

# **Analysis of Terrestrial Reference Frame results from the IDS Analysis Campaign**

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# IDS Analysis campaign

**History**

**Participation**

**Means and method**

**Results**

**Preliminary analysis**

**Future**

# IDS analysis : history

- 1999-2000*      *IDS call for participation : 10 Analysis Center propositions  
but no analysis coordinator*
- Nov. 2001*      *IGN/CLS proposition to initiate the analysis with station coord./veloc.  
call for participation to an IDS analysis campaign (TRF) : 5 propositions  
preparation : Doris info (IDS ftp server), sinex and time series spec.,  
data centers coordination*
- March 2002*      *Martine Feissel is named as the coordinator  
other newly analysis initiatives :*
- orbits      : Henno Boomkamp (ESA)*
  - EOP        : Daniel Gambis (OBSPM)*  
*10 series on line (<http://hpiers.obspm.fr/eop-pc/>)*  
*J. Ray and M. Rothacher*
- geocenter : ?*

# IDS analysis campaign : participation

Group	Team – contact	Contribution to the station coordinates analysis
<b>IGN-JPL (France-USA)</b>	Pascal Willis (IGN) Yoaz Bar-Sever (JPL)	Multi-satellites Weekly solutions Monthly – global solutions
<b>INASAN (Russia)</b>	Suriya Tatevian Kuzin Sergey	Weekly solutions
<b>University of Texas/CSR (USA)</b>	John Ries	Topex/Poseidon satellite
<b>LEGOS/CLS (France)</b>	Jean-François Crétaux (LEGOS/GRGS) Laurent Soudarin (CLS)	Multi-satellites Monthly solutions (from 1993 until now) Global solution

## For operational use only

<b>SOD/CNES (France)</b>	Jean-Paul Berthias Alfred Piuze, Adèle Guitard	3 days multi-satellites solution a few days delay for station network control
<b>SSALTO/CLS-CNES (France)</b>	Jean-Jacques Valette	Monthly/weekly multi-satellites solutions (routine process 48 h delay) for station network control

# IDS analysis campaign : submitted solutions

<i>Analysis Center</i>	<i>Data Span</i>	<i>Solution*</i>	<i>Satellites</i>	<i>Constraints</i>
<i>IGN-JPL (IGN)</i>	<i>1993-2001</i>	<i>w/m</i>	<i>Spot2/3/4 Topex</i>	<i>Minimum</i>
<i>INASAN (INA)</i>	<i>1999-2001</i>	<i>w</i>	<i>Spot2/3/4 Topex</i>	<i>Minimum</i>
<i>LEGOS-CLS (LCA)</i>	<i>1993-2001</i>	<i>m/g</i>	<i>Spot2/3/4 Topex</i>	<i>Loose (1 m)</i>
<i>[CSR (CSR)</i>	<i>2002</i>	<i>m</i>	<i>Topex - Jason prepared but not submitted]</i>	
<b><u>for operational use, calculation within a week delay</u></b>				
<i>SOD (SOD)</i>	<i>June 2001</i>	<i>w</i>	<i>Spot2/3/4 Topex</i>	<i>Loose (1-10m)</i>
<i>SSALTO (SSA)</i>	<i>since Jan.2001</i>	<i>w/m</i>	<i>Spot2/4 Topex/Jason</i>	<i>Non removable</i>

**\* w : week, m : month, g : global**

# Means and Method

CATREF IGN/LAREG software (Z. Altamimi & P. Sillard) :

**comparison/combination of stations positions and velocities (Helmert Transf.)  
physical and statistical models**

TRF definition for each submitted solution :

**epoch is the median of data set**

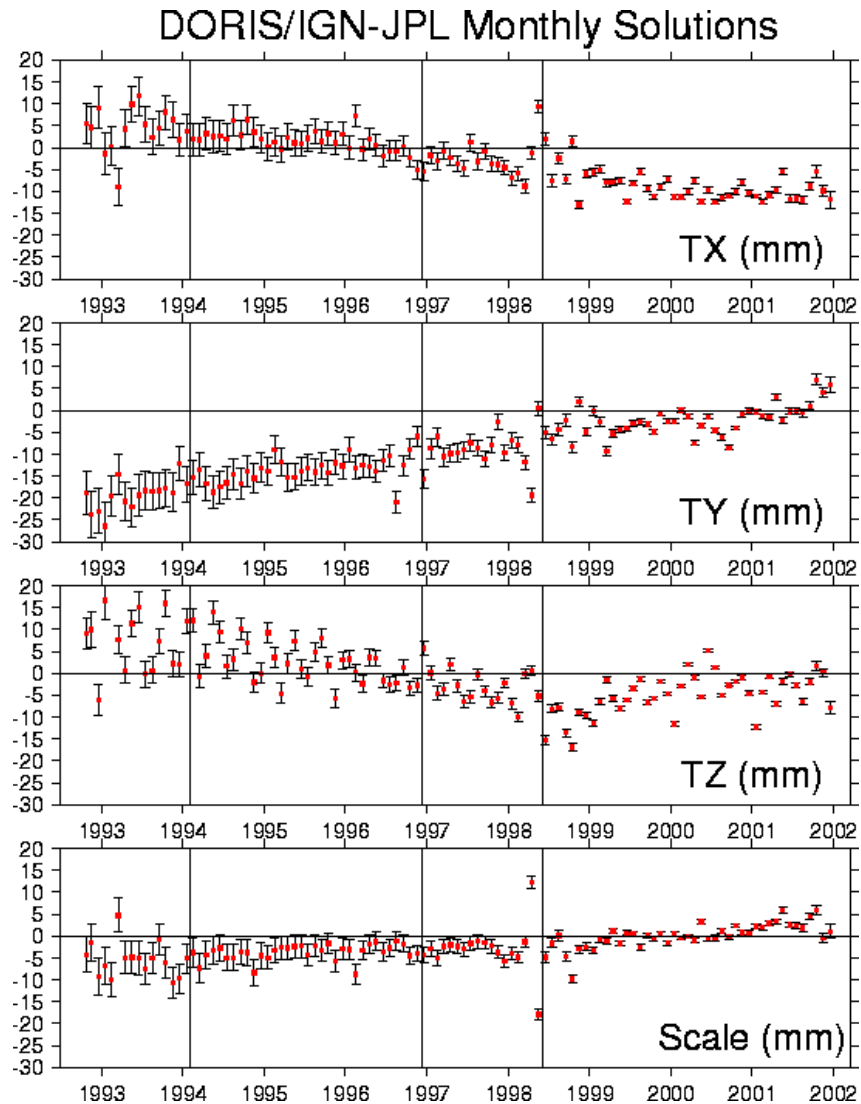
**constraints :**

	<b>removable (10<sup>-5</sup>)</b>
	<b>loose (&gt; 1 m, 10 cm/y)</b>
	<b>minimum</b>

Analysis work :

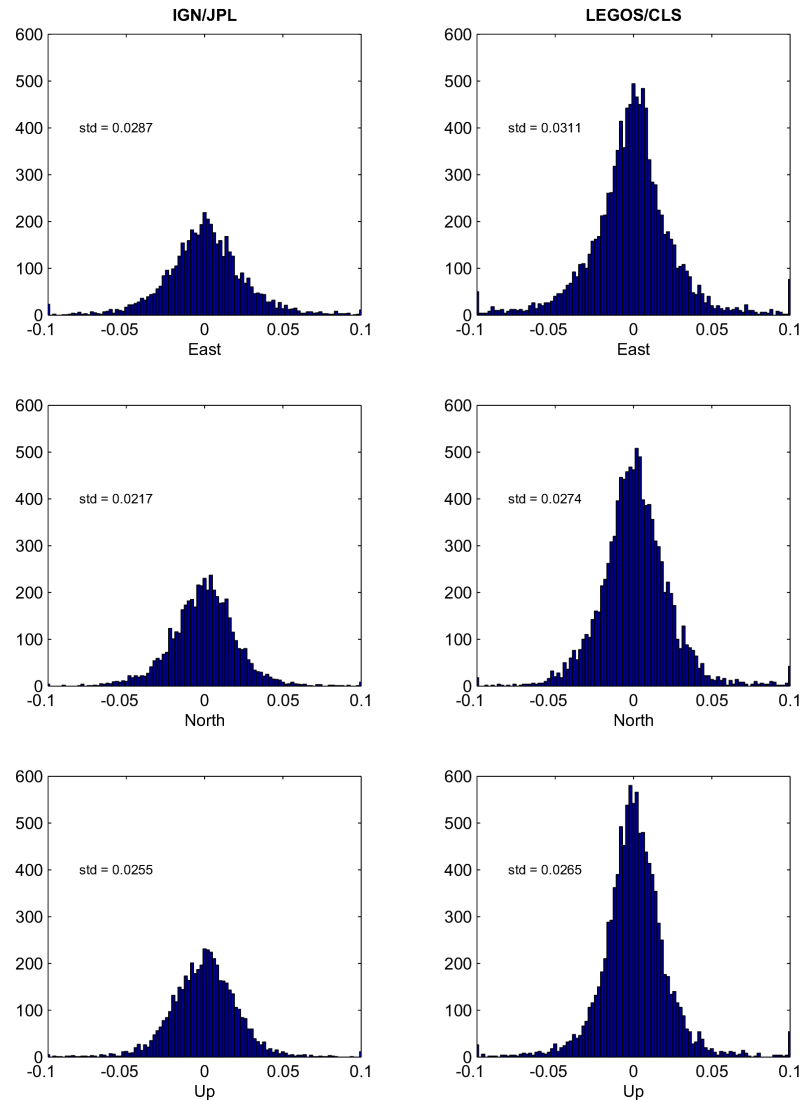
focus on internal consistency  
users need (system information, new stations, Jason,...)

# Transformation parameters



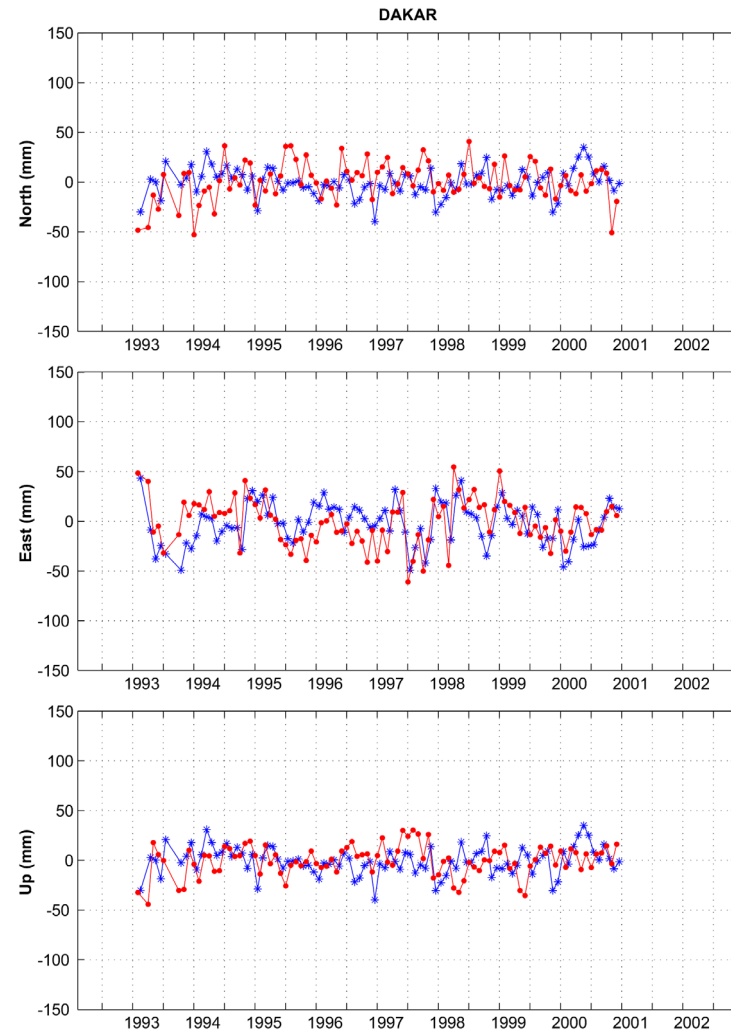
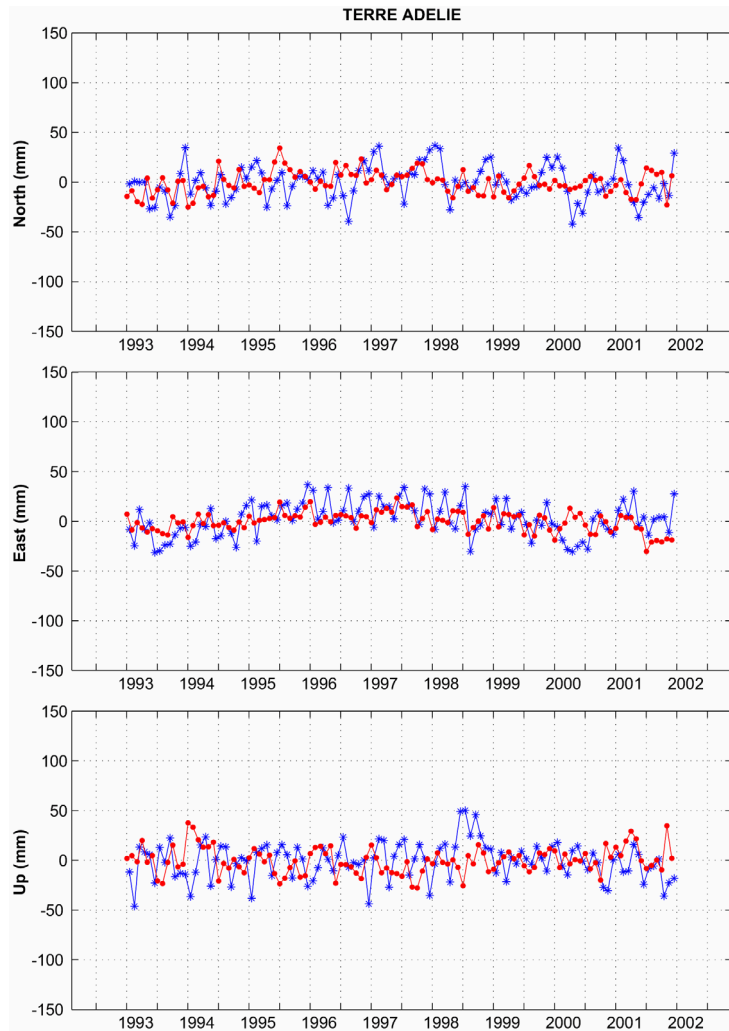
*ITRF2000 projection*

# 3D residuals histogram - monthly solutions





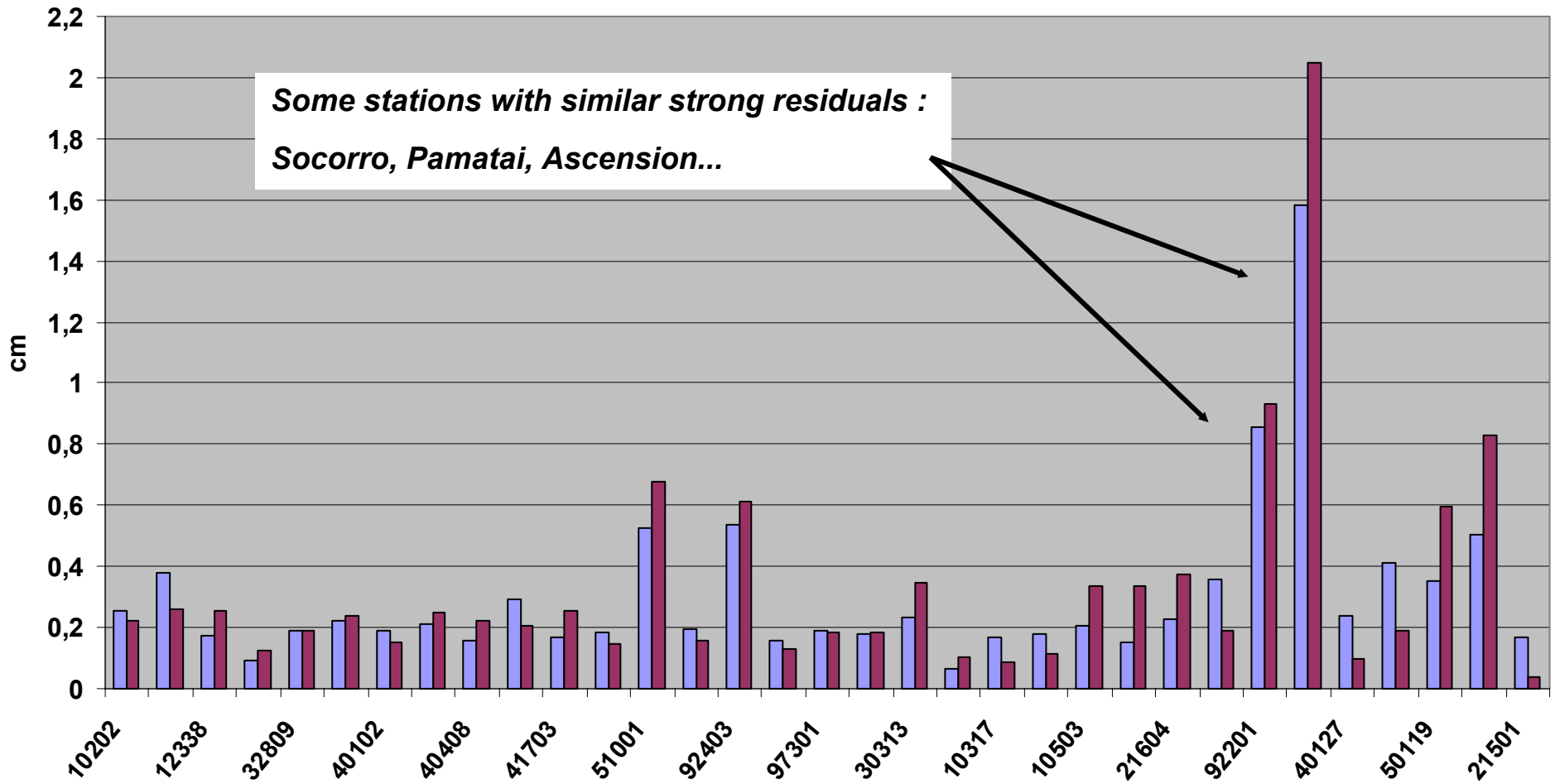
# Monthly time series



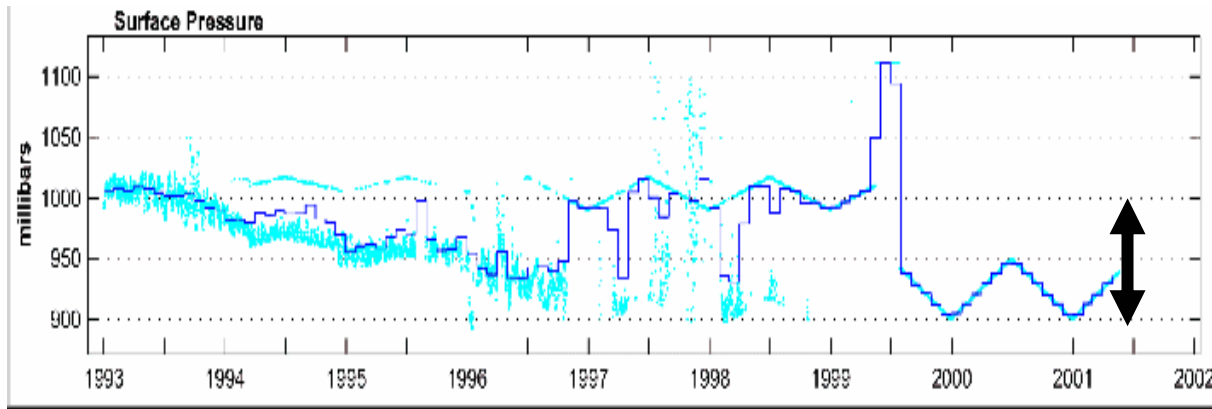
# station analysis

Station monthly solutions : mean of 3D residuals

IGN / JPL    LEGOS / CLS



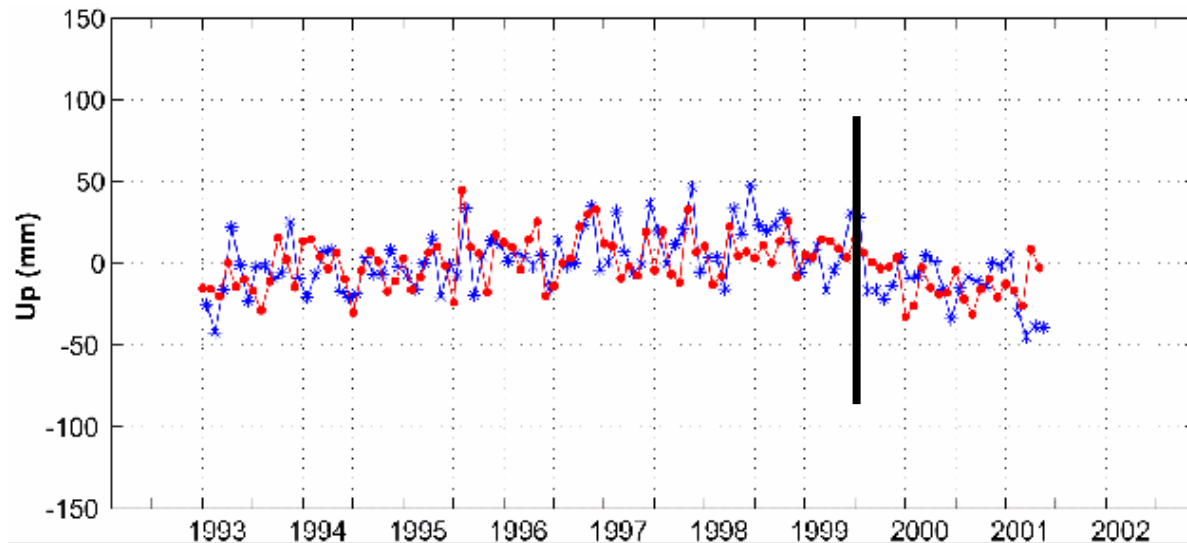
# Tristan da Cunha : troposphere estimation problem?



*100 mb drift of the pressure sensor  
from 1993 until 1998*

*1mb is equivalent to 10 m in altitude*

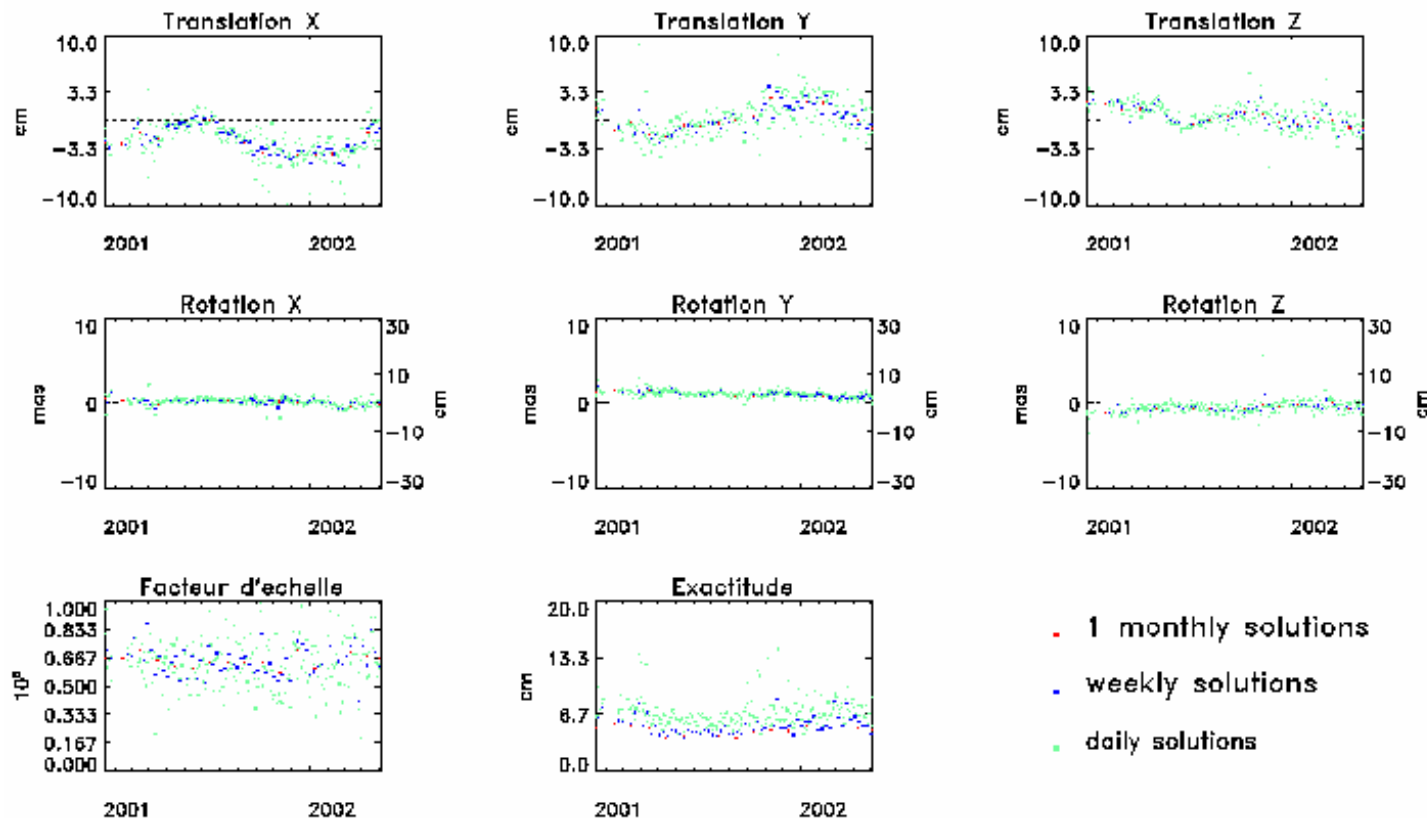
*Mid-1999 sensor failure, corrections  
of the seasonal initial parameters*



*The zenithal bias depends on the surface pressure  
but also the mapping function not in the derivatives*

# Quick solutions - SSALTO /SOD

SSALTO / DORIS LOCALISATION  
(48h MOE orbit from CNES/SOD, ITRF2000 reference)



***Useful solutions for network control, new stations,  
seismic activity monitoring (Arequipa), Diode navigator,...***

# FUTURE (1/4)

## ENCOURAGING

*10 years of Doris data (Spot2/3/4 and Topex)*

*3 more satellites with new instrument generation (JASON, ENVISAT, SPOT5)  
dual channel, phase observations,...  
very stable Jason orbit (cross-track)*

*dynamism and synergy (recent questions around Jason data processing)*

*possible new AC participation*

# FUTURE (2) : possible new AC participation

Group	Team – contact	On-going developments and needs
AIUB/IGN (Switzerland/France)	Karine Le Bail (IGN) Urs Hugentobler (AIUB) Werner Gurtner (AIUB)	Integration of Doppler equation in Bernese software Doris data format? <u>RINEX transformation proposal?</u>
Geodetic Obs. of Pecny (Czech Republic)	Jan Kostelecky	Software under development Interested by a DORIS data processing software
IAA-RAS (St-Petersburg)	George Krasinsky	Preliminary results of Topex/Poseidon Doppler processing Need for outputs comparisons and information about the system (satellite models,...)

**No answer**

# Future (3)

## URGENT

### A NEW DORIS DATA FILE SPECIFICATION :

- *content (uso, time ref, new observation type, ionosp.)*
- *format*
- *delay*

### Old data conversion

# Future (4)

to be discussed

*More DORIS system information and better access*

*(uso behaviour, station events, satellite attitudes models,...)*

*TRF products specifications*

*(multi-satellites, mature monthly and global solutions)*

*Products validation process*

*Combination*

***Participation ?***



# Active contributors

*P. Willis*  
*J. Ries*  
*JP. Berthias*  
*C. Noll*  
*J.M. Lemoine*  
*A. Guitart*  
*M. Feissel*  
*P. Sillard*  
*S. Kuzin*  
*K. Le Bail*  
*J.F. Crétaux*  
*G. Beziat*  
*F. Arib*  
*Urs Hugentobler*  
*Yoaz Bar-Server*  
...

## Sinex file naming convention

Station network coordinates (sinex format)

-----  
1/ Global sinex solutions (cf IERS convention)

CCCYVDVV.snX.Z

CCC = the center acronym 3 characters

YY = the 2-digit year of the solution submission

D for DORIS

2/ Periodic sinex solutions

CCCYDDDTVV.snX.Z

CCC = the center acronym 3 characters

YY = the 2-digit year of the first observation

DDD = the 3-digit day of year of the first observation.

T = the type of the solution with  
m/w/d for monthly/weekly/daily solutions

VV = the version number of the solution

Note that there is no inclusion of the satellites name but the information may be found in the headers of each file.

The sinex files are compressed (unix) for storage and lower caps are used for filemames.

# Time series

CCCYTUVVAAAA

CCC = the center acronym 3 characters

YY = the 2-digit year of the solution submission

T = the type of the solution with  
m/w/d for monthly/weekly/daily solutions

VV = the version number of the solution

AAAA = the 4-letter identification of the station (unicity)

\* Head lines of selected sinex blocs

\*

+ File/reference

+ File/comment (reference system, ellipsoid)

+ Site/id

+ Solution/apriori (XYZ initial coordinates with the reference epoch)

\*

\* Solutions given in both cartesian and geographical coordinates systems

\* Data description below (offset are versus the XYZ initial coordinates)

\*

\* format

\*

\* Year Day dx sx dy sy dz sz dlat slat dlon slon dh sh