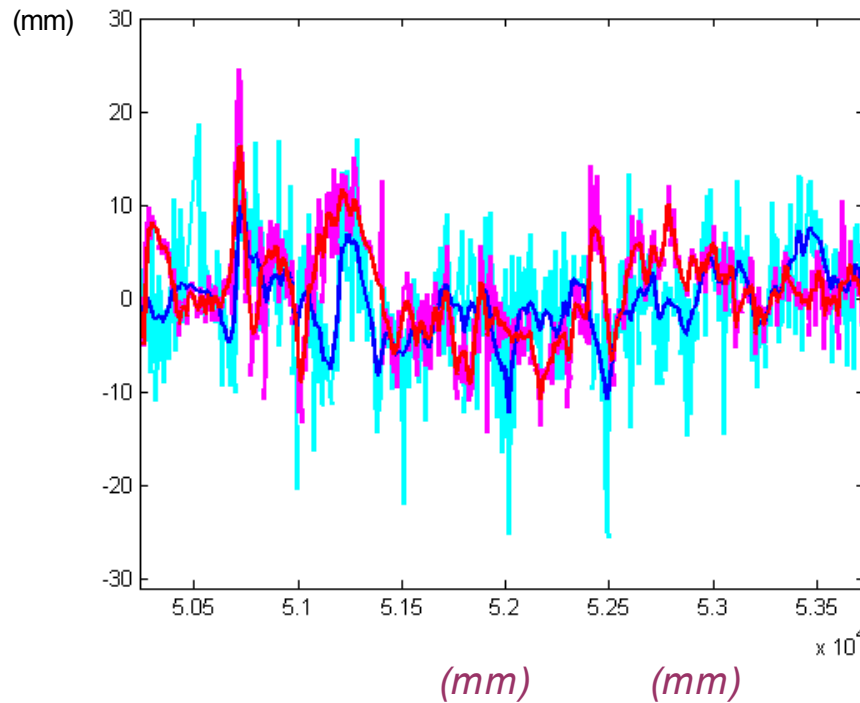
Height residual time series



— GPS
— smoothed GPS

	SLR code	GPS code	σ_{wnslr} (mm)	σ_{wngps} (mm)	σ_{0slr}	σ_{0gps}	ρ
Yaragadee	7090 (498)	YAR1 (497)	0.92 ± 0.09	0.84 ± 0.06	3.37 ± 0.15	0.38 ± 0.02	0.46 ± 0.10
Wetzell	8834 (417)	WTZR (500)	1.19 ± 0.15	0.42 ± 0.05	2.97 ± 0.15	0.54 ± 0.03	0.11 ± 0.17

Yarragadee Height residual time series, Annual signal removed



Annual signal :
Amplitude : 5.5 ± 0.2 mm

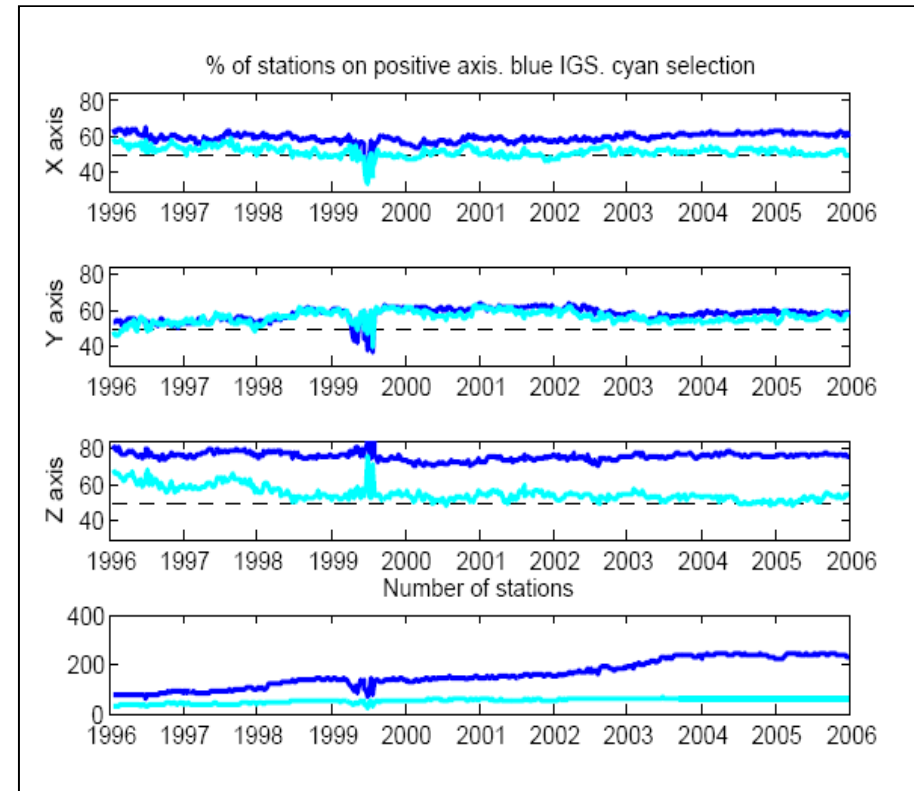
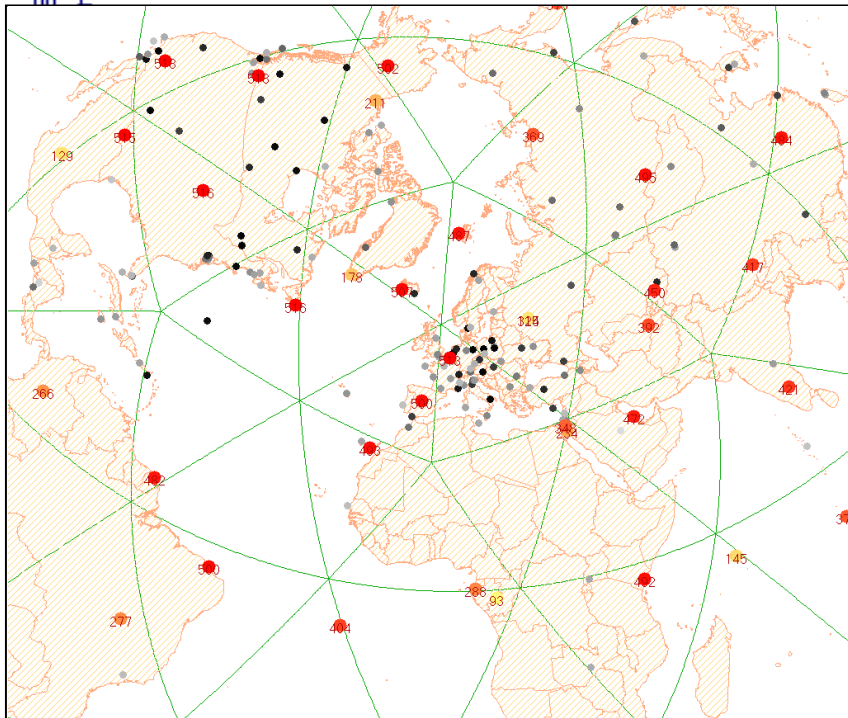
- SLR
- smoothed SLR
- GPS
- smoothed GPS

	SLR code	GPS code	σ_{wnslr}	σ_{wngps}	σ_{0slr}	σ_{0gps}	ρ
Yaragadee	7090 (498)	YAR1 (497)	0.69 ± 0.10	0.72 ± 0.06	3.49 ± 0.15	0.39 ± 0.02	0.23 ± 0.14

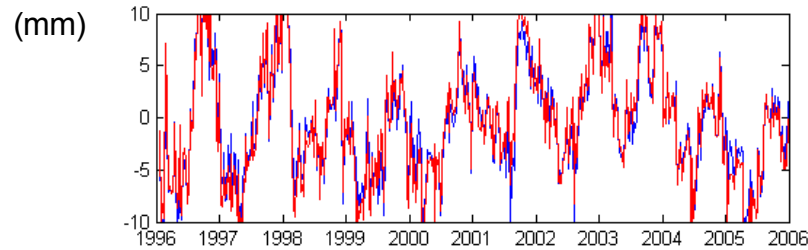
Network effect:

- Propagation of some part of station individual motion into global parameters or conversely

How can we quantify the network effect?

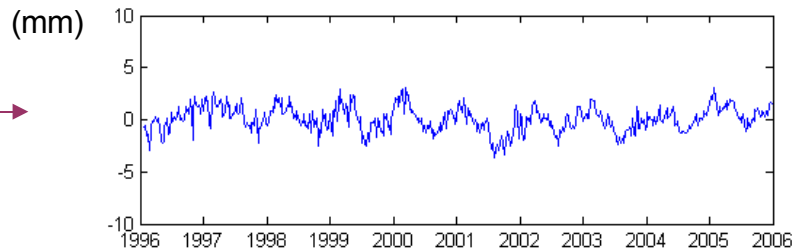


Example : DRAO, height component



— Full network
— selection

Difference →



Scattering East (mm)	Annual ampl. East (mm)	Scattering North (mm)	Annual ampl. North (mm)	Scattering Up (mm)	Annual ampl. Up (mm)
0.40 ± 0.08	0.20 ± 0.14	0.40 ± 0.06	0.20 ± 0.11	1.20 ± 0.13	1.10 ± 0.20

* Computed from 2000.0

Spectral analysis :

Annual signal detected in the height residual time series of the three techniques

Significant regional correlation detected in the annual signal

→ Confirmed by SLR and VLBI in some areas:
Australia, South of Africa...

Correlations :


Rather good consistency between VLBI and GPS in the height
Same conclusion for few SLR sites.

The network effect might contribute to the disagreement observed.
Need to be investigated

Article submitted to JGR:

Spectral and correlation analyses of ITRF2005 VLBI, GPS and SLR height residuals: How well do space geodetic techniques agree? , Journal of Geophysical Research, submitted, X. Collilieux , Z. Altamimi , D. Coulot , J. Ray , P. Sillard

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ITRF



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- Domes Numbers**
- DOMES description
- DOMES request
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- Site Information and Selection
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- Guidelines
- Get coordinates
- Selected points
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- Links
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Search by DOMES number :

Residuals list of plots

SLR	DOMES	Code			
GPS					
SLR					
VLBI					
DORIS /LCA					
DORIS /IGN-JPL	1863	1864	1868	1873	
	1884	1893	1953	7080	7090
	7097	7105	7109	7110	7122
	7123	7124	7130	7210	7231
	7236	7237	7249	7295	7307
	7307	7308	7328	7335	7337
	7339	7355	7356	7357	7358
	7403	7404	7405	7410	7411
	7501	7502	7505	7520	7525
	7530	7541	7543	7545	7548
	7589	7597	7805	7806	7810
	7810	7811	7820	7823	7824
	7824	7825	7830	7831	7832
	7835	7836	7837	7838	7839
	7840	7841	7843	7845	7847
	7848	7849	7850	7882	7883
	7884	7918	7920	7939	7941
	8833	8834			

[Go back to ITRF2005 page](#)

<http://itrf.ensg.ign.fr>

<http://itrf.ensg.ign.fr> - Residuals Plot - Module Plot

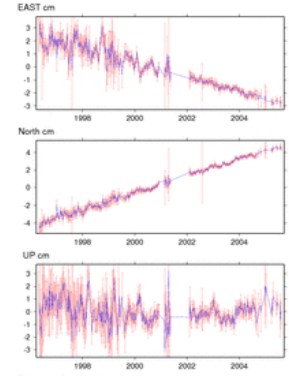
IGS solution (GPS)

Choose ITRF solution:

Detrended Trended

Choose plot: **ASC1 30602M001**

ALBH 40129M003
 ALGO 40104M002
 ALIC 50137M001
 ALRT 40162M001
 AMC2 40472S004
 AMMN 22201M001
 ANKR 20805M002
 AOML 49914S001
 AREQ 42202M005
 ARP3 49878S003
 ARTU 12362M001
ASC1 30602M001
 ASPA 50503S006
 ATWC 49934M001
 AUCK 50209M001
 BAHR 24901M002
 BAKE 40152M001
 BAKO 23101M002
 BAN2 22306M003
 BARB 43401S001



Reference Position of the plot :
 X = 6118526.071 m Y = -1572344.716 m Z = -876451.130 m

Domes	Description	code	country
30602M001	PLATEA-BEAM MAST/ROOF MOUNT	ASC1	BRITISH DEPENDENCIES IN ATLANTIC OCEAN

Done

Thank you !