

Combination of space geodesy techniques for monitoring the kinematics of the Earth

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- (5) Société Noveltis - Toulouse - France*
- (6) Société CLS - Toulouse - France*
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*Thanks to M. bougeard ⁽⁴⁾, M. Feissel ⁽⁴⁻¹⁾ and P. Sillard ⁽⁷⁾
for their interests in this work*

Summary



- 1- Objectives and organization*
- 2- Individual results*
- 3- Combination of observations*
- 4- Combination of individual solutions*
- 5- Prospects*

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Objectives and organization

□ Objectives

to prove the efficiency of space technique combinations for computation of Earth Orientation Parameters and Terrestrial Reference Frames

techniques used: *SLR, DORIS, GPS & VLBI*

parameters: polar motion (*x_p* and *y_p*), universal time *UT1-UTC*,

nutations corrections (every *6 hours*) and station positions (every *week*)

homogeneous computational framework

(*same software* used for all individual computations)

computations made over one year (*2002*)

□ Organization

two combinations: observations and individual solutions
Computations based on *GRGS's* experience and expertise

with teams of *OCA, CNES, IGN, Noveltis, CLS* and Paris' Observatory

work started in 2000 with P. Yaya's PhD (July 2002, 1st) under direction of N. Capitaine, D. Gambis (Paris' Obs.) and in

Summary



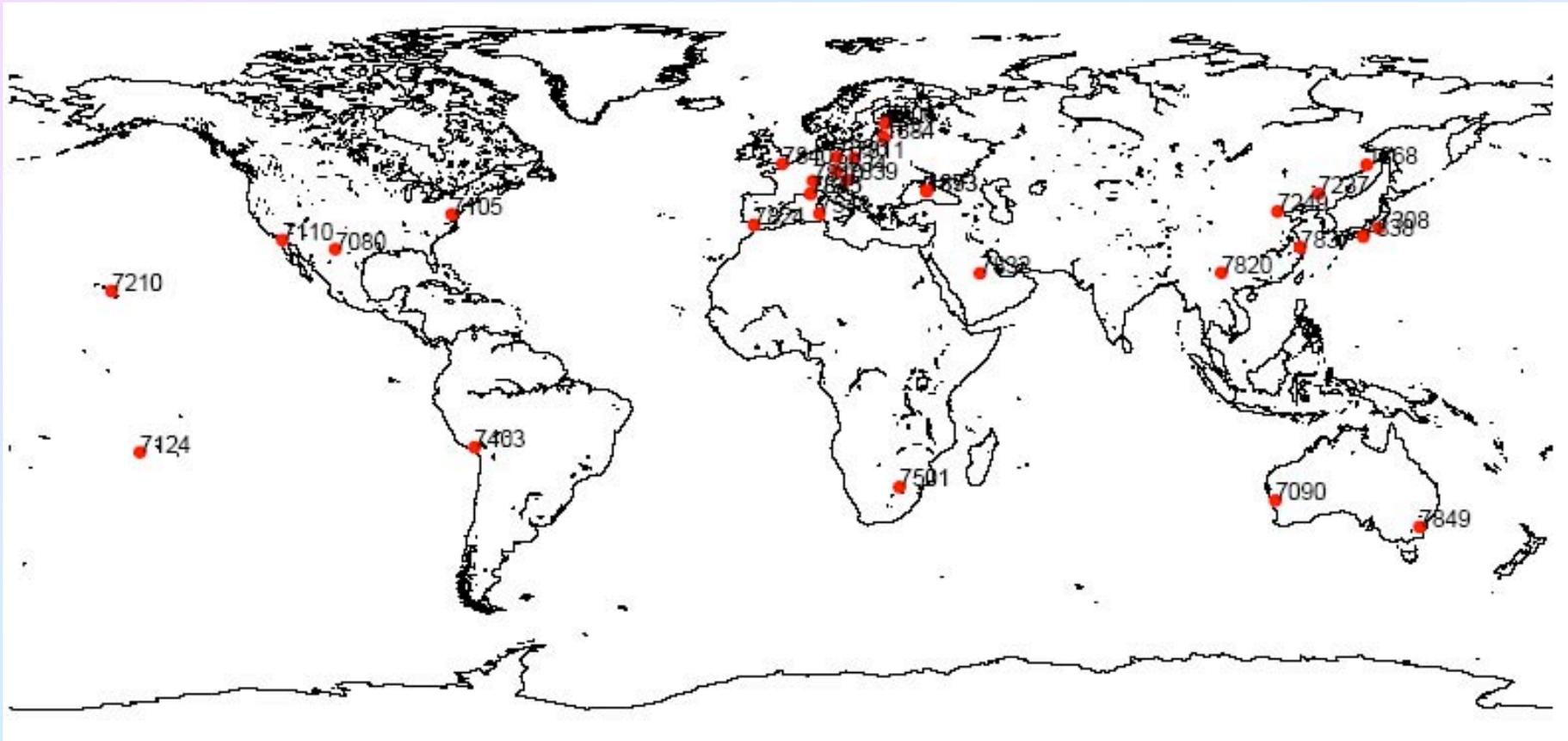
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Satellite Laser Ranging

OCA/GEMINI : P. Berio & D. Coulot

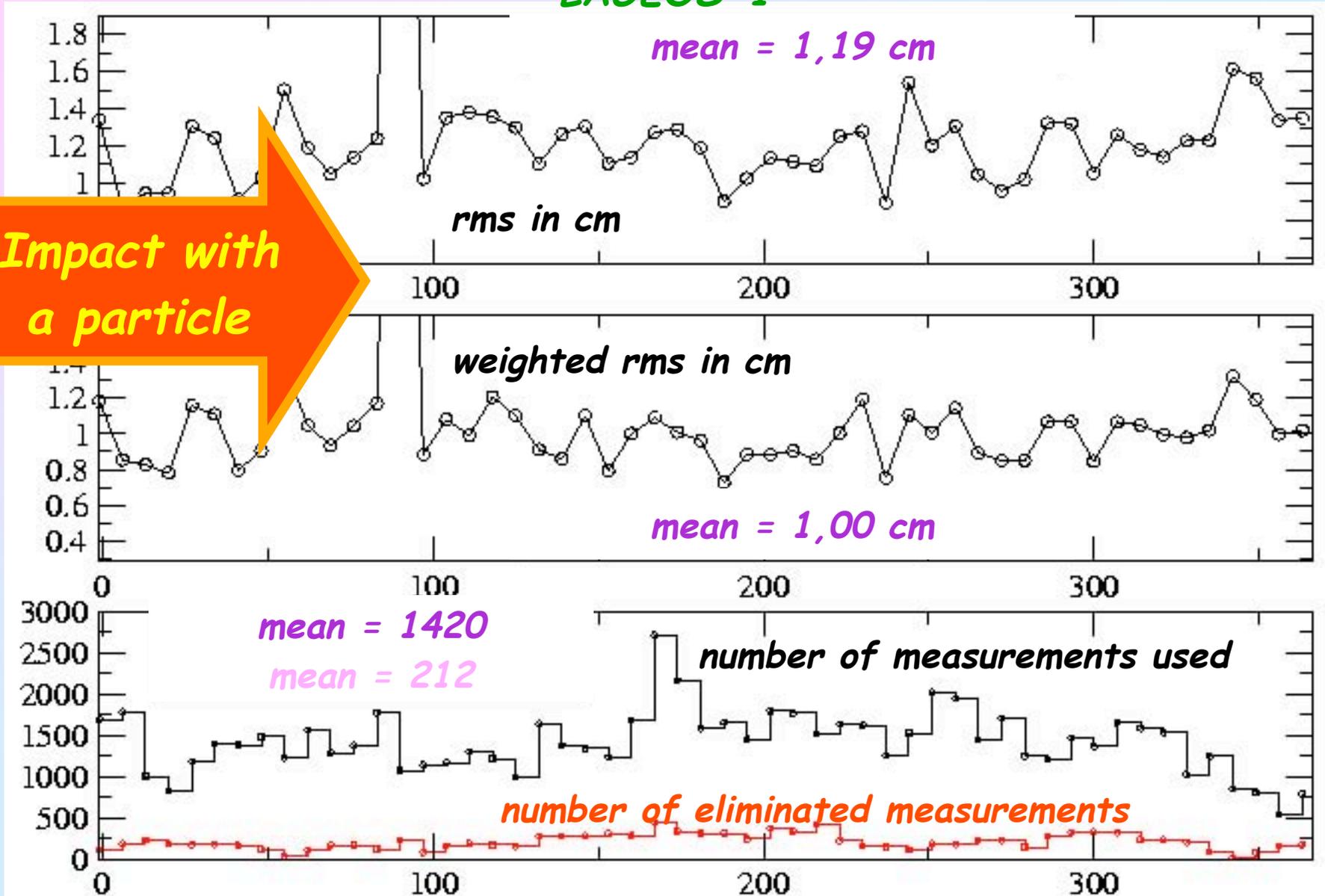
□ *Satellites LAGEOS-1 et -2 : 7-day orbital arcs*

*Hill's modelling for orbital errors on three components
(Radial, Along-track and Across-track)*



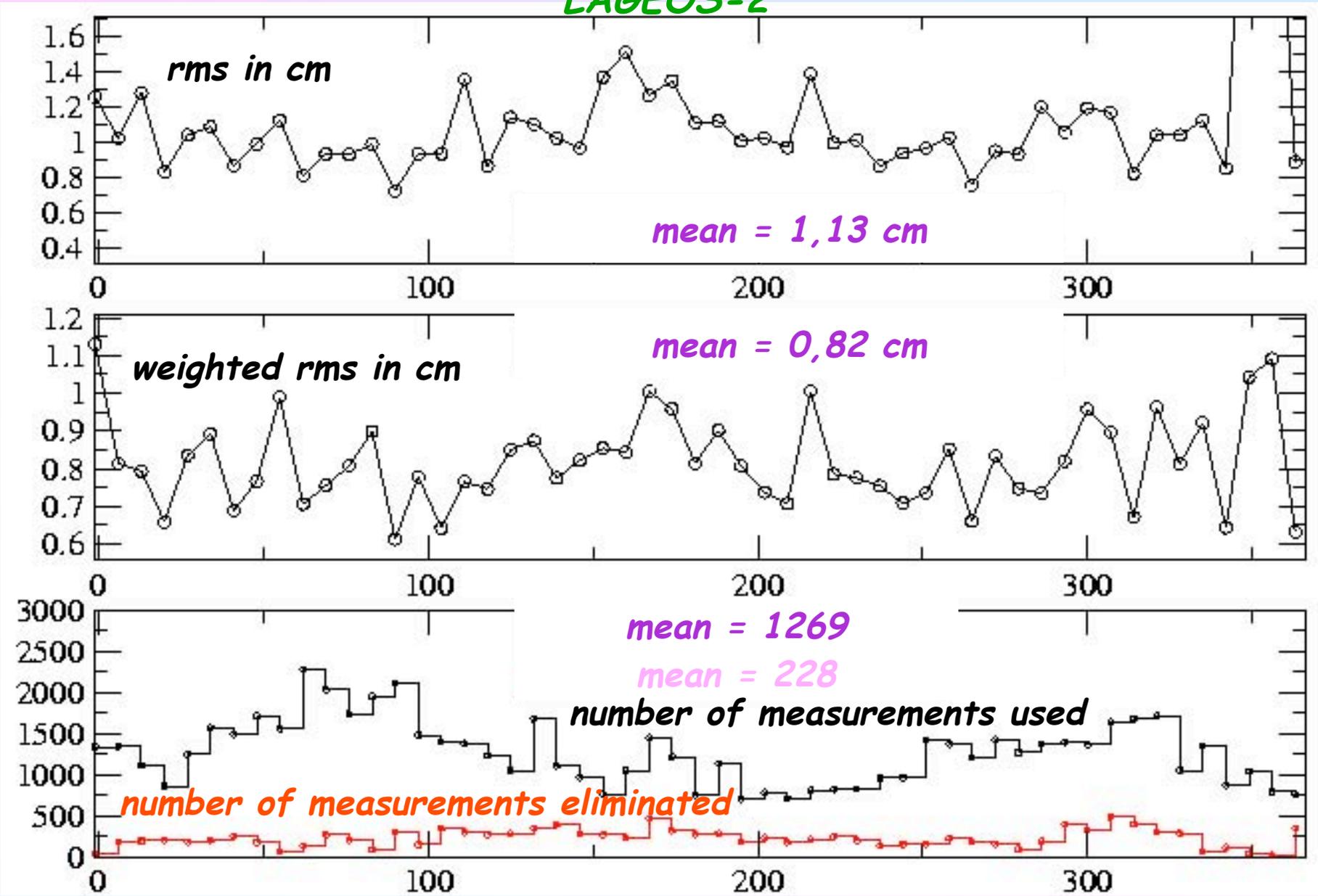
Station network

Satellite Laser Ranging LAGEOS-1



Day Of Year 2002

Satellite Laser Ranging LAGEOS-2



GPS

CNES/OMP/Noveltis : S. Loyer

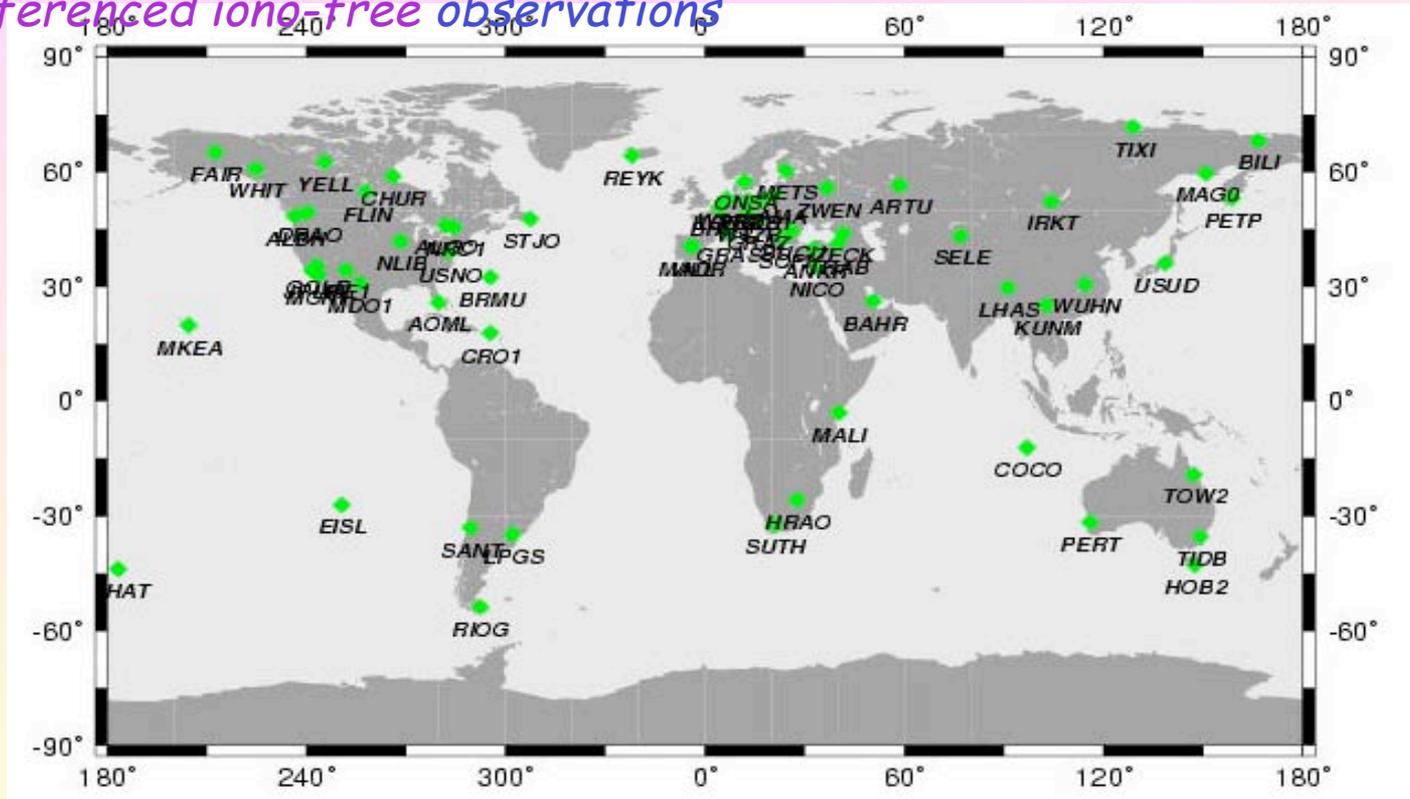
□ 2-day orbital arcs

□ Strategy

Solar Radiation Pressure : Bar-Sever 2003 for blocks II + 1 scale factor/day
+ Y-bias/day

Atmospheric drag neglected

Undifferenced iono-free observations

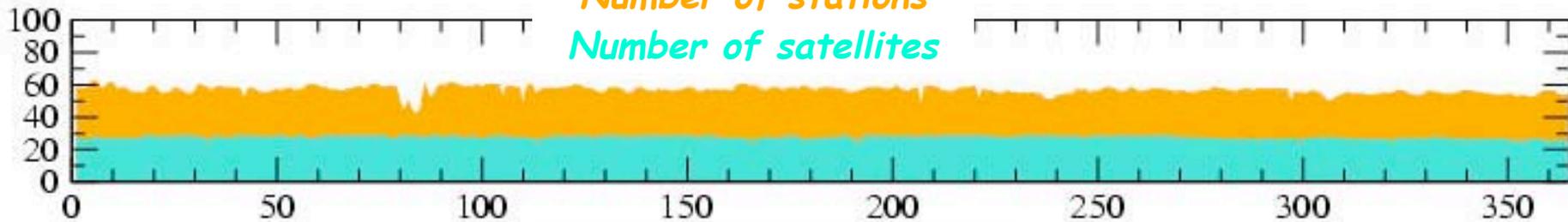


GPS

Average of orbit residuals and processed data per arc

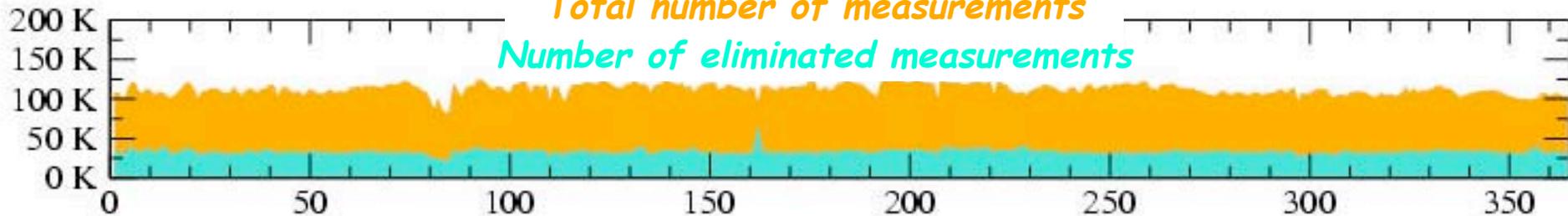
Number of stations

Number of satellites

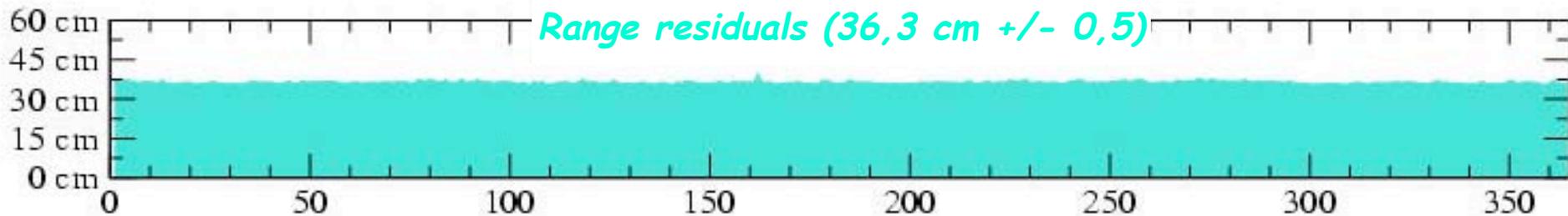


Total number of measurements

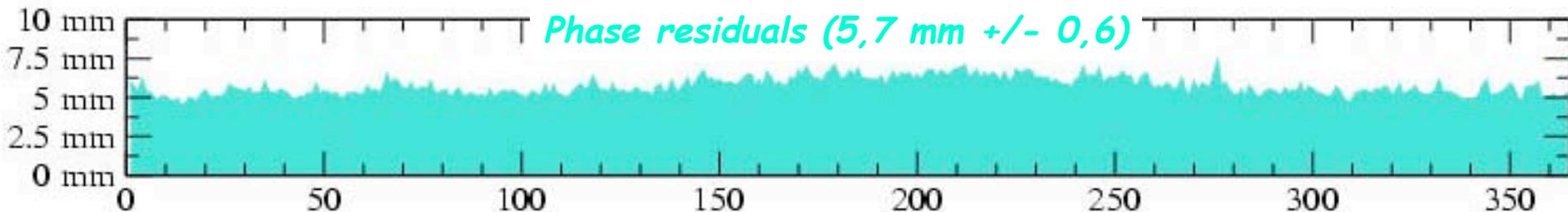
Number of eliminated measurements



Range residuals (36,3 cm +/- 0,5)



Phase residuals (5,7 mm +/- 0,6)



DORIS

CLS : L. Soudarin

- From Sun 06.01.2002 (GPS week 1148 day 0) to Sat 28.12.2002 (GPS week 1198 day 6)
- Arc length: 3.5 days starting on Sunday 0:00 or Wednesday 12:00 (between 1 and 3.5 days in case of orbit correction manoeuvres or data lacks)
- Satellites: SPOT2, SPOT4, TOPEX, SPOT5 (start 16.06.2002 = GPS week 1171 day 0) and ENVISAT (start 21.07.2002 = GPS week 1176 day 0)
- Reduced parameters: orbit drag coefficients, solar pressure coefficients, tropo



Station network

DORIS

Average of orbit residuals and processed data per arc

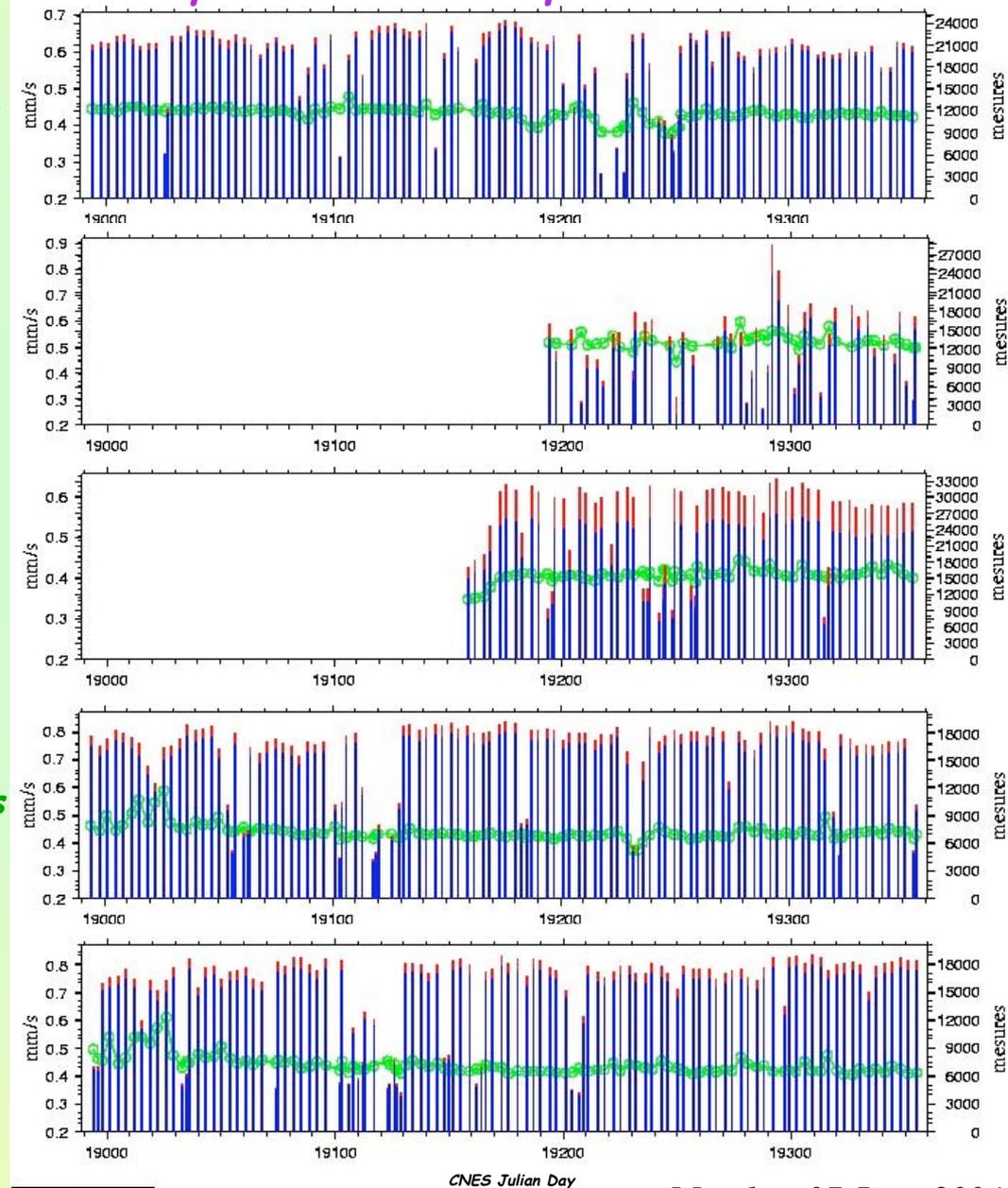
Topex: 106 arcs, residuals rms 0.44 mm/s
18763 measurements (752 rejected)

Envisat: 48 arcs, residuals rms 0.53 mm/s
11174 measurements (1754 rejected)

Spot5: 63 arcs, residuals rms 0.41 mm/s
20929 measurements (4926 rejected)

Spot4: 112 arcs, residuals rms 0.45 mm/s
14719 measurements (1018 rejected)

Spot2: 113 arcs, residuals rms 0.45 mm/s
14273 measurements (892 rejected)

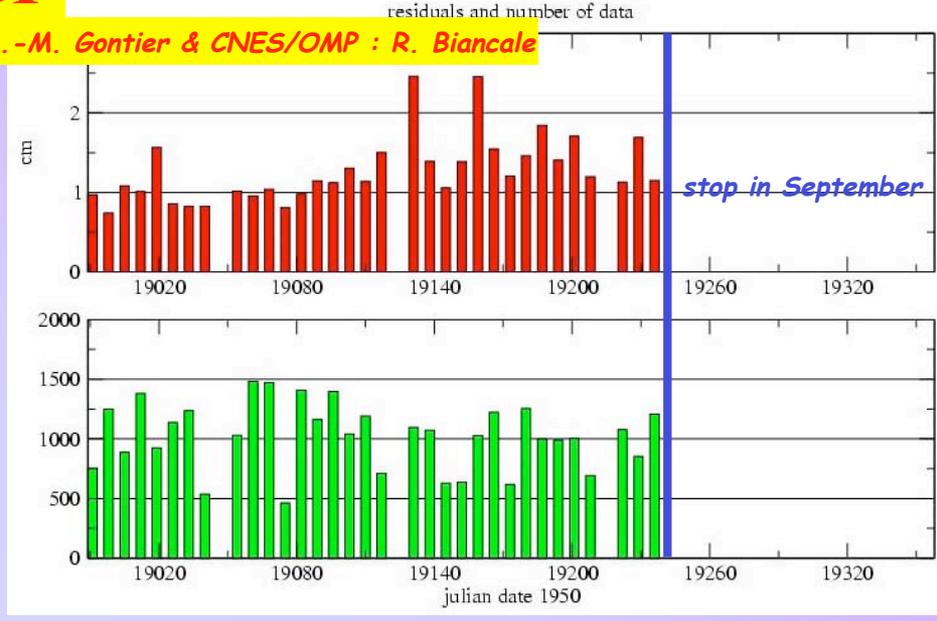
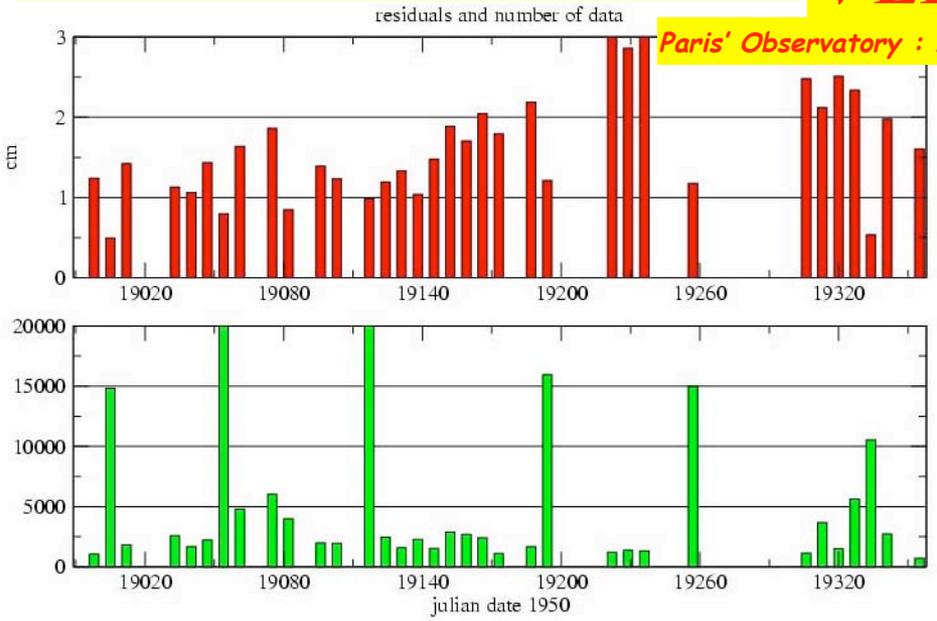


Session A : astronomical sessions

VLBI

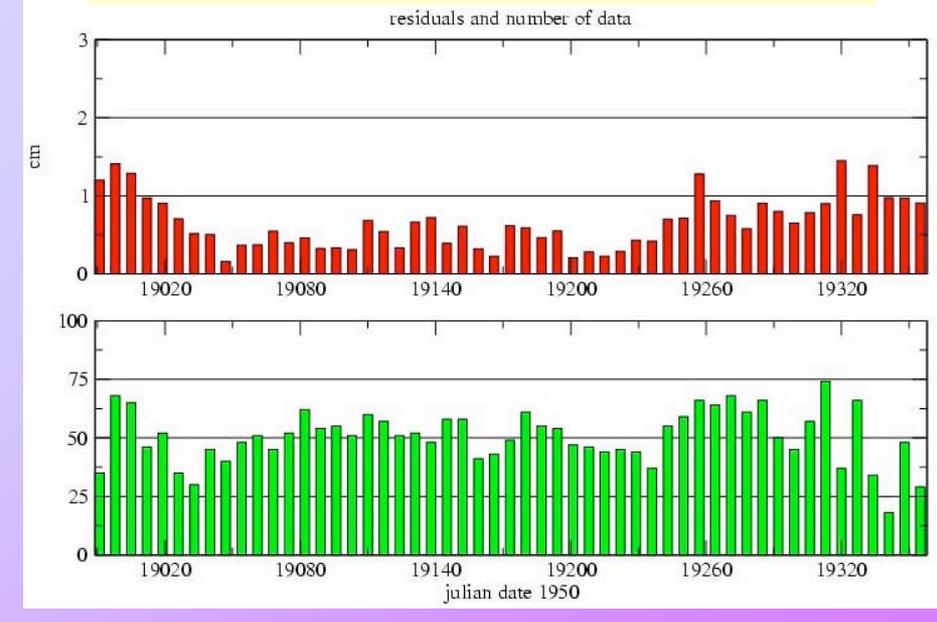
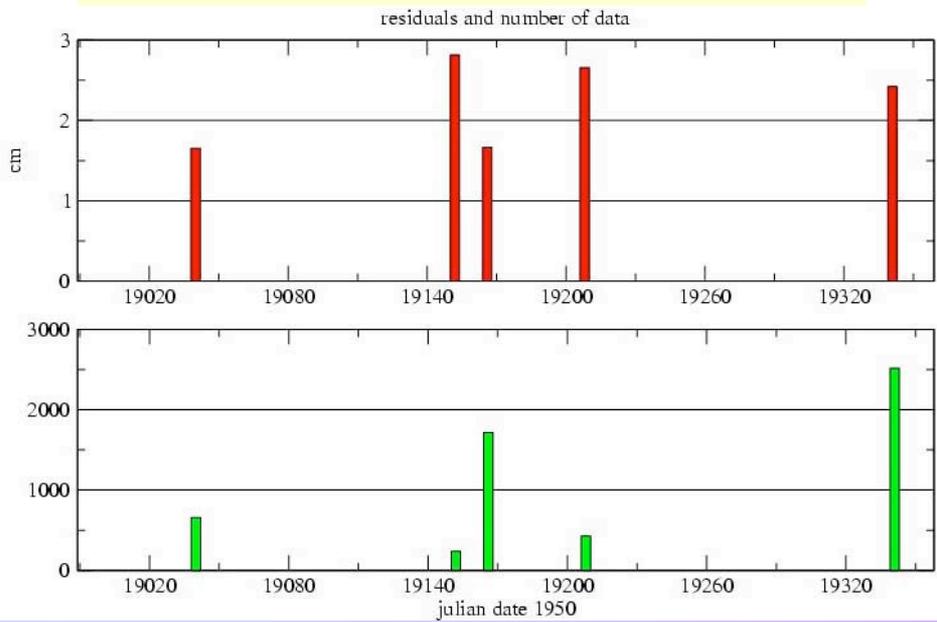
Session E : sessions dedicated to Earth's rotation

Paris' Observatory : A.-M. Gontier & CNES/OMP : R. Biancale



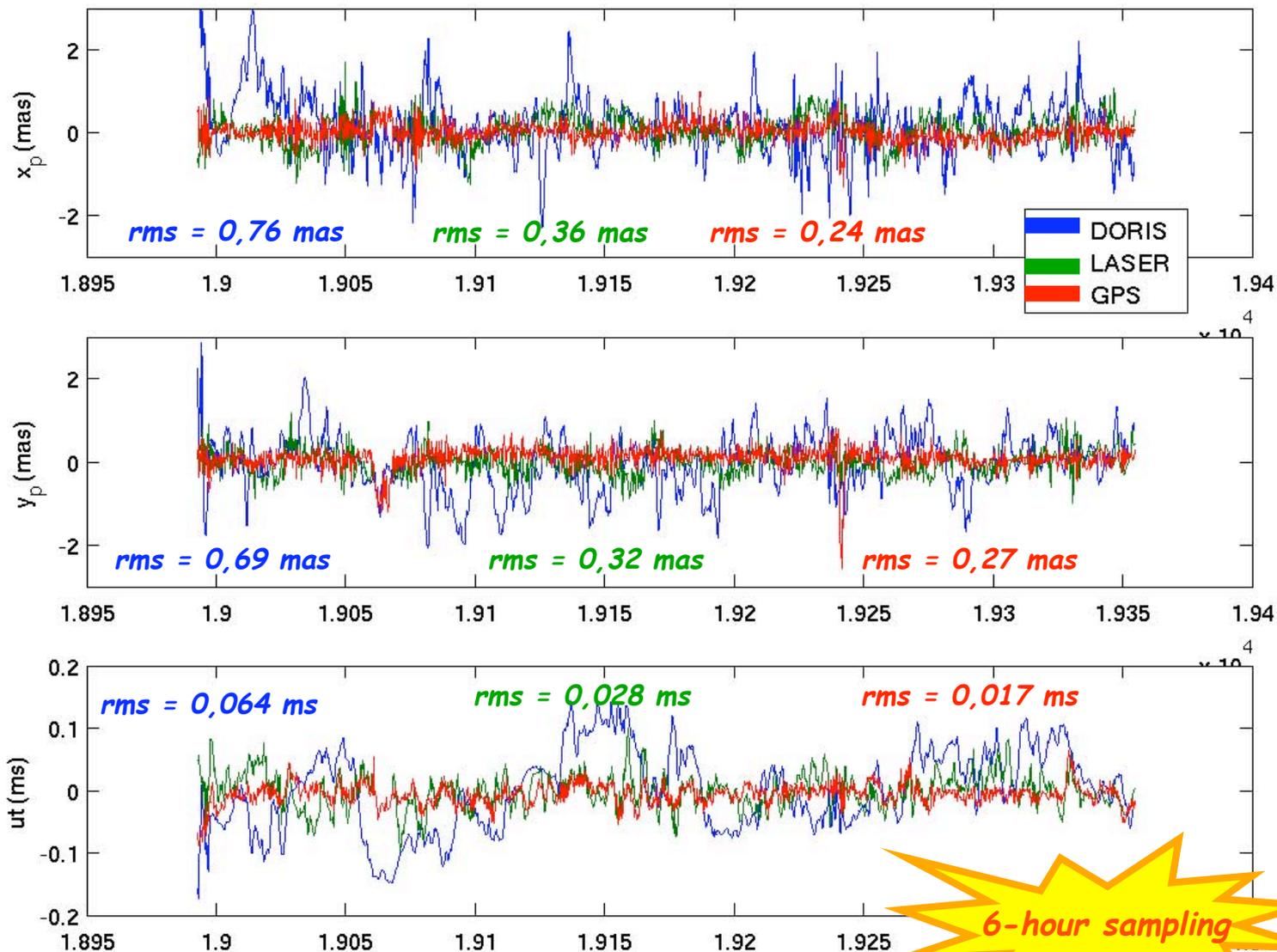
Session F : sessions of Japanese network

Session U : intensive sessions for baseline Kooke-Wettzell



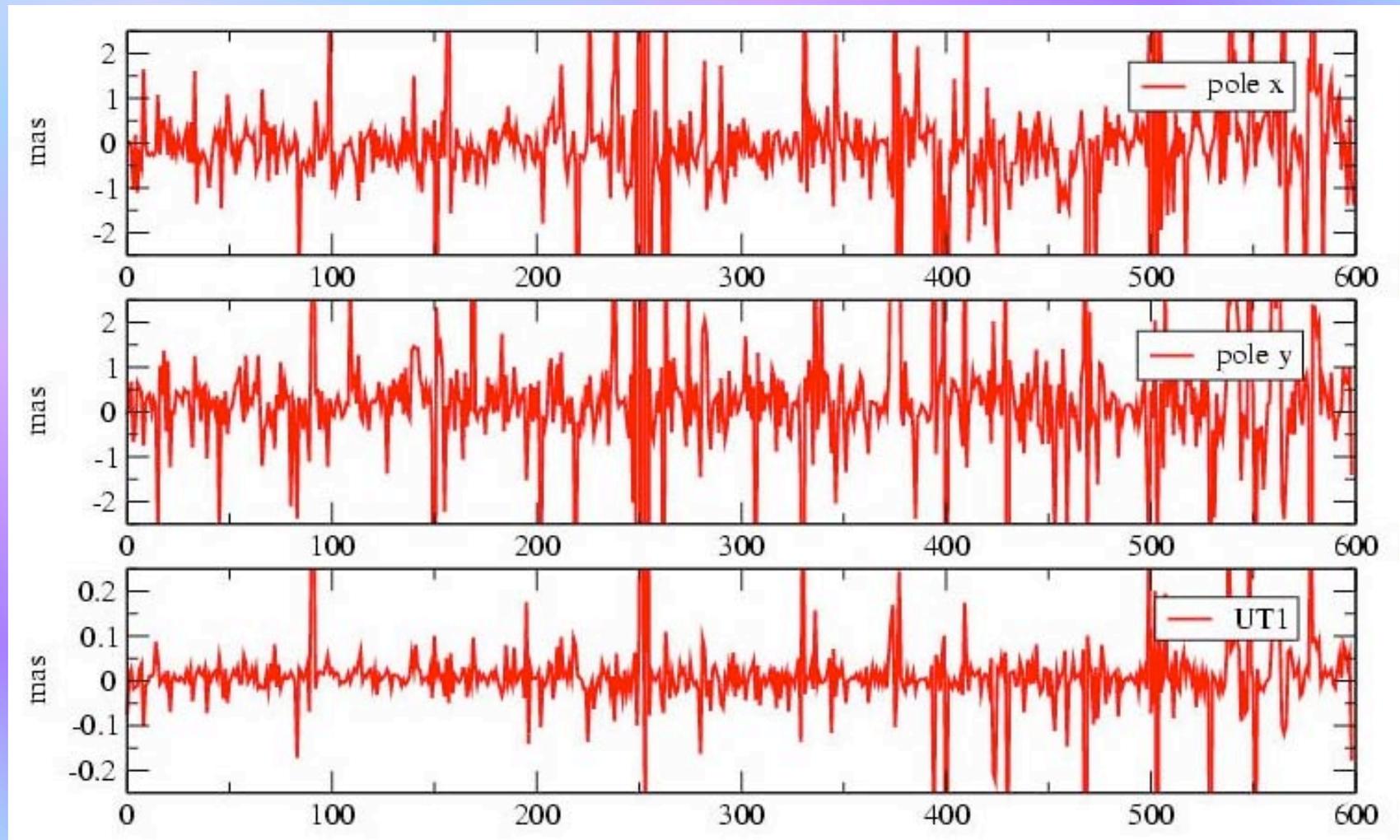
Results for EOPs : a priori = EOPC04

Minimal constraints on station positions and continuity constraints on EOPs



Results for EOPs : a priori = EOPC04

Results for VLBI (R. Biancale) - Constraints on EOPs



Time Index (6-hour sampling without time gaps)

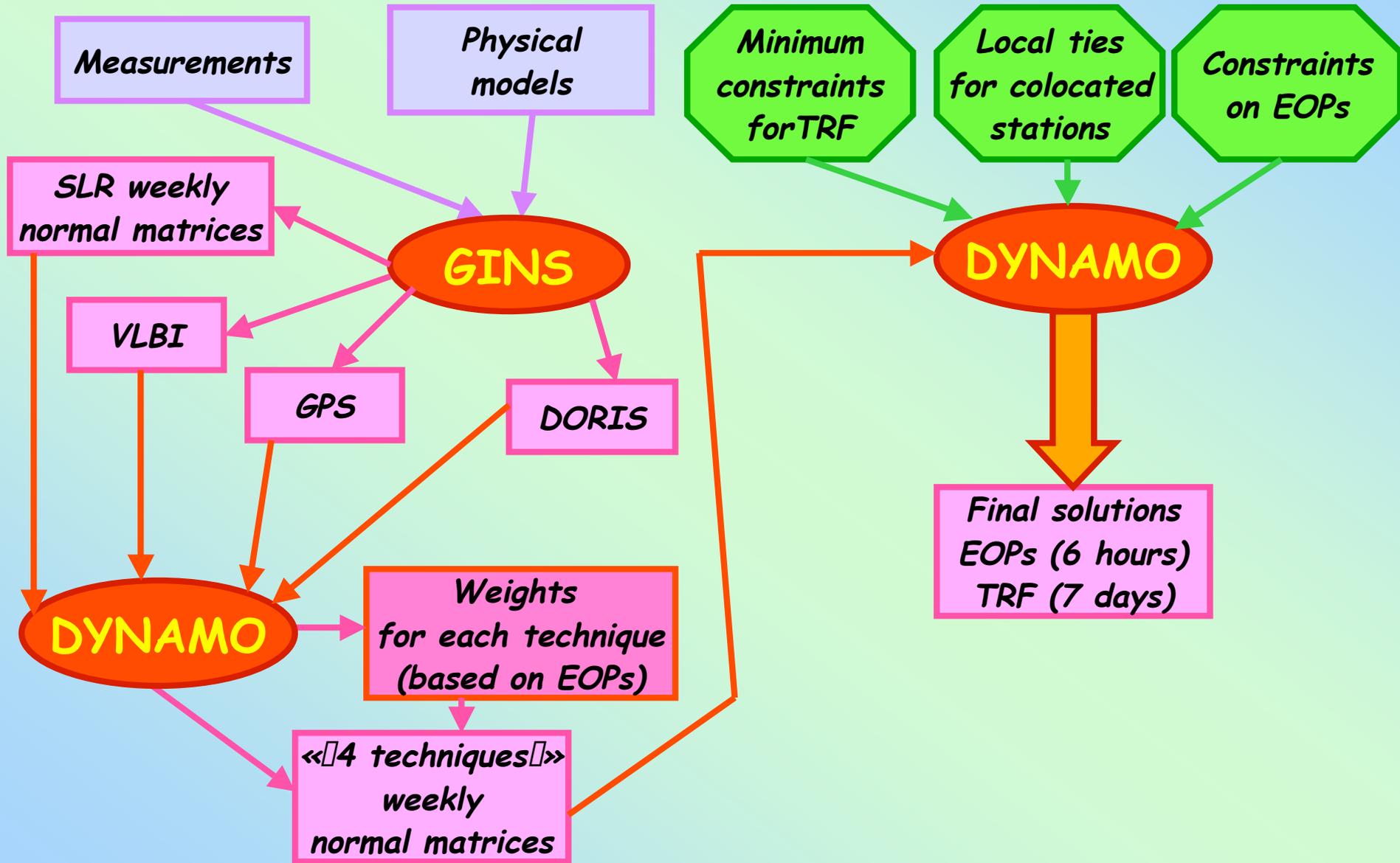
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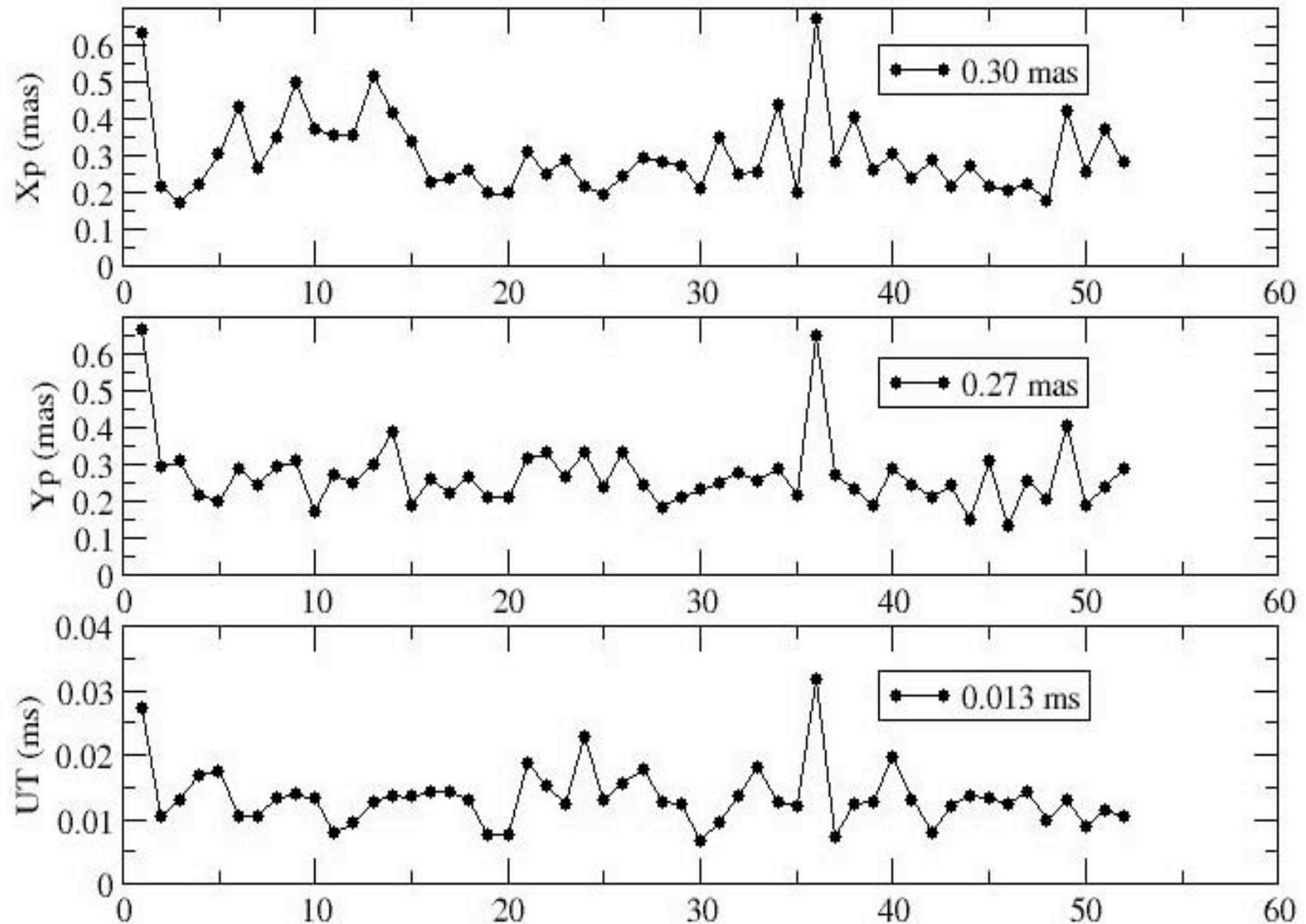
Combination of observations

Softwares *GINS* + *DYNAMO*



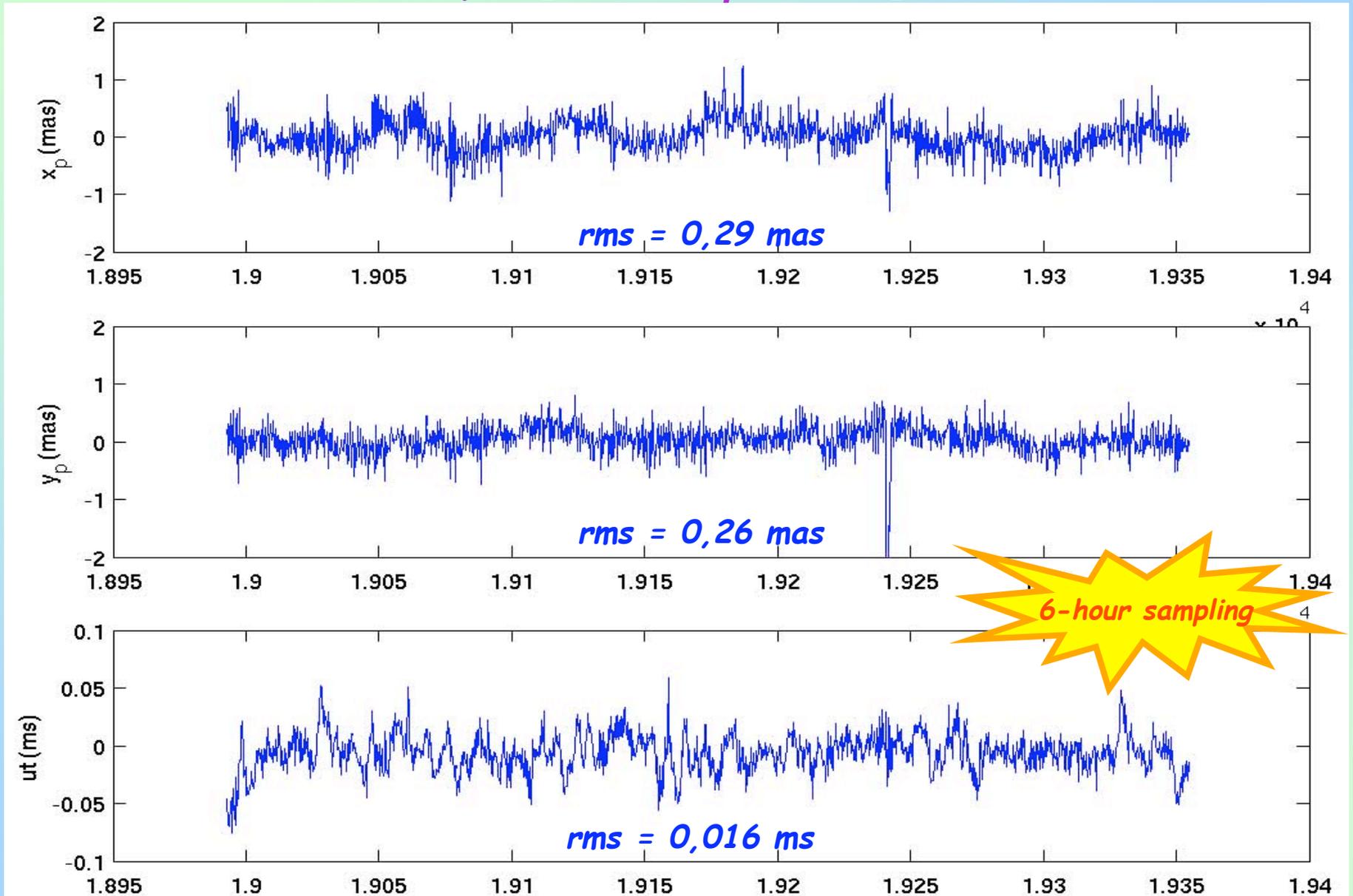
Combination of observations

Results for EOPs



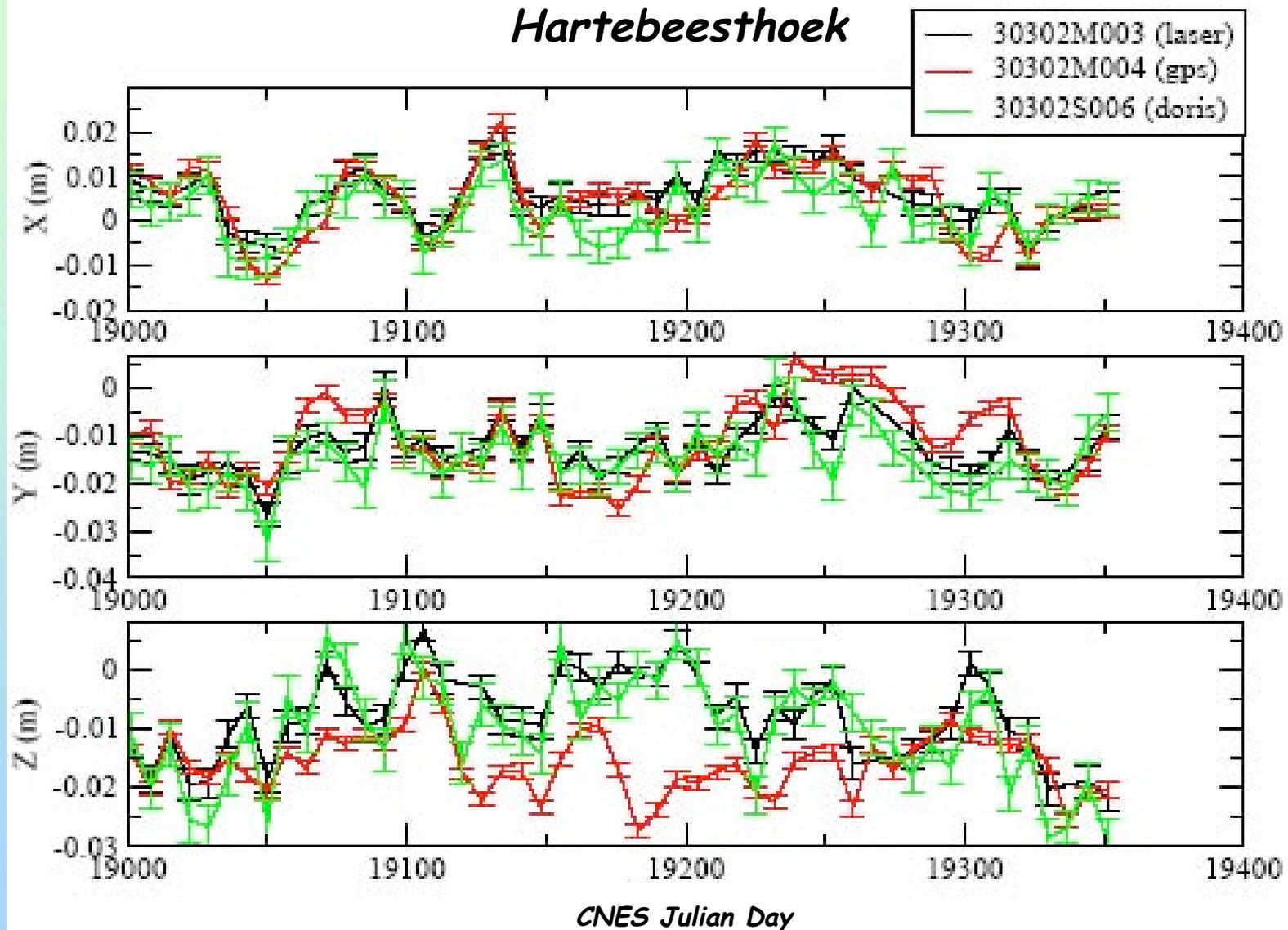
Combination of observations

Results for EOPs : a priori = EOPC04



Combination of observations

Results for colocated station positions : a priori = ITRF2000

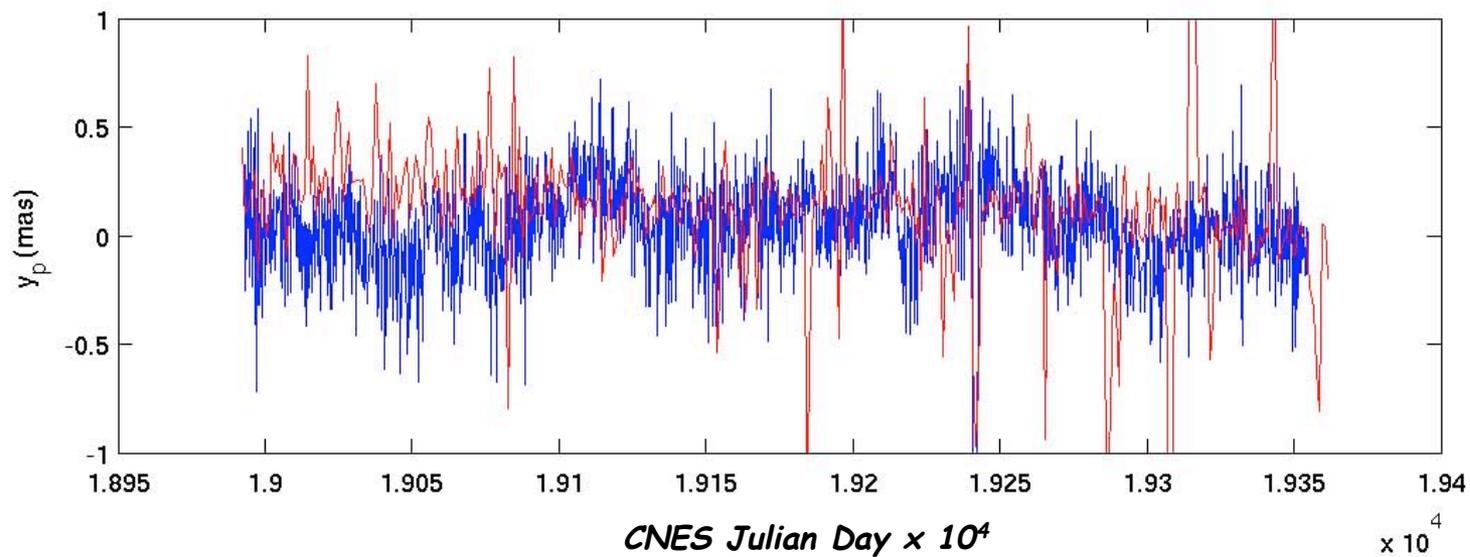
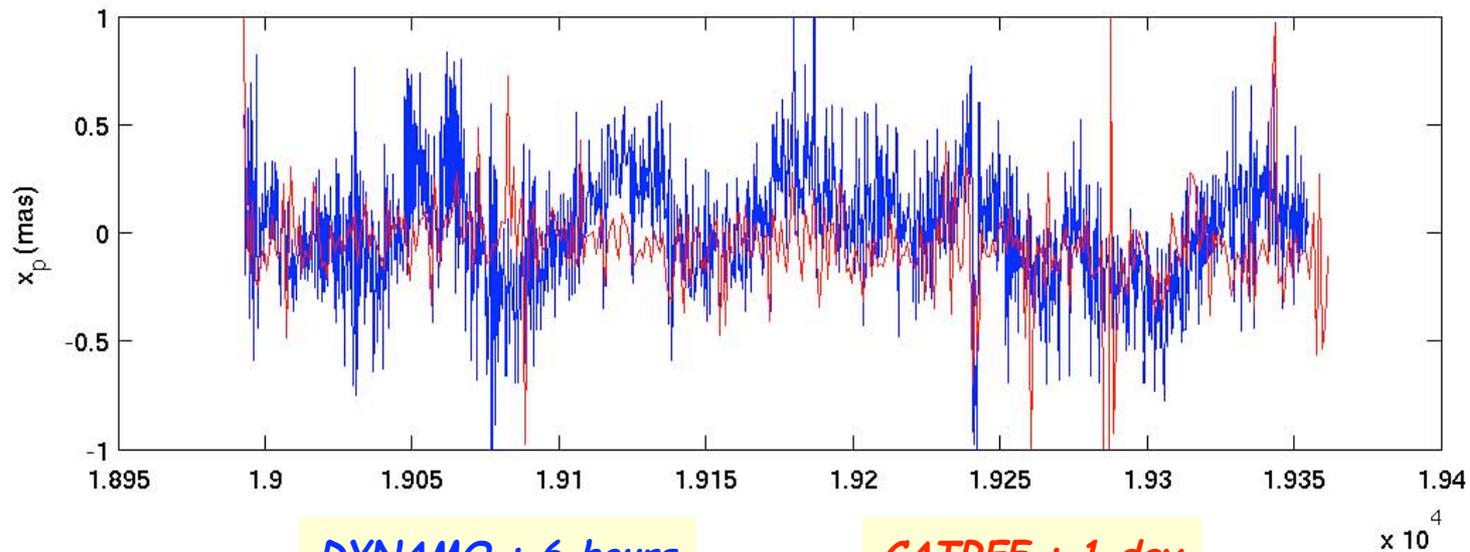


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Comparison of the two combinations



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Prospects

- *Work still in progress even if satisfying results*
 - => *include LLR in both combinations*
 - => *DYNAMO : combination with a daily sampling*
- *VLBI has to be further studied*
 - => *combination with UT1 in CATREF*
 - => *combination with nutation corrections in DYNAMO*
- *Weighting of individual techniques to be studied*
 - => *DYNAMO and CATREF*
- *Constraints on parameters*
 - => *continuity on EOPs not only every week but on year*
 - => *minimal constraints on a datum in DYNAMO*
- *Analysis of EOP and station position time series*
- *Study linked with the IERS pilot project in the future*