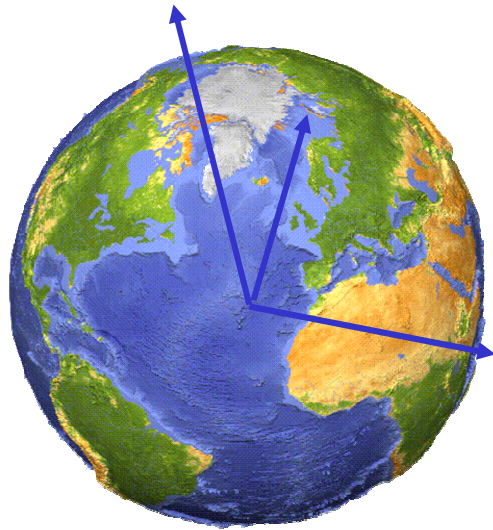


# DORIS weekly station position time series.

## Status before ITRF2008 analysis



IGN/LAREG



Acknowledgement:

M. Gobinddass, L. Soudarin, T. van Dam, P. Willis

# Outline

- Data
- Results w.r.t. ITRF2005
- DORIS position time series
- Comparison with GPS, SLR and VLBI position time series



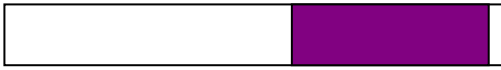


# Outline

- Data
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# DATA

## DORIS weekly frame time series

AC	Period	Acronym
LCA	2002.0 2008.0 	wd19
IGN	1993.0 2008.0 	wd07
IGN	1993.0 2008.6 	wd06

# DATA

DORIS weekly frame time series

AC	Period	Acronym
LCA	2002.0 2008.0 	wd19
IGN	1993.0 2008.0 	wd07
IGN	1993.0 2008.6 	wd06

## MAIN DIFFERENCE

### LCA solution includes:

- Atmospheric loading correction
- Jason-1 satellite data in 2002

vs  
ITRF2005-like  
strategy

# Outline

- Data
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CATREF Software

Station  
Positions &  
Velocities

$$\underline{X_s^i} = \underline{X_c^i} + (t_s^i - t_0) \dot{\underline{X_c^i}} + \underline{T_k} + \underline{D_k} \underline{X_c^i} + \underline{R_k} \underline{X_c^i}$$

Input

Output

Helmert parameter

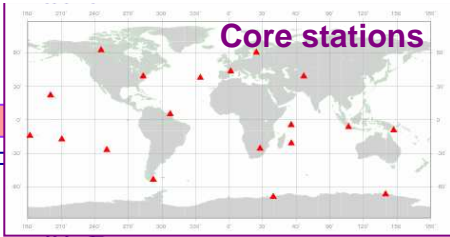
Frame definition

$$B \begin{pmatrix} \underline{X_c} - \underline{X_{ITRF2005}} \\ \underline{\dot{X}_c} - \underline{\dot{X}_{ITRF2005}} \end{pmatrix} = 0$$

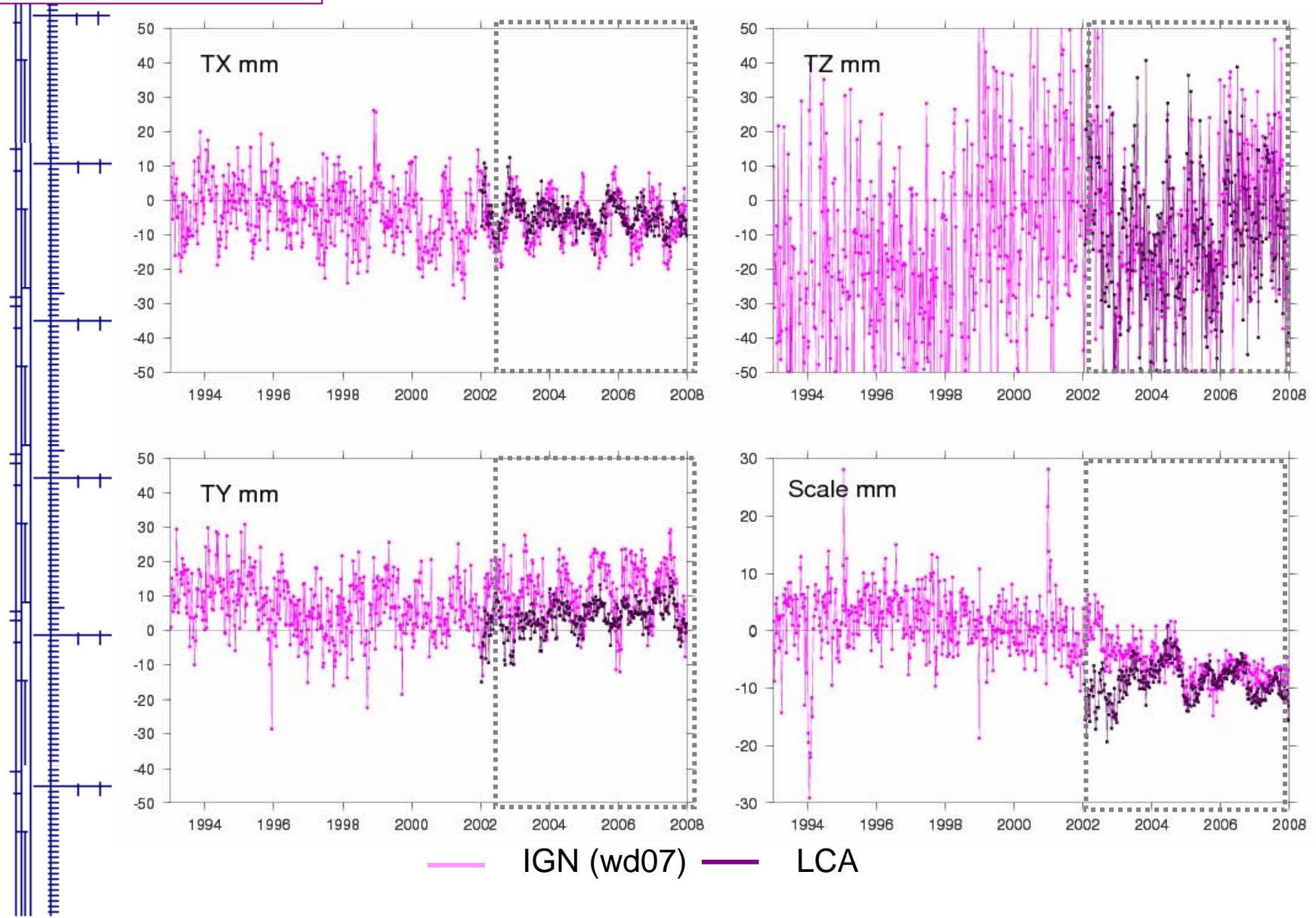
Earth Orientation  
parameters

$$\begin{aligned} \underline{x_s^p} &= \underline{x_c^p} + \underline{R2_k} \\ \underline{y_s^p} &= \underline{y_c^p} + \underline{R1_k} \\ \underline{UT_s} &= \underline{UT_c} - \frac{1}{f} \underline{R3_k} \end{aligned}$$

# Result w.r.t ITRF2005



## Translation and scale w.r.t ITRF2005

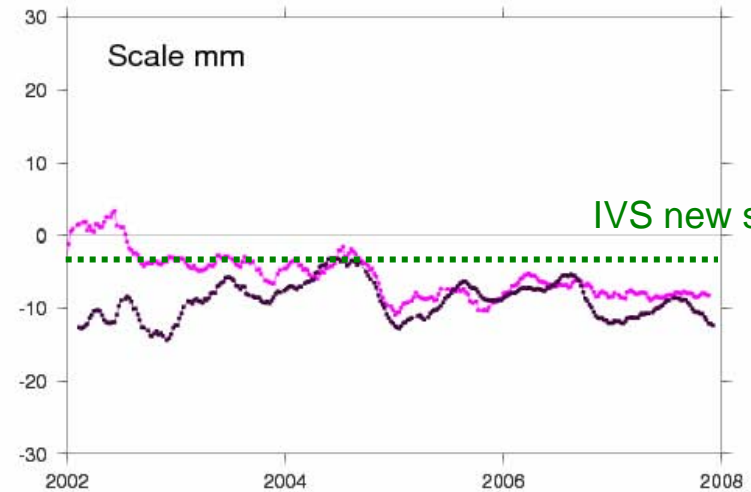
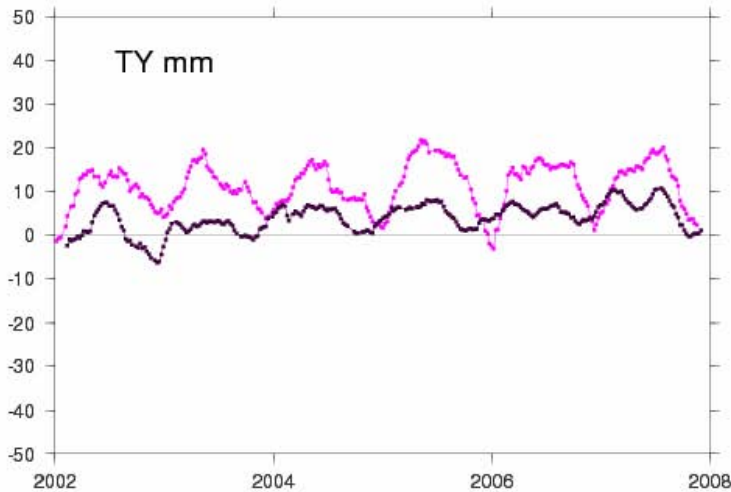
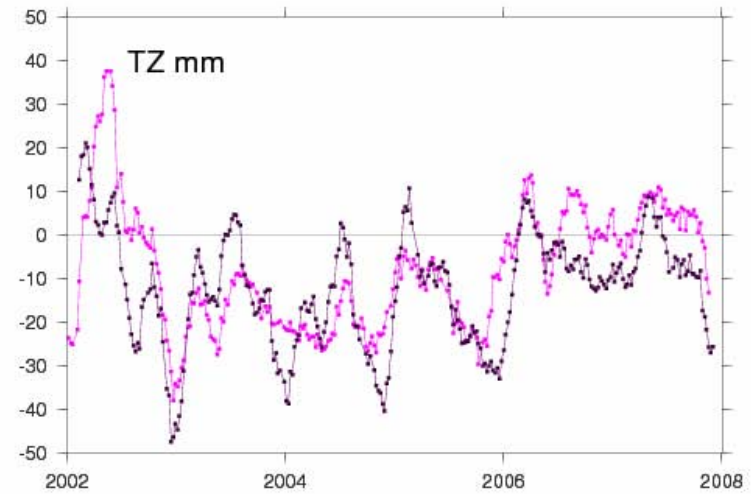
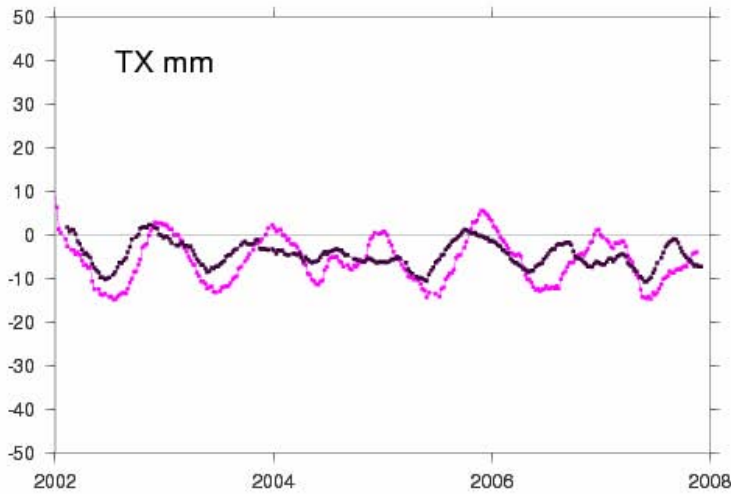




# Result w.r.t ITRF2005

## Translation and scale w.r.t ITRF2005

10 weeks Running averaged filter applied



— IGN (wd07) — LCA

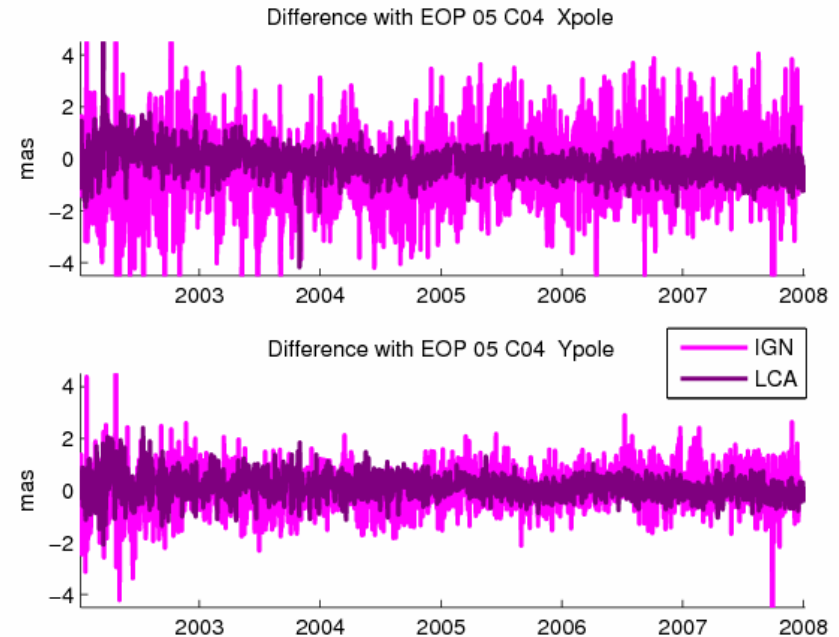
## DORIS Earth Orientation Parameters : difference with EOP05C04 At mid-day epoch

### EOP estimation strategies

	Parameter / day
IGN (wd07)	$(x_p, y_p, UT)$ and $(\dot{x}_p, \dot{y}_p, LOD)$
LCA	$(x_p, y_p)$

### WRMS w.r.t EOP05C04 2002-2008

WRMS	IGN (wd07)	LCA
X (mas)	1.57	0.56
Y (mas)	0.81	0.44

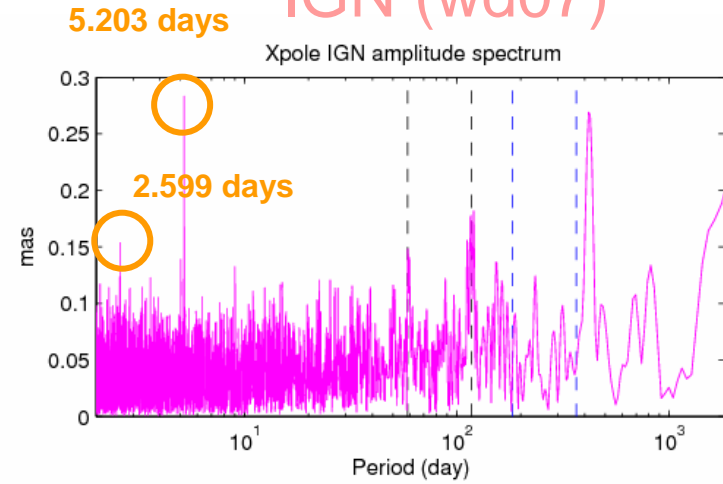
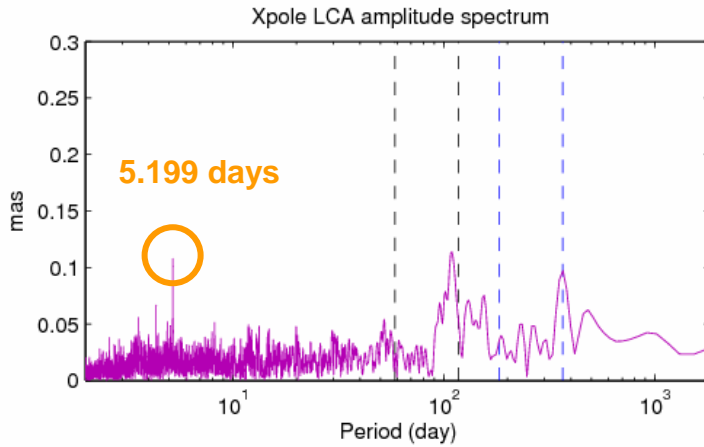


DORIS Earth Orientation Parameters : difference with EOP05C04

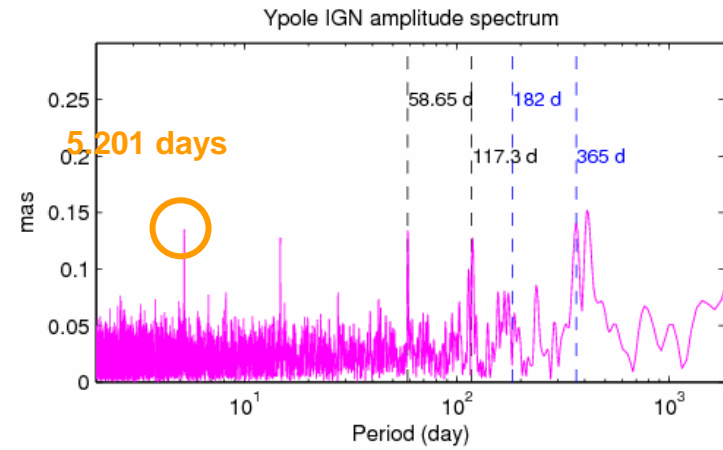
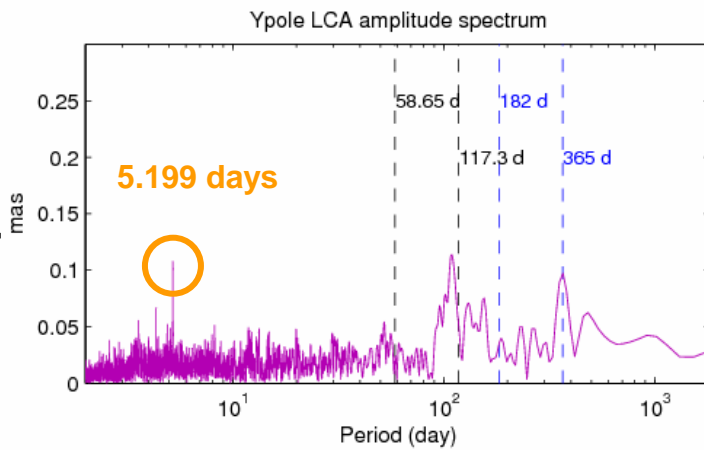
LCA

IGN (wd07)

Xpole



Ypole



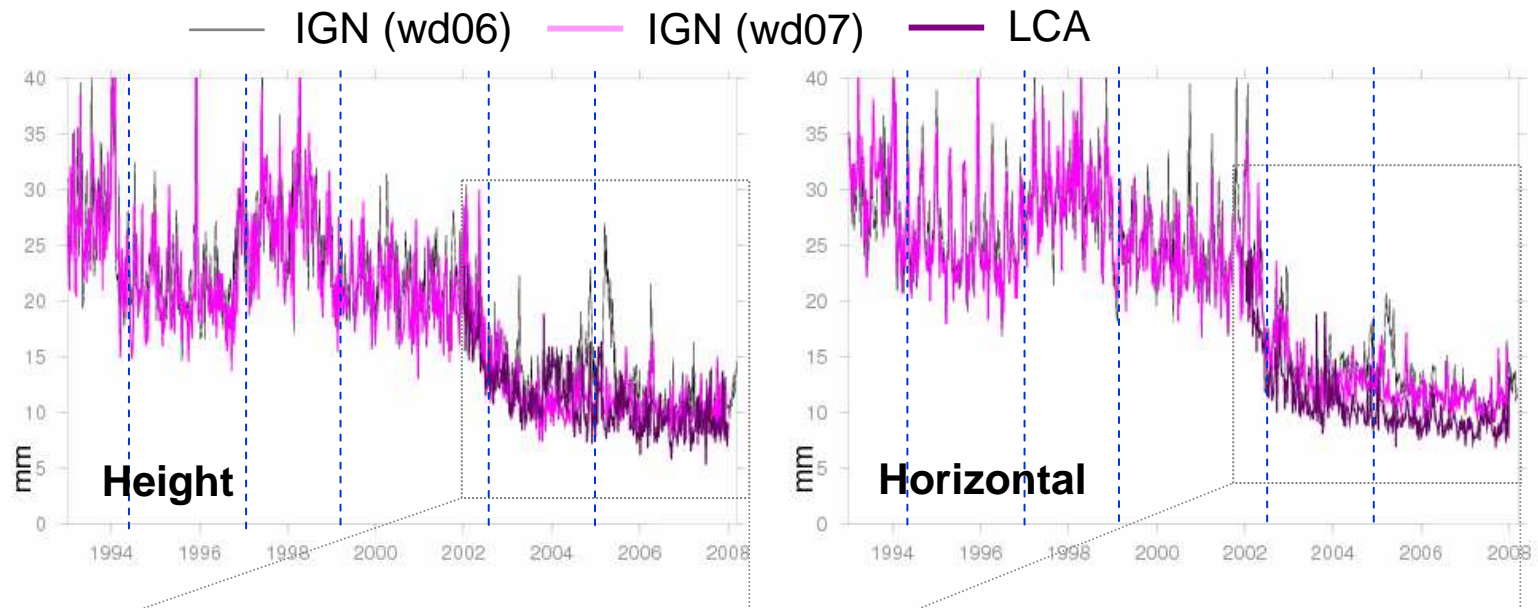
# Outline

- Data
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# DORIS position time series

General WRMS for the whole DORIS network

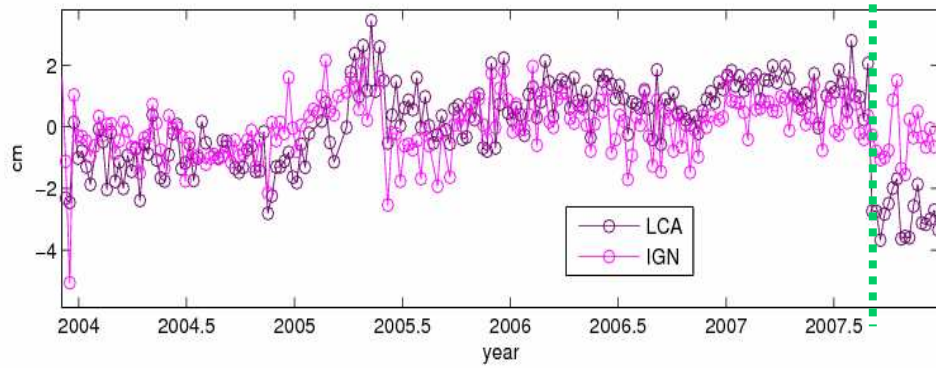


# DORIS position time series

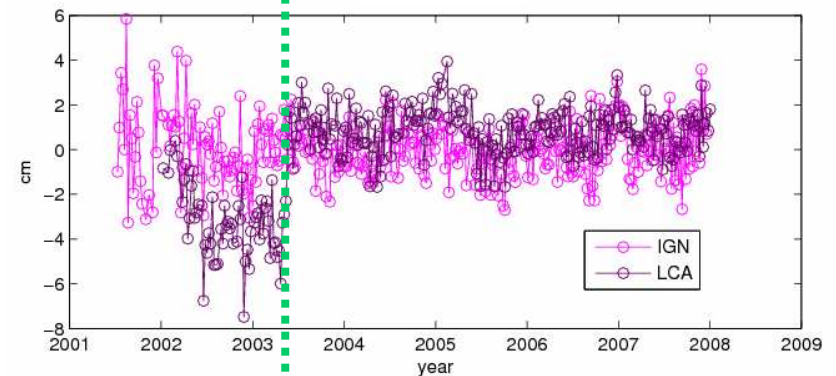
## Discontinuities

Discontinuities detected by 1 AC only

YASB

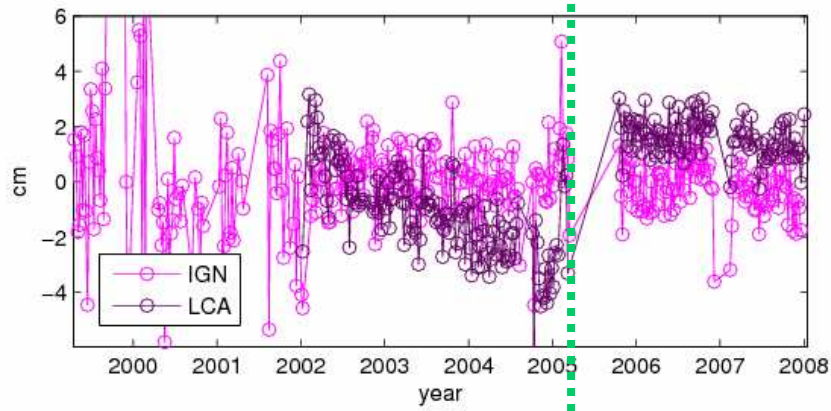


SANB

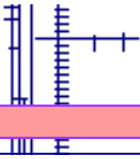


?

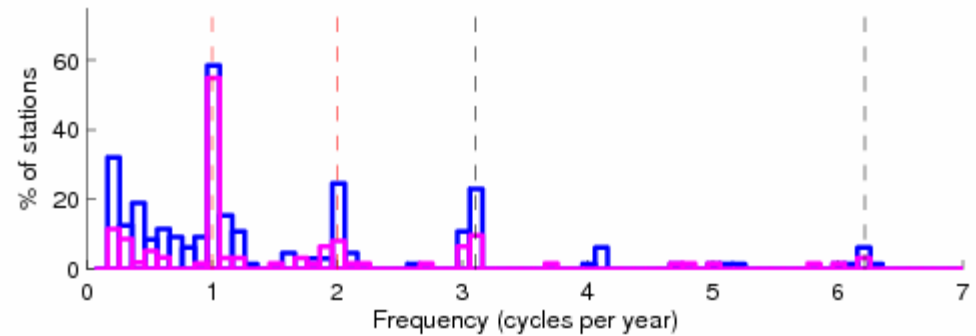
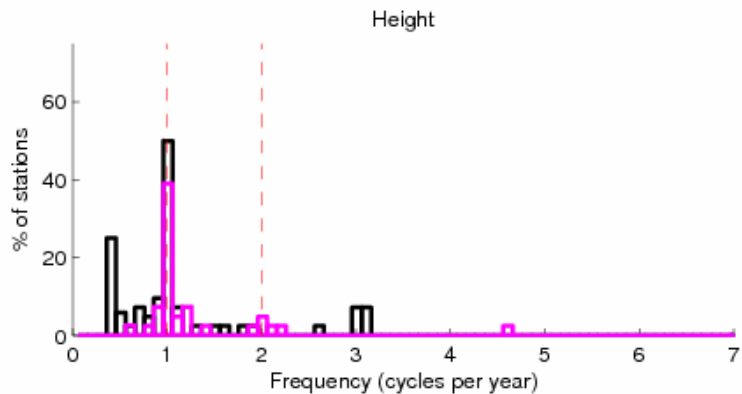
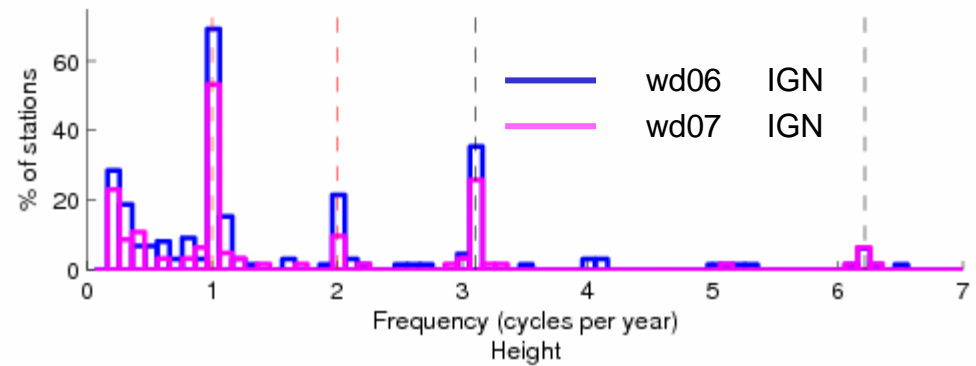
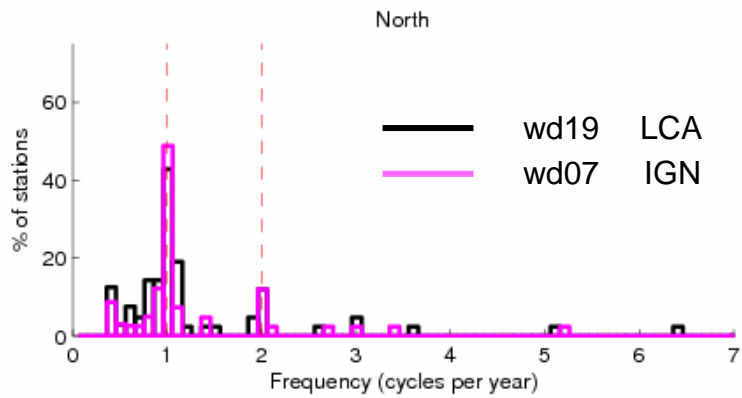
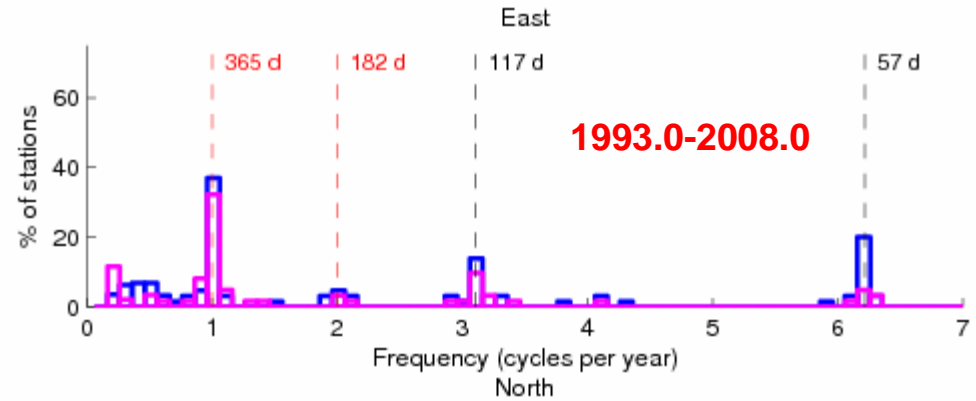
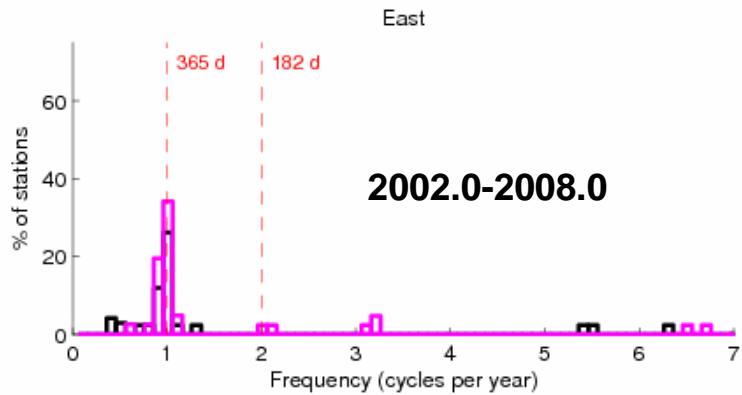
CHAB



\* NB: conventional constant offset between  
The couple of time series



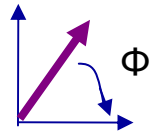
# DORIS position time series : Spectral content



In agreement with (Lebail, 2006) and (Williams and Willis, 2006) results



# DORIS position time series

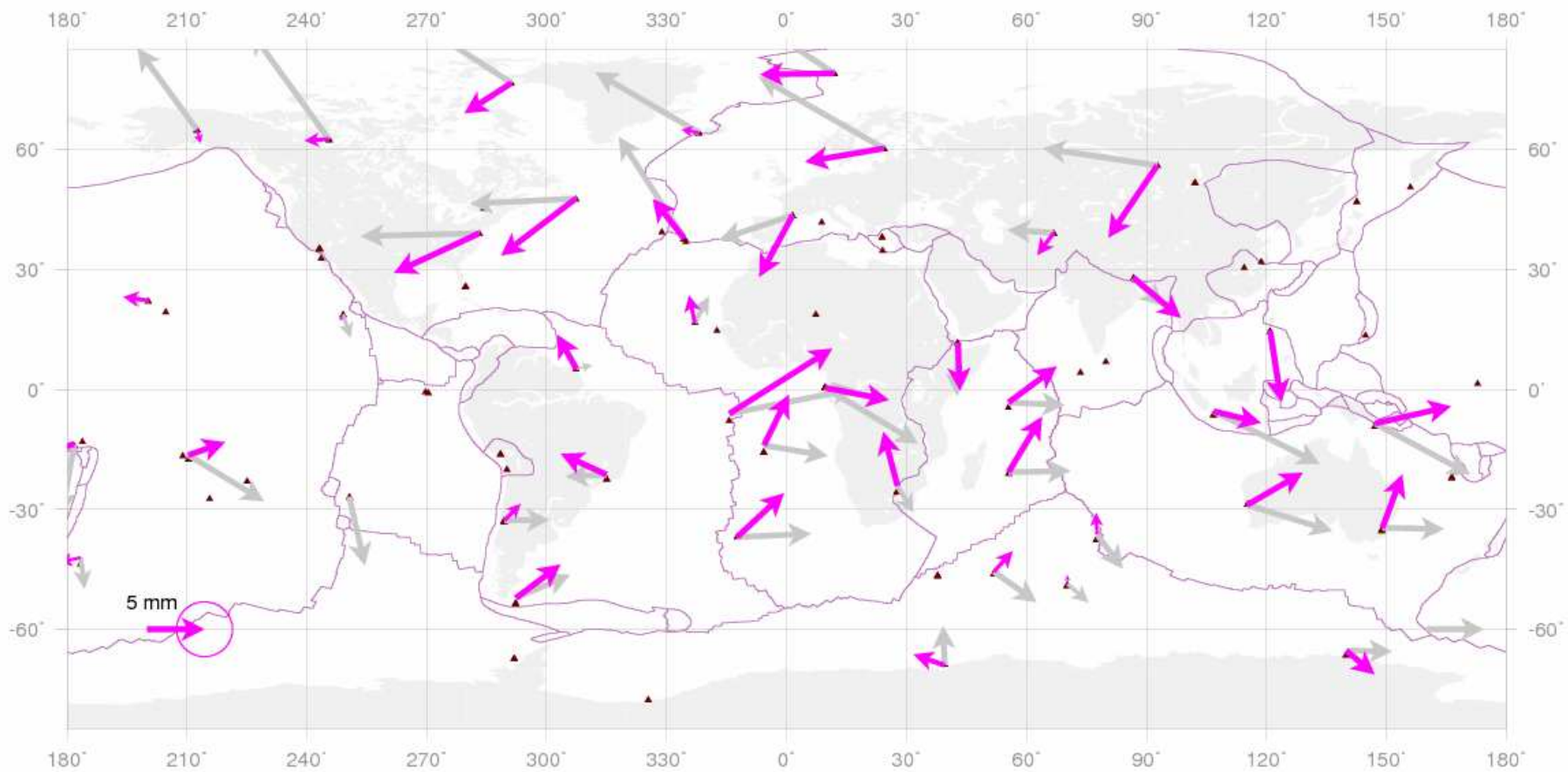


$$A \cdot \cos(\omega \cdot T - \Phi)$$

## Annual signal; Height component

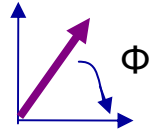
— IGN (wd06)    — IGN (wd07)

2002.0-2008.0





# DORIS position time series

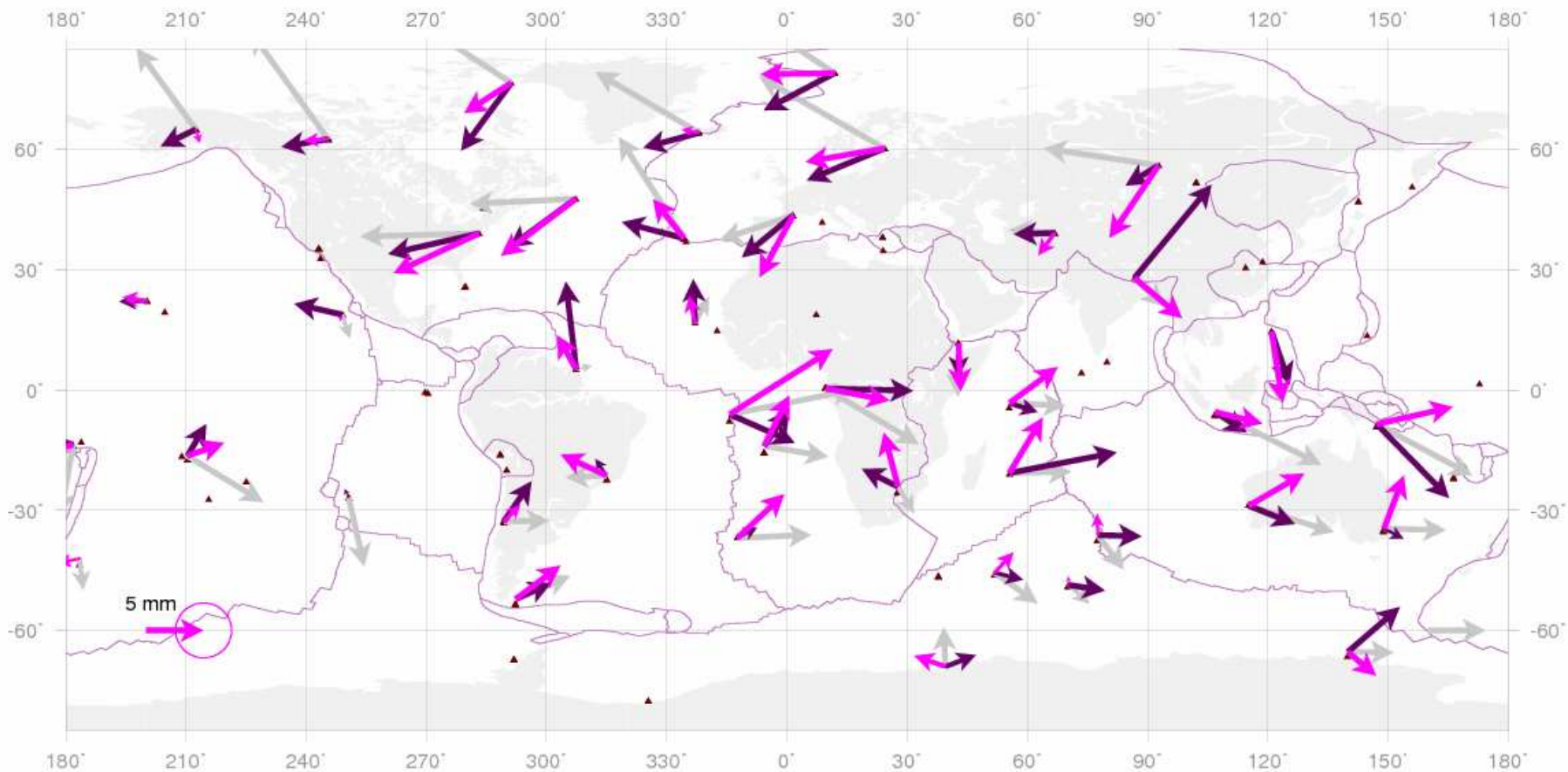


$$A \cdot \cos(\omega \cdot T - \Phi)$$

## Annual signal; Height component

— IGN (wd06) — IGN (wd07) — LCA

2002.0-2008.0



**WARNING : LCA solution is corrected for atmospheric loading**

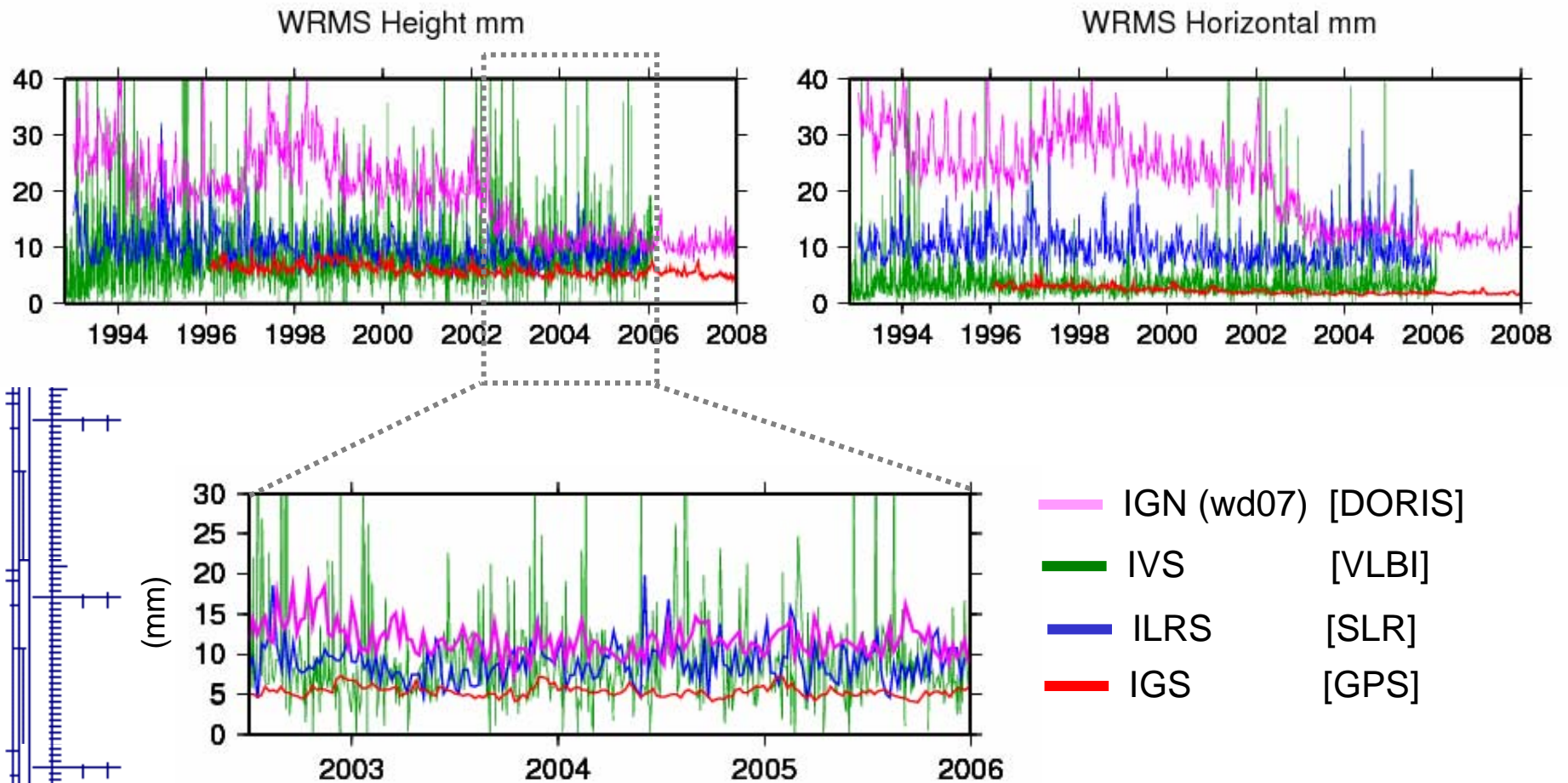
# Outline

- Data
- Results w.r.t. ITRF2005
- DORIS position time series
- Comparison with GPS, SLR and VLBI position time series

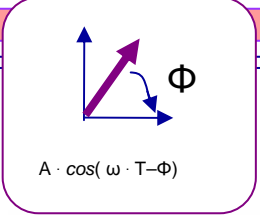


# Comparison with GPS, SLR and VLBI position time series

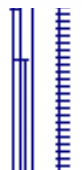
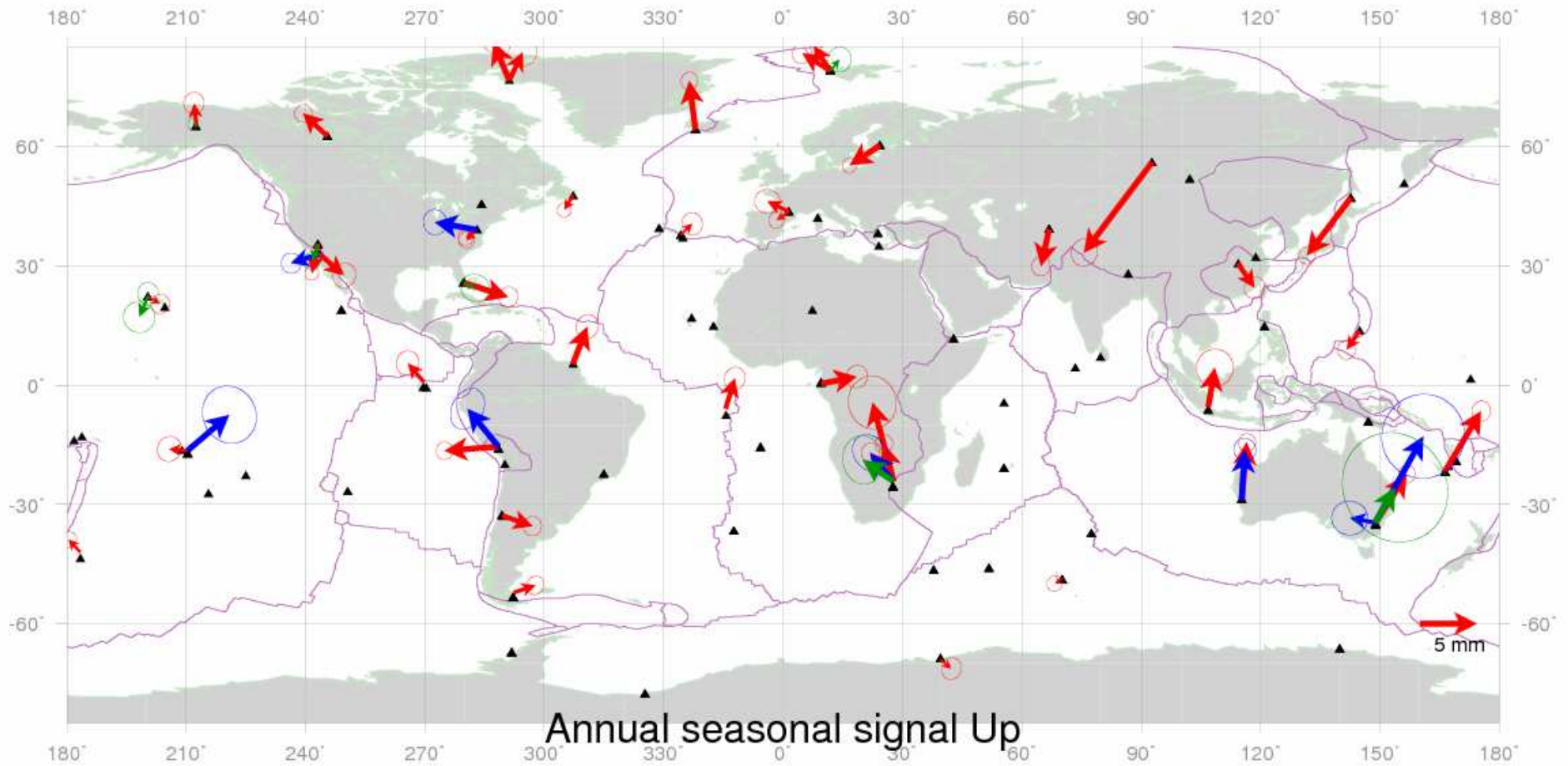
## Comparison of Position time series



# Comparison with GPS, SLR and VLBI position time series



Only annual signal widely detected on the Height component for SLR, VLBI and GPS results (Collilieux et al., 2007)



— IGS [GPS]    — ILRS [SLR]    — IVS [VLBI]

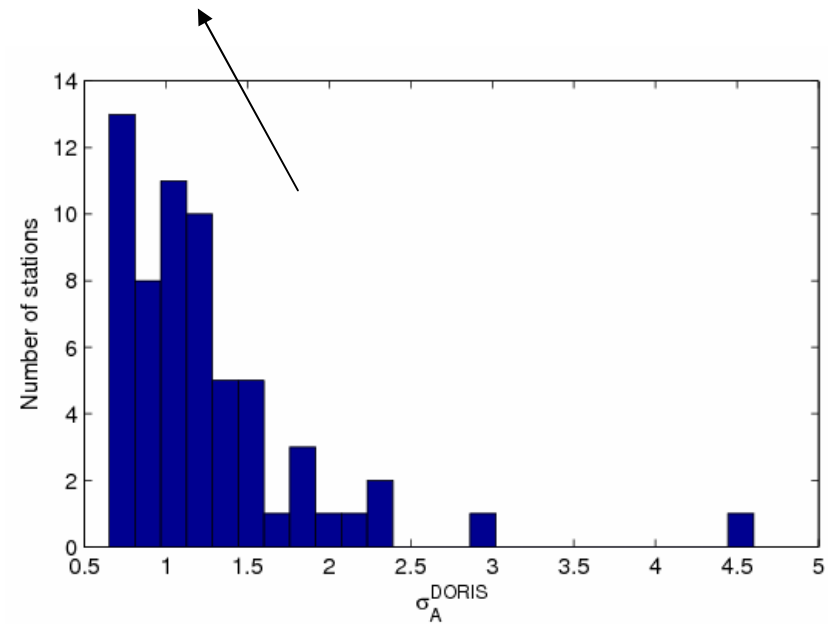
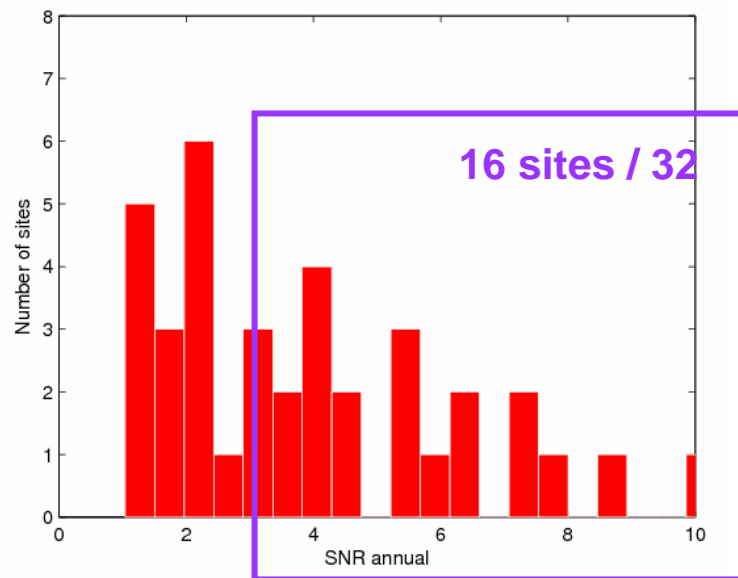
# Comparison with GPS, SLR and VLBI position time series

- DORIS annual signal has larger uncertainty in annual signal determination

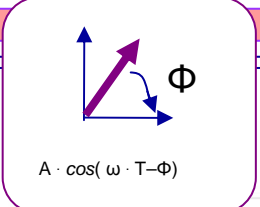
→ Investigate signal where SNR sufficiently large

We define

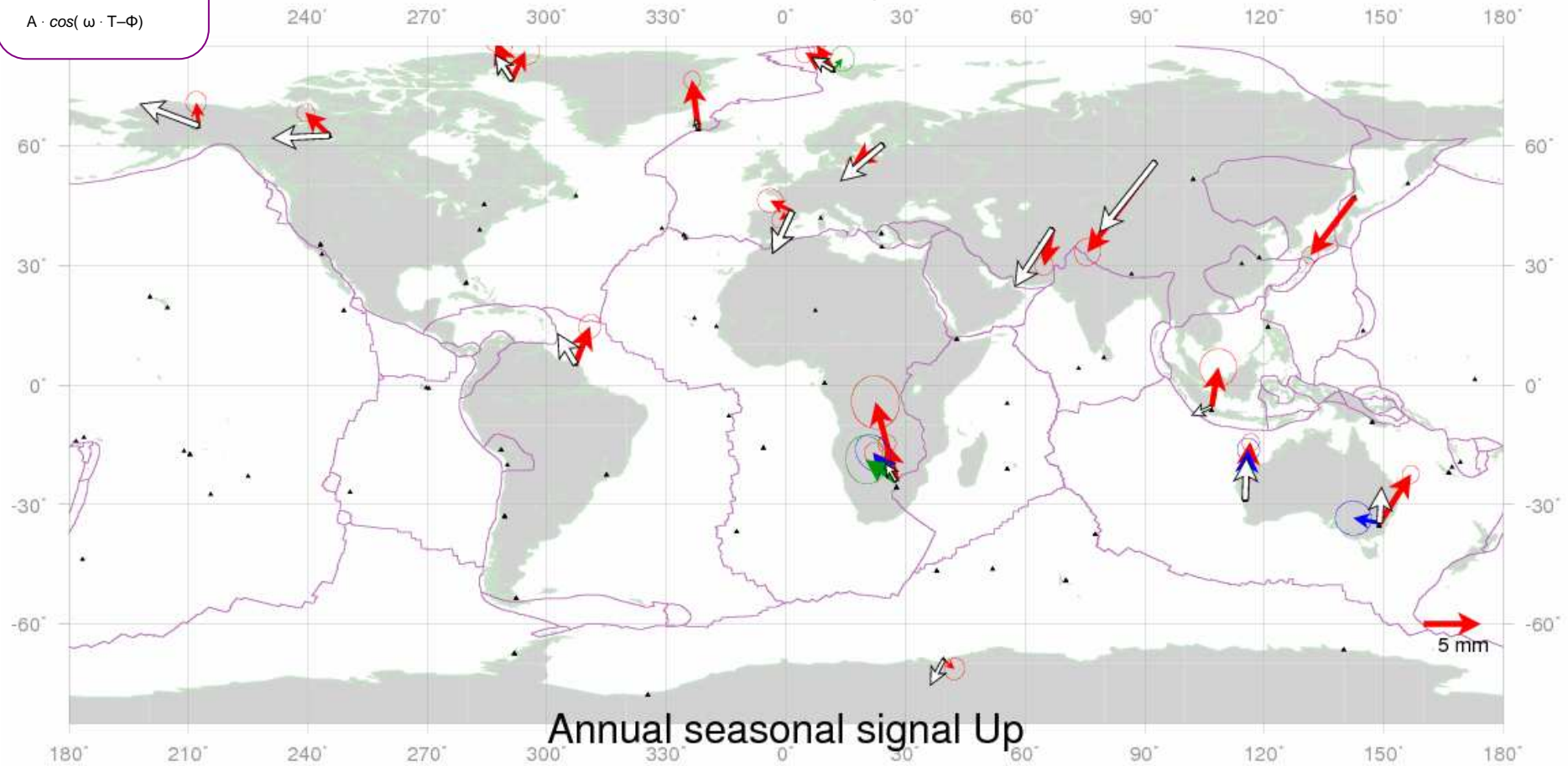
$$\text{SNR}_{\text{annual}} = \max(\hat{A}_{\text{gps}}, A_{\text{LOAD}}) / \sigma_A^{\text{doris}} > 3$$



# Comparison with GPS, SLR and VLBI position time series

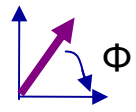
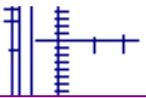


## DORIS co-located annual signal with SNR > 3



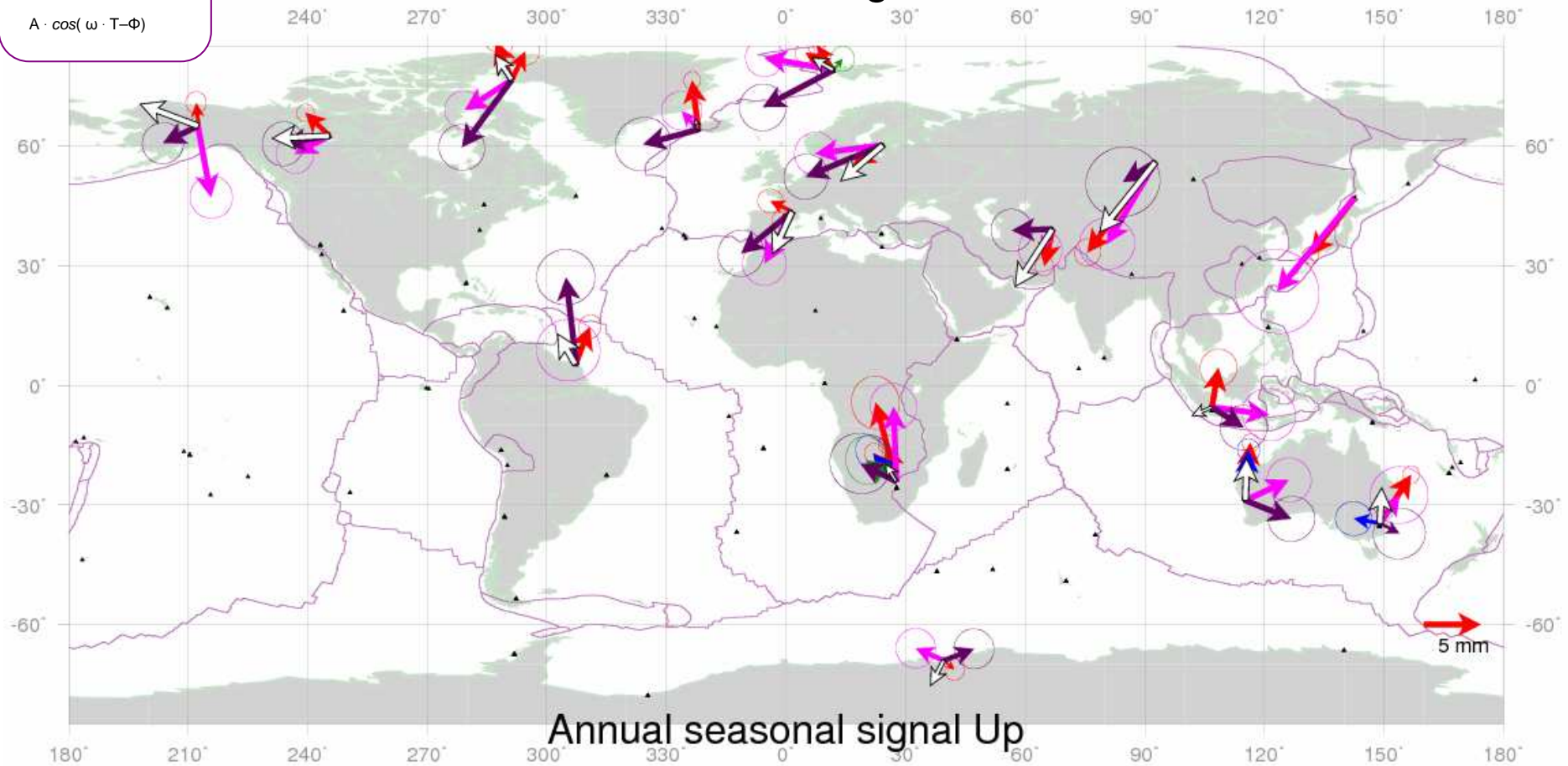
- IGS [GPS]
  - ILRS [SLR]
  - IVS [VLBI]
  - LOAD
- (Tonie van Dam)

# Comparison with GPS, SLR and VLBI position time series



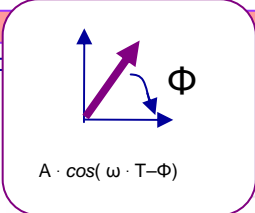
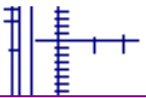
$$A \cdot \cos(\omega \cdot T - \Phi)$$

## DORIS co-located annual signal with SNR > 3

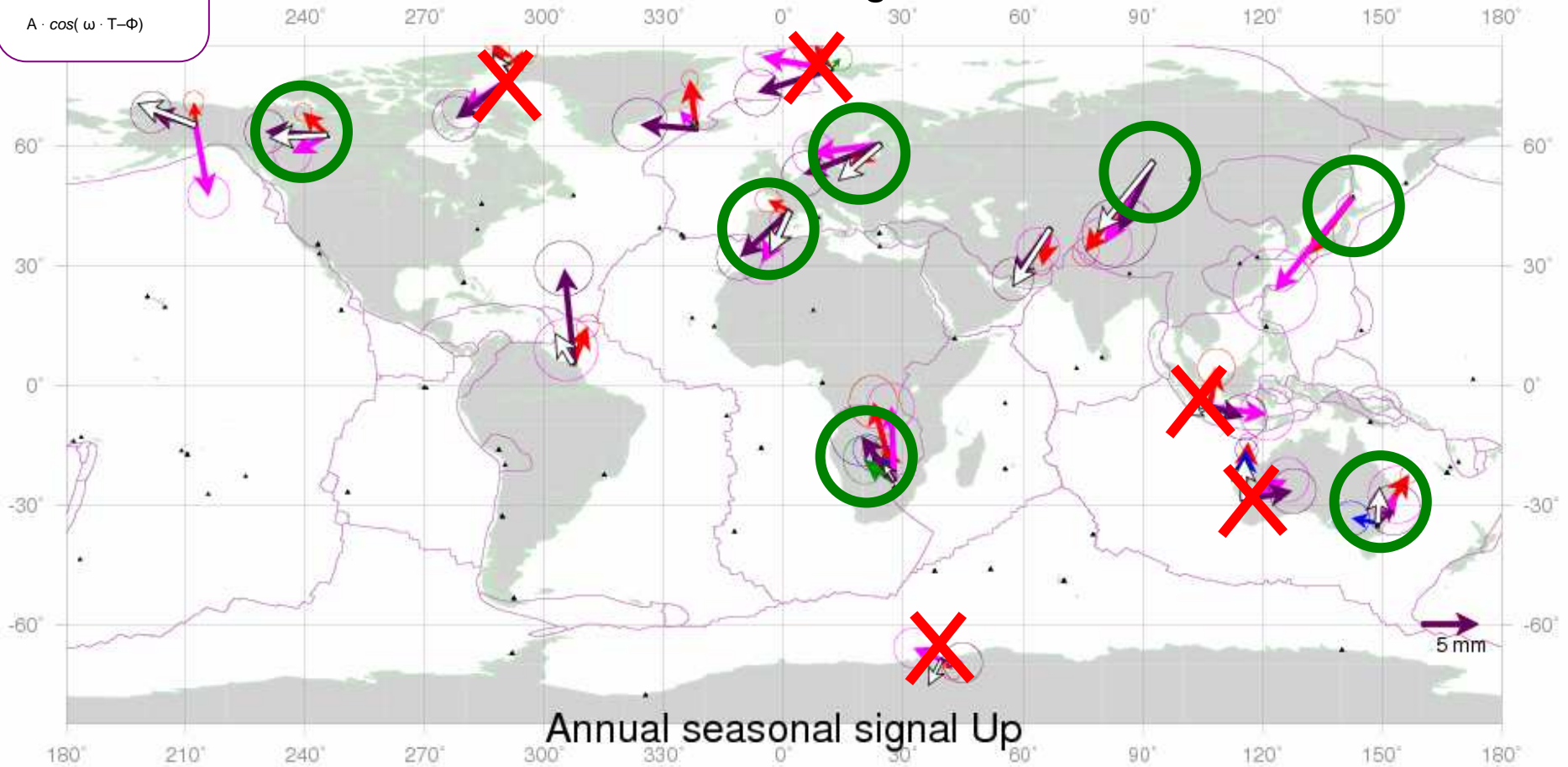


- IGS [GPS]
  - ILRS [SLR]
  - IVS [VLBI]
  - LOAD
  - IGN (wd07)
  - LCA
- (Tonie van Dam)

# Comparison with GPS, SLR and VLBI position time series



## DORIS co-located annual signal with SNR > 3

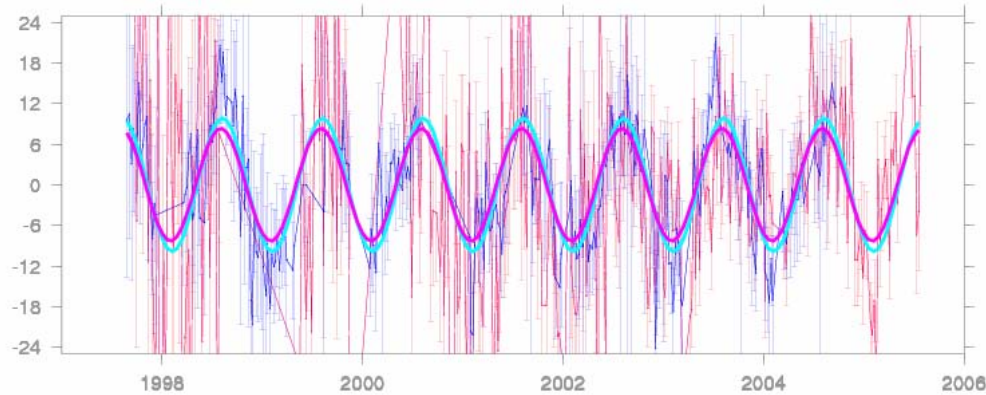


- IGS [GPS]
- ILRS [SLR]
- IVS [VLBI]
- LOAD (Tonie van Dam)
- IGN (wd07)
- LCA + ATM load (Tonie van Dam)



# Comparison with GPS, SLR and VLBI position time series

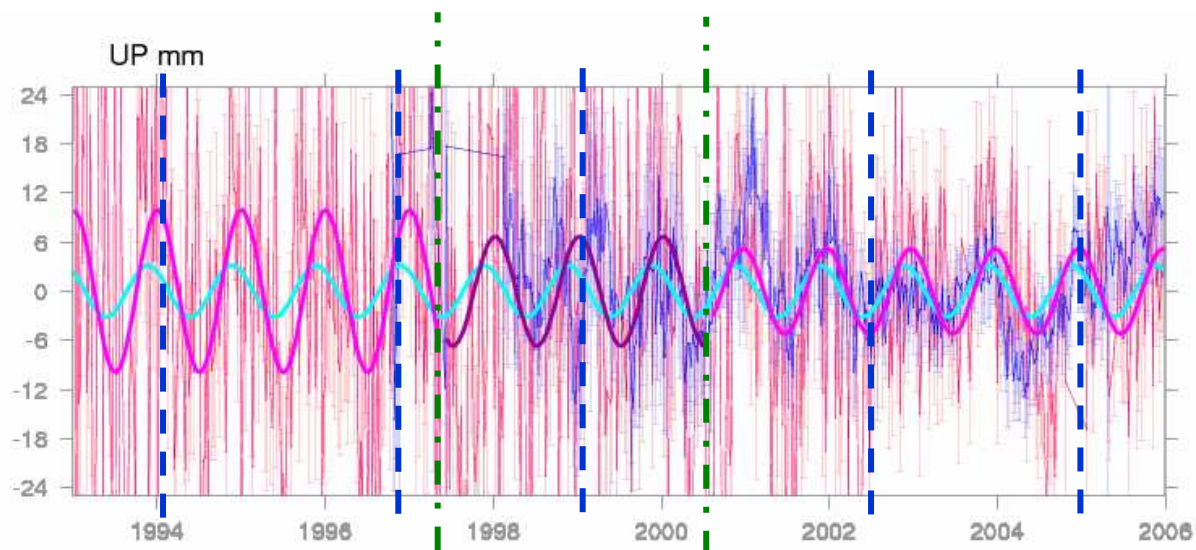
## Exemple : KRASNOYARSK



New IGN strategy  
Improves height  
annual signal

- IGN (wd07)
- IGS [GPS]

## Time-variable annual signal : HARTEBEEESTHOEK



Equipment changes

Satellite constellation  
changes

## CONCLUSION

- Better agreement in translation and scale for IGN and LCA ACs
- Agreement of the EOP time series at (1.6,0.8) mas WRMS for (xp,yp). High frequency signals need to be understood.
- Significant improvement in IGN position time series since ITRF2005
- Larger annual signal for DORIS height time series. Clear improvement for the most recent data. Some discrepancies between IGN and LCA ACs at the annual frequency
- Evidence of loading effect detection for few sites with sufficient SNR. Confirms *Mangiarotti et al., 2001* conclusions.

Thank you



CfP ITRF2008



Zuheir Altamimi  
IGN France



- Same strategy as for ITRF2005
- Inputs from TC under the form of time series
  - Station positions
  - Polar motion/rates
  - UT1 (VLBI)
  - LOD
- Full history of all techniques
  - Since the eighthies for SLR and VLBI
  - 1993 – 2008 for DORIS
  - GPS: at least 2000 – 2008
- No correction for any geophysical fluid loading effects

## CfP of ITRF2008: Schedule

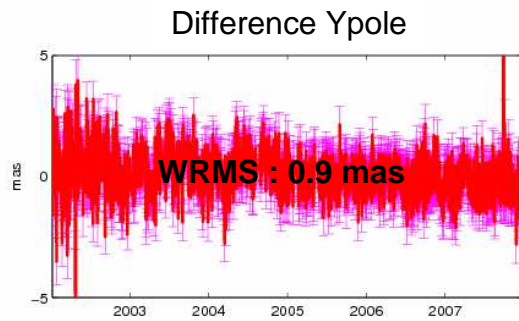
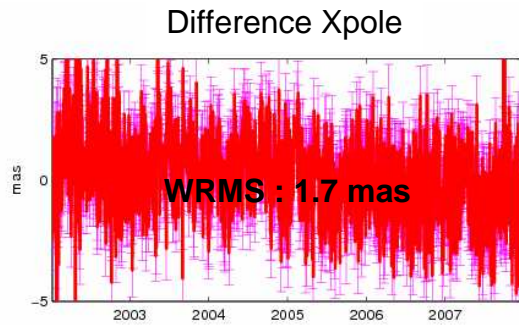
November 10, 2008	Dissemination of the Call
February 10, 2009	Deadline for submissions by Technique/Analysis Centers
April 19-24, 2009	EGU: First results - Discussion
Until May 10, 2009	Analysis by the ITRF CCs
May 10 - June 10, 2009	Preliminary ITRF2008 solution for evaluation by TCs/ACs
July 15, 2009	Final ITRF2008 solution

Thank you



# Result w.r.t ITRF2005

EOP difference IGN (wd07) minus LCA at the estimation epoch



F.T.

