Positioning results with the SAA corrective model for Jason DORIS data

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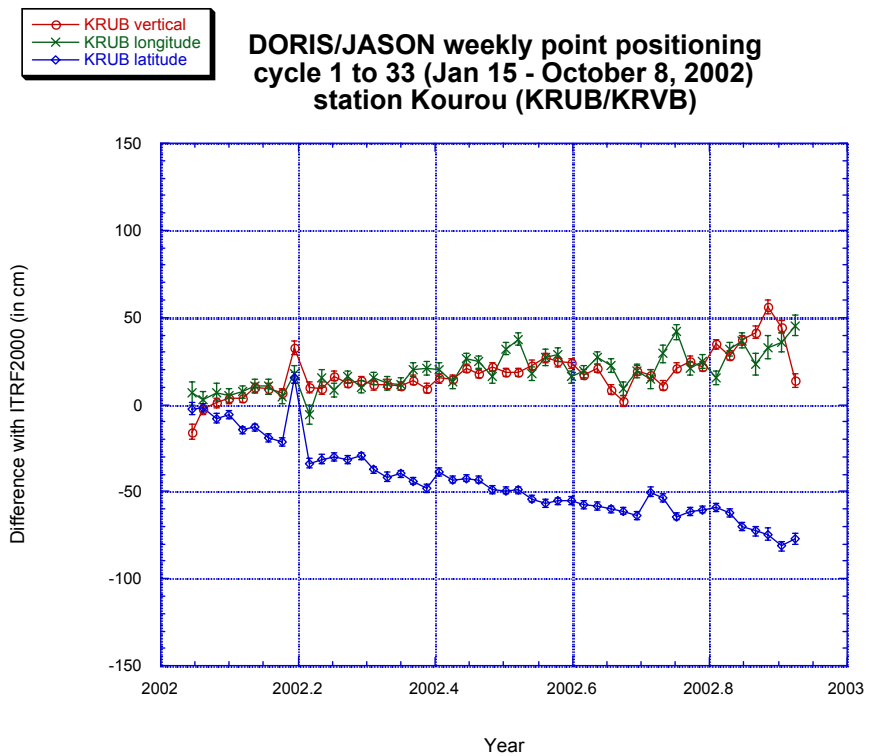
Positioning problem with DORIS/Jason data

The frequency of the onboard DORIS Ultra-Stable Oscillators (USO) of Jason-1 is perturbed by the crossing of the South Atlantic Anomaly (SAA), where a great density of high energy protons is encoutered.

One of the consequences is the corruption of the positioning for the stations in the SAA area (artificial temporal drift).



From Willis et al.,
DORIS/JASON data:
What is happening in the
South Atlantic Anomaly region?
IDS analysis workshop , 2003

Corrective model for Jason-1 DORIS data

- Use of DORIS/Jason data is critical because of
  - the end of the Topex mission,
  - the postponement of the renewal of the DORIS constellation to at least 2008 (Jason-2) because of the Cryosat launch failure,
  - the probality to loose another instrument before 2008 (Spot2 is 16 years old!).

- A corrective model for Jason-1 DORIS Doppler data related to the SAA has been under development at CNES since September 2003.

- Description of the model by Lemoine et Capdeville (Journal of Geodesy , submitted) and presented by J.M Lemoine, this workshop.

- Model for the two chains of the DORIS receiver:

  Chain 2 (the "redundant" OUS): 1st period, from launch in December 2001 until June 2004

  Chain 1 (the "nominal" oscillator): 2nd period, since June 25, 2004

Chain 2 Model Assessment

Two series of results:

- **Preparation of the model (2004)**

6 months of data from CNES files (FIMBI33)

All SAA stations measurements considered

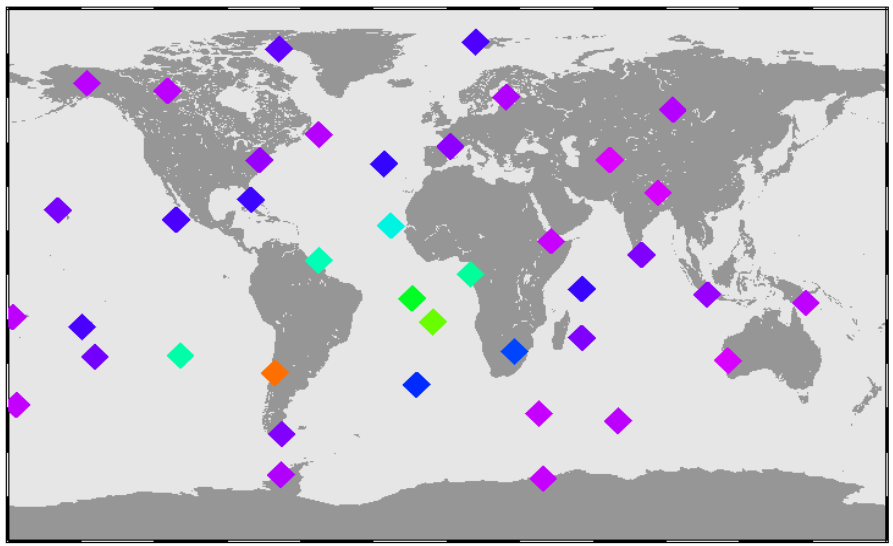
- **Analysis in progress**

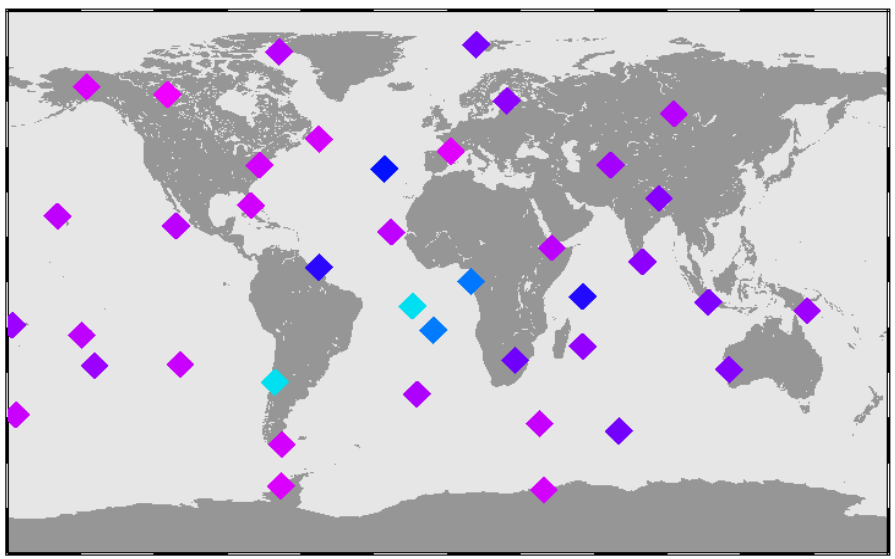
One year of data (2003) from CDDIS files

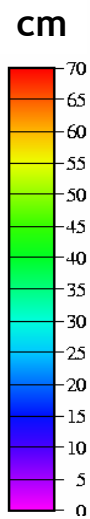
SAA stations measurements nearly all rejected in the orbit computation (a priori residuals > 999 mm/s)

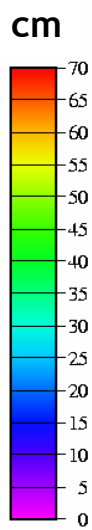
Chain 2 Model Assessment

Positioning residuals (wrt ITRF2000)









CNES data files (fimbi 33

DORIS/JASON

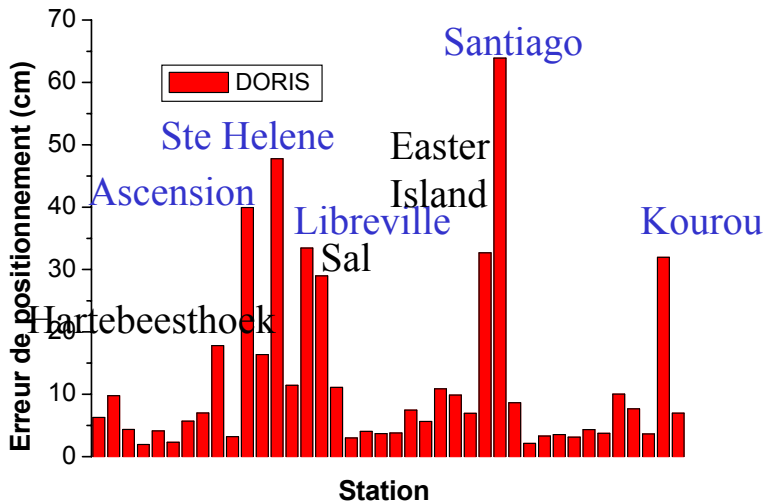
One monthly solution oct. 2003

DORIS/Jason with SAA model

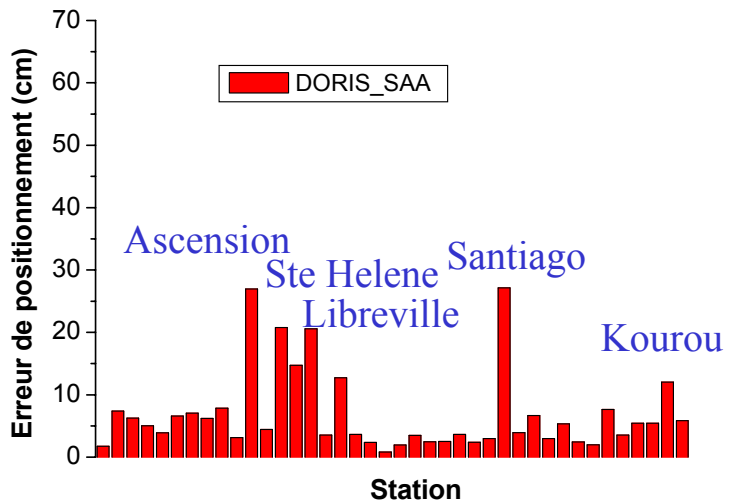
Scale: from 0 to 70 cm

Positioning residuals (wrt ITRF2000)

DORIS/JASON



DORIS/Jason with SAA model



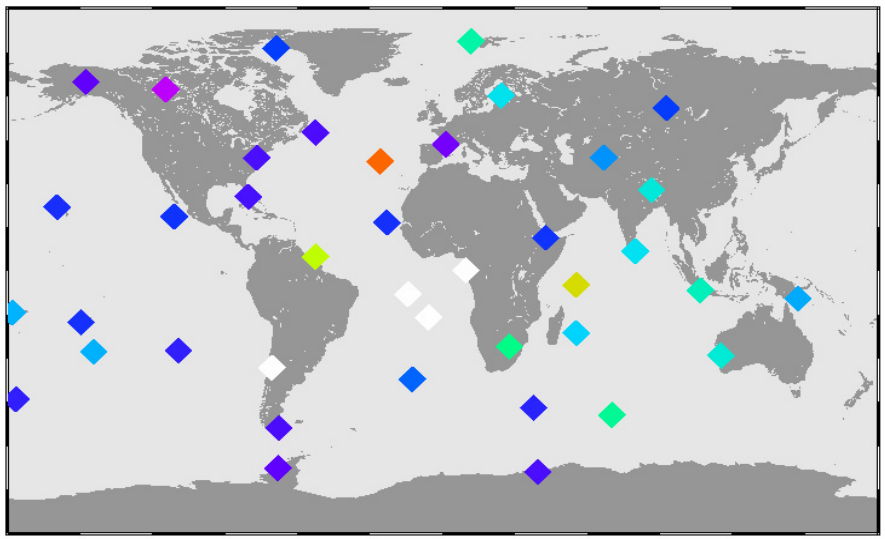
Monthly solution oct. 2003

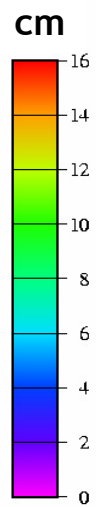
εmean=12.3 cm
σ=14.2 cm
Min=1.95 cm
Max=63.9 cm

εmean=6.9 cm
σ =6.5 cm
Min=0.8 cm
Max=27.1 cm

Chain 2 Model Assessment

Positioning residuals (wrt ITRF2000)

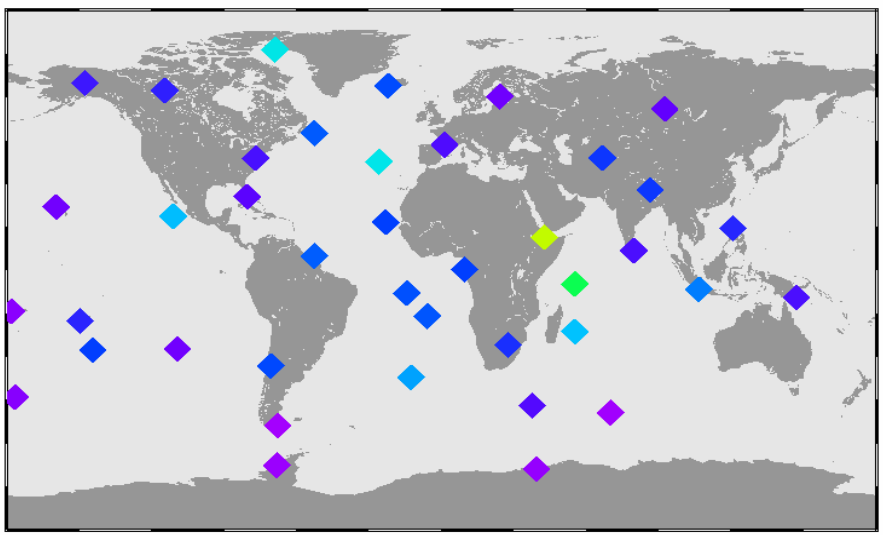


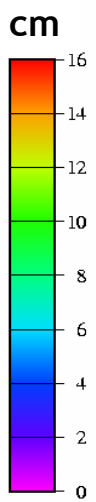


DORIS/Jason with SAA model

One monthly solution oct. 2003

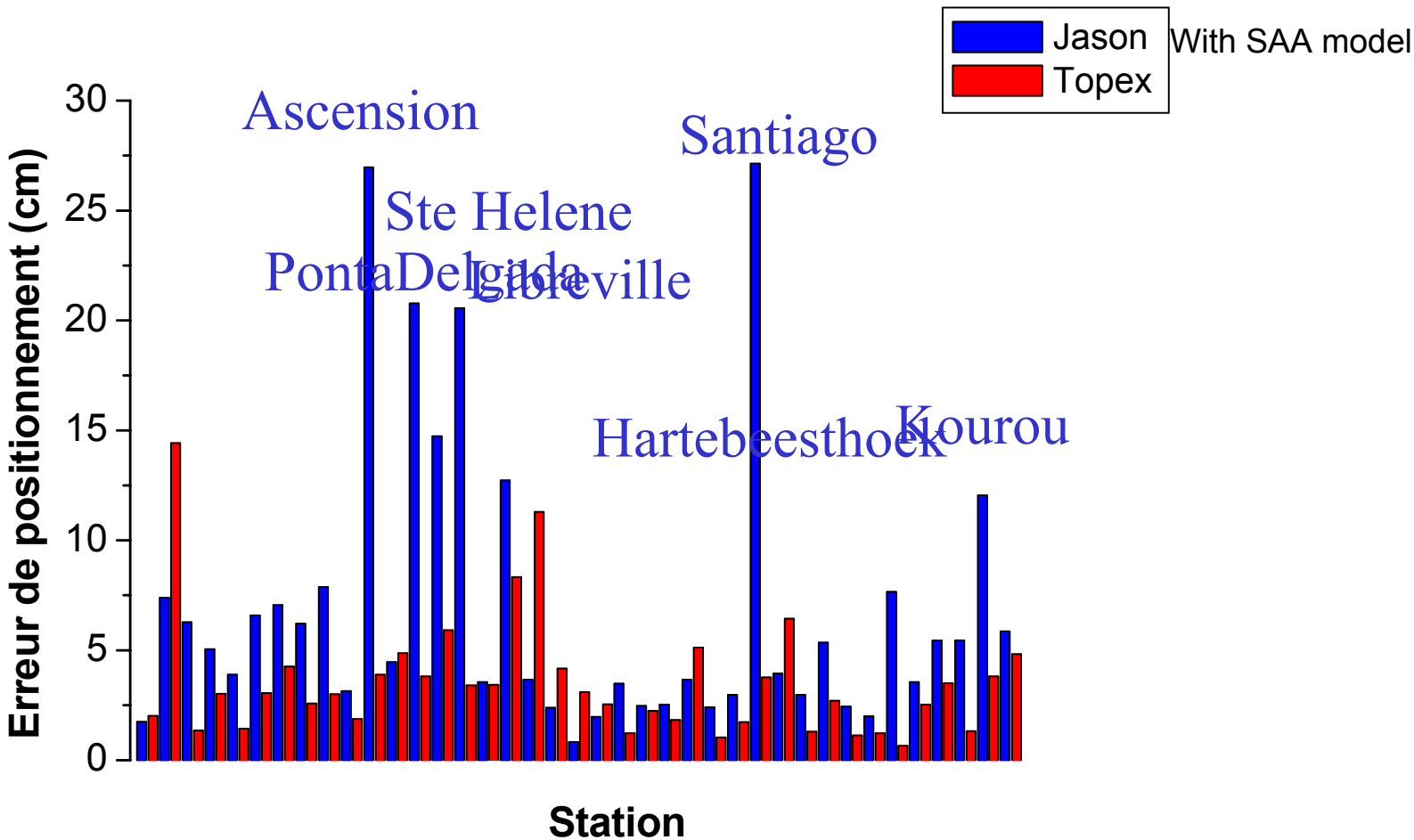
Scale: from 0 to 16 cm





TOPEX

Positioning residual (wrt ITRF2000)

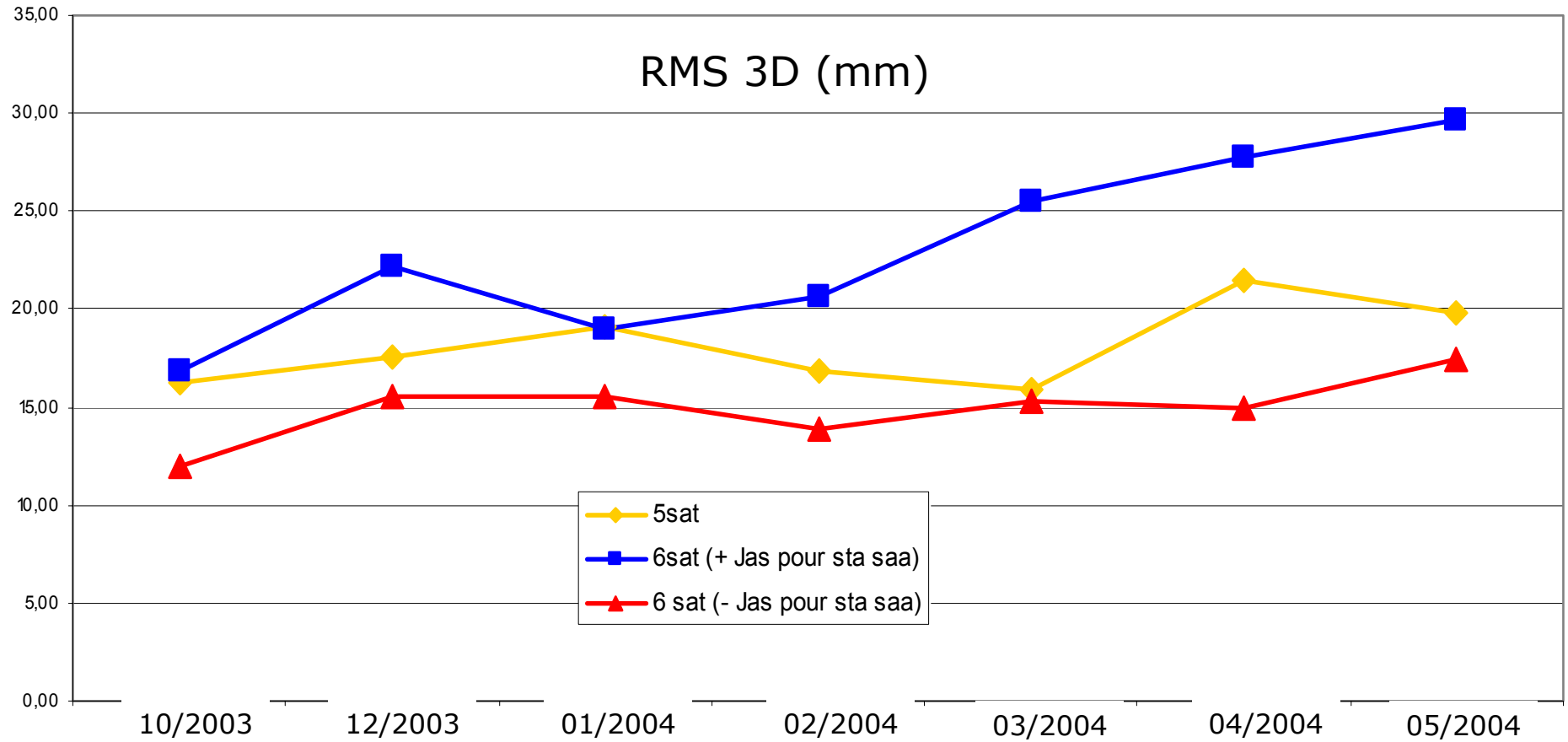


Chain 2 Model Assessment

Positiong residuals (wrt a DORIS multi-yr sol.)

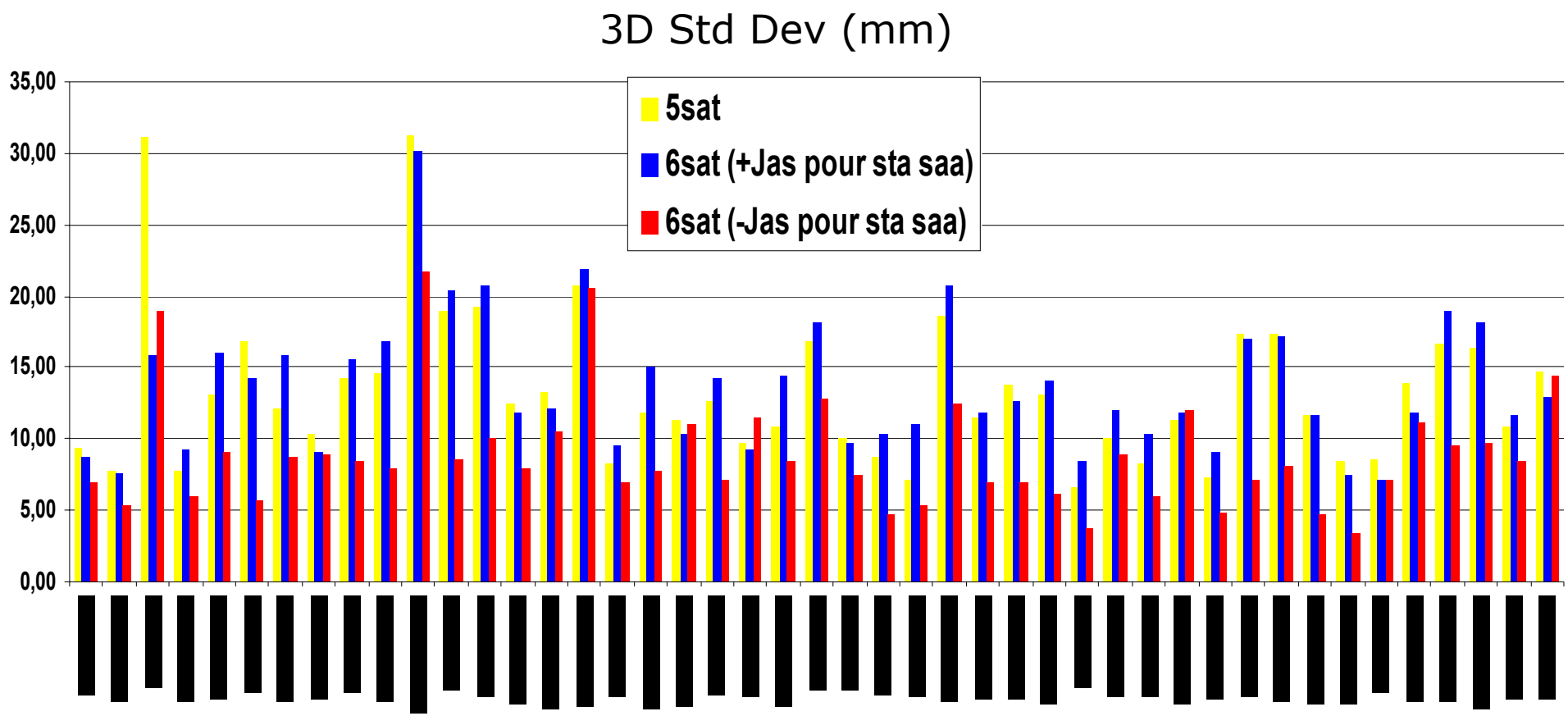
Monthly solutions: 10/2003, 12/2003, 01/2004, 02/2004, 03/2004, 04/2004 et 05/2004

Multi-satellites: Spot, Envisat et Topex



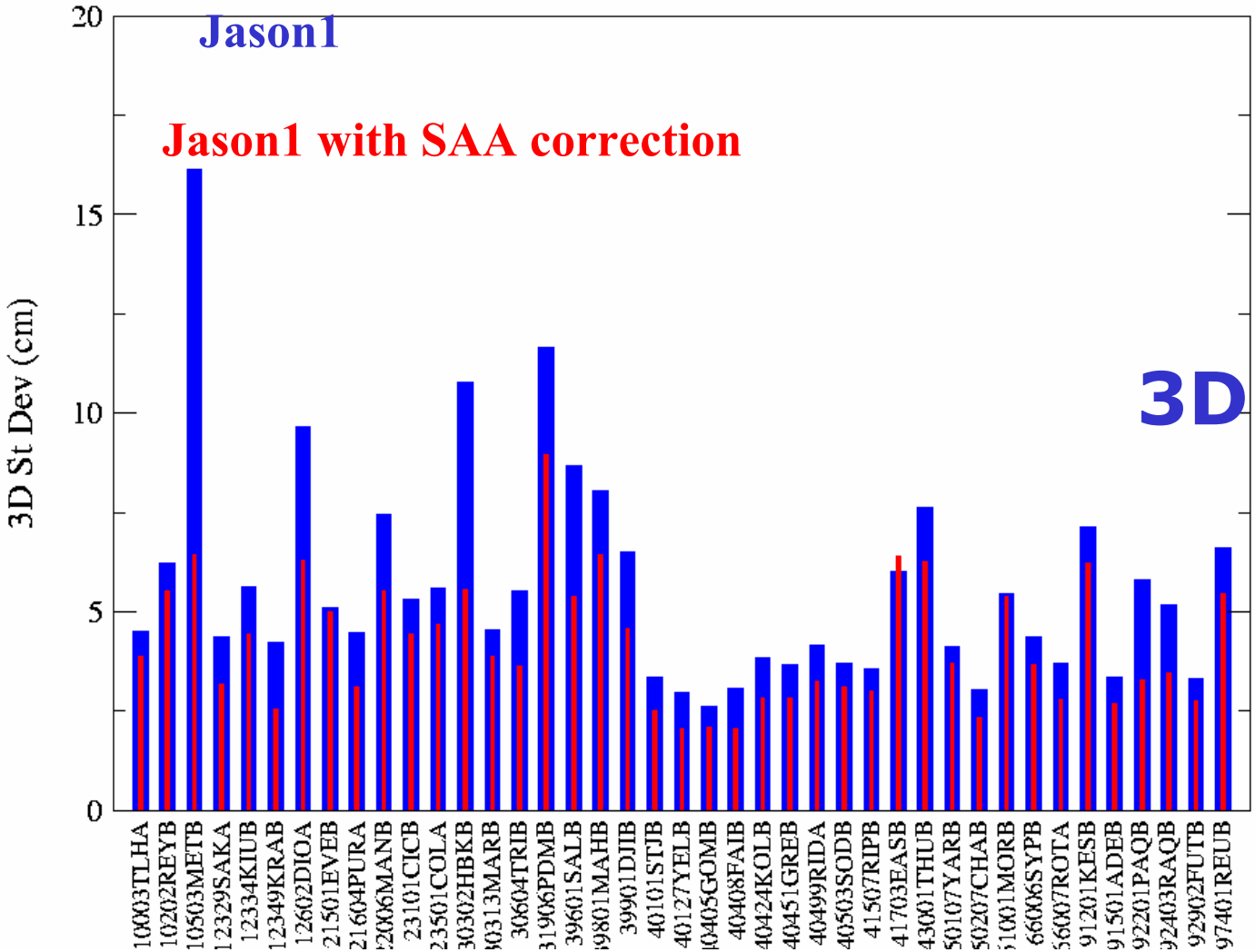
Positiong residuals (wrt a DORIS multi-yr sol.)

(over 1 month)



Chain 2 Model Assessment

CDDIS data files: SAA stations data included but with large residuals and so nearly all rejected in the orbit computation



Solution 2003
51 weekly solutions

mean=5.6 cm
σ=2.7 cm
Min=2.6 cm
Max=16.1 cm

3D Std Dev

mean=4.2 cm
σ =1.6 cm
Min=2.1 cm
Max=8.9 cm

Chain 1 Model Assessment

Two series of results:

- **Preparation of the model (2005)**

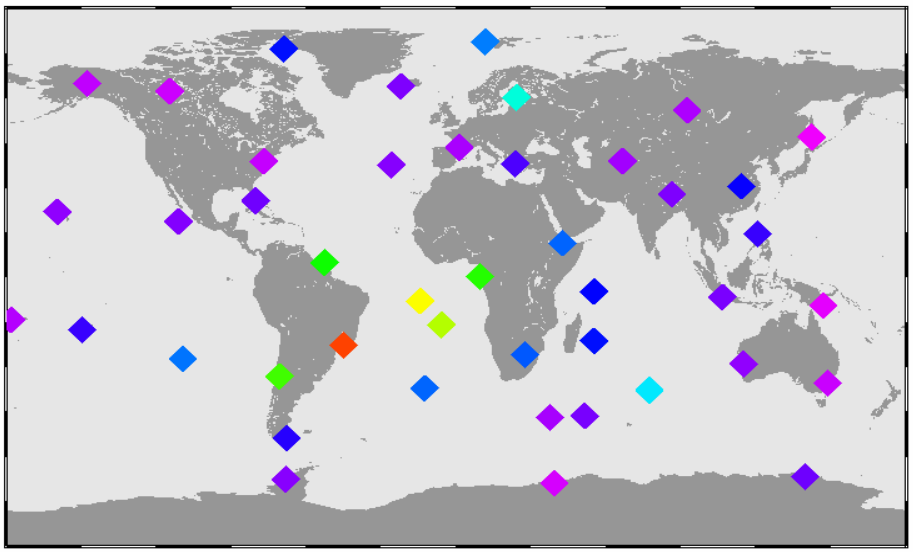
3 months of data from CNES files (FIMBI33)
All SAA stations measurements considered

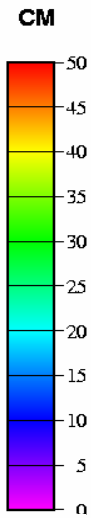
- **Analysis in progress**

One year of data (2005) from CDDIS files with SAA stations measurements under-weighted

Chain 1 Model Assessment

Positioning residuals (wrt ITRF2000)

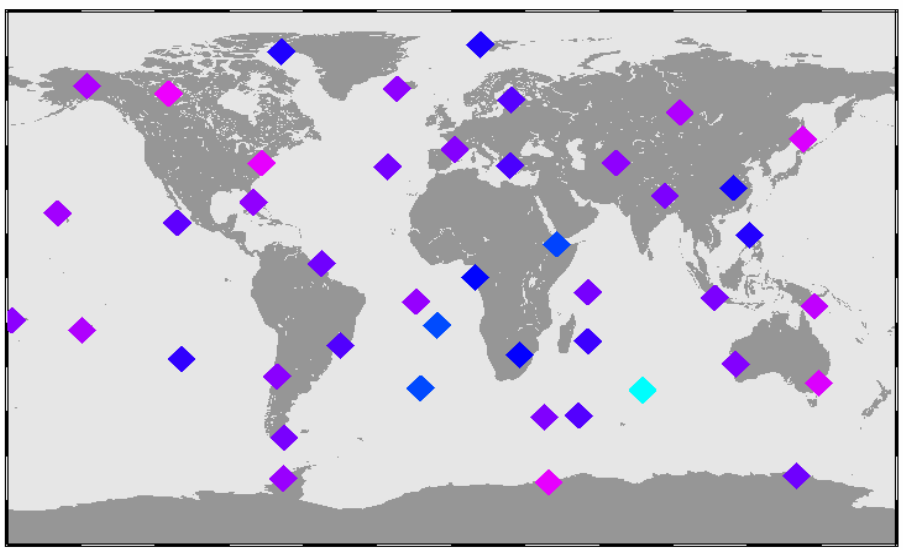


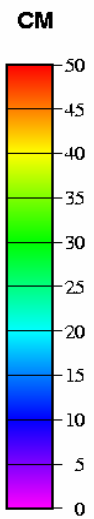


CNES data files (fimbi 33)

DORIS/JASON

One monthly solution june 2005



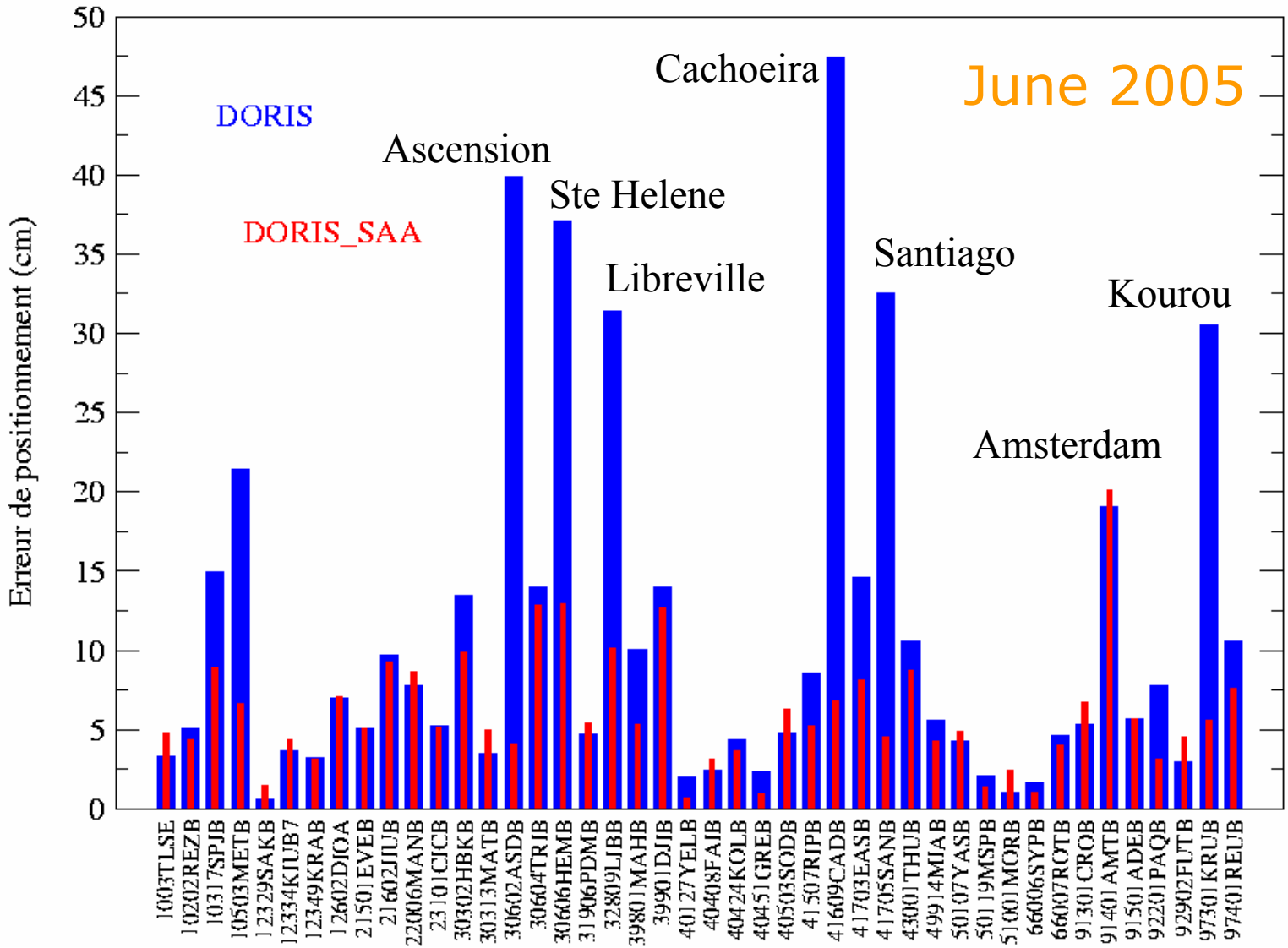


DORIS/Jason with SAA model

Scale: from 0 to 50 cm

Chain 1 Model Assessment

Positiong residuals (wrt ITRF2000)



εmean=11.3 cm
σ=11.3 cm
Min=0.6 cm
Max=47.4 cm

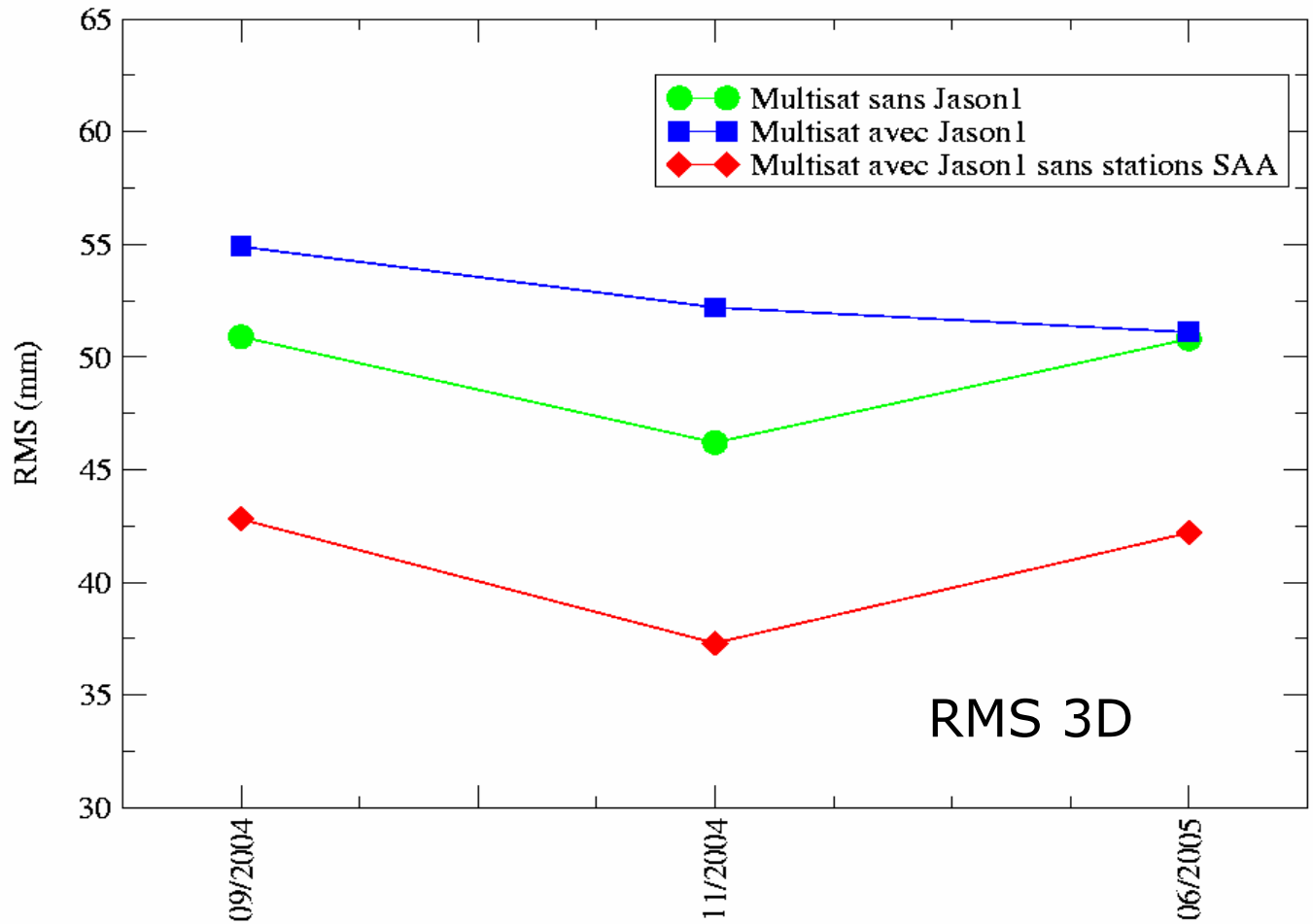
εmean=6.1 cm
σ=3.7 cm
Min=0.6 cm
Max=20 cm

Chain 1 Model Assessment

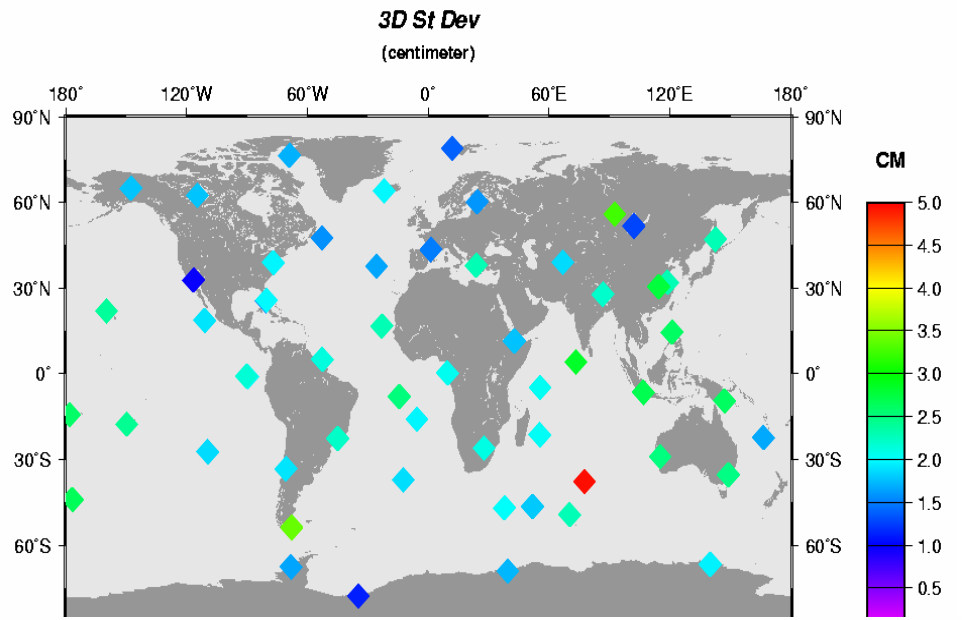
Positiong residuals (wrt ITRF2000)

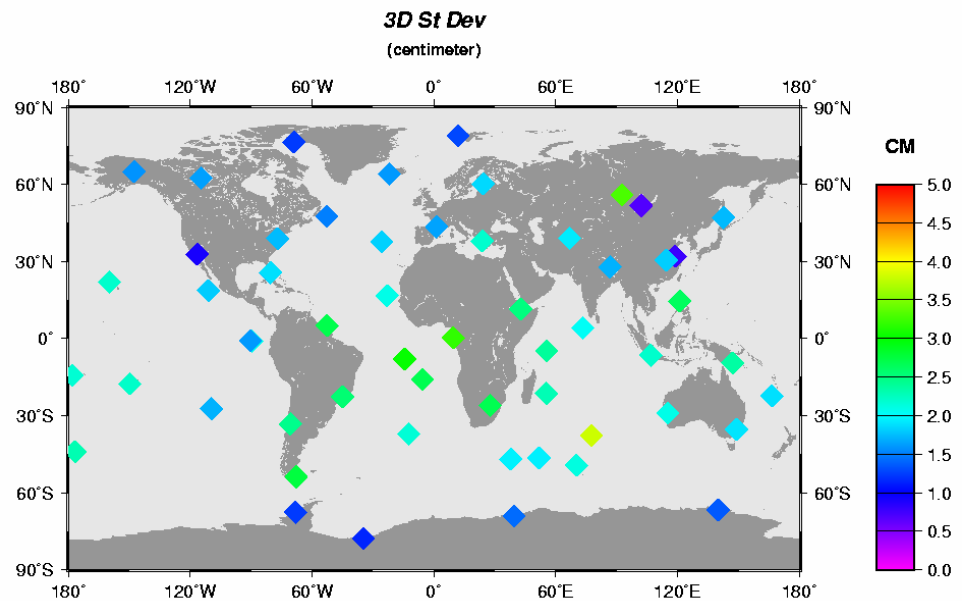
Monthly solutions: 09/2004, 11/2004, 06/2005

Spot, Envisat and Topex (only 09/2004)



Chain 1 Model Assessment





CDDIS data files: SAA stations data under-weighted

DORIS/ssse

3D St Dev

Year 2005
52 weekly solutions

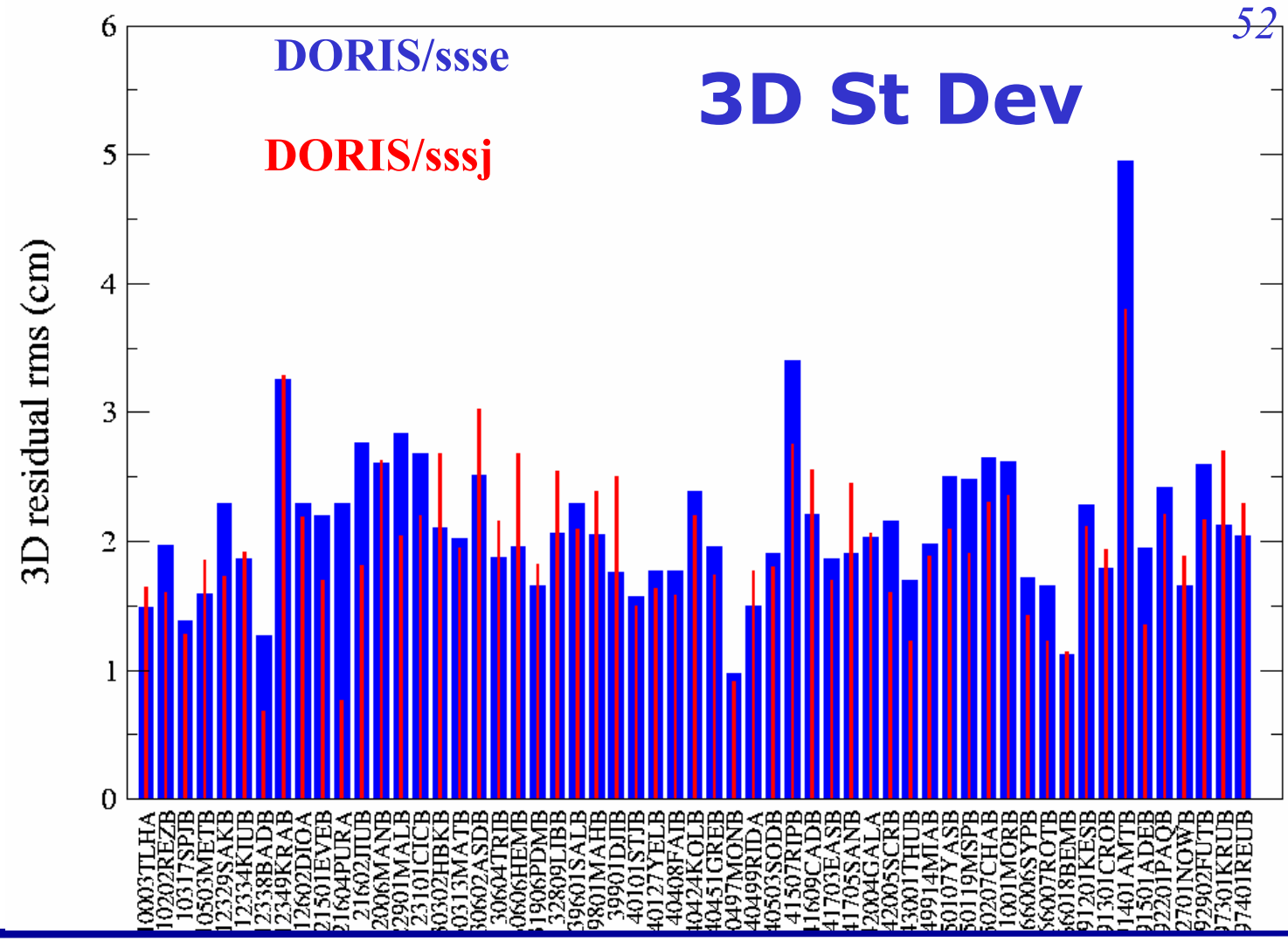
DORIS/sssj
Jason1 with SAA correction

All stations included i.e SAA stations included in Jason contribution

Positioning results with Jason SAA model

Chain 1 Model Assessment

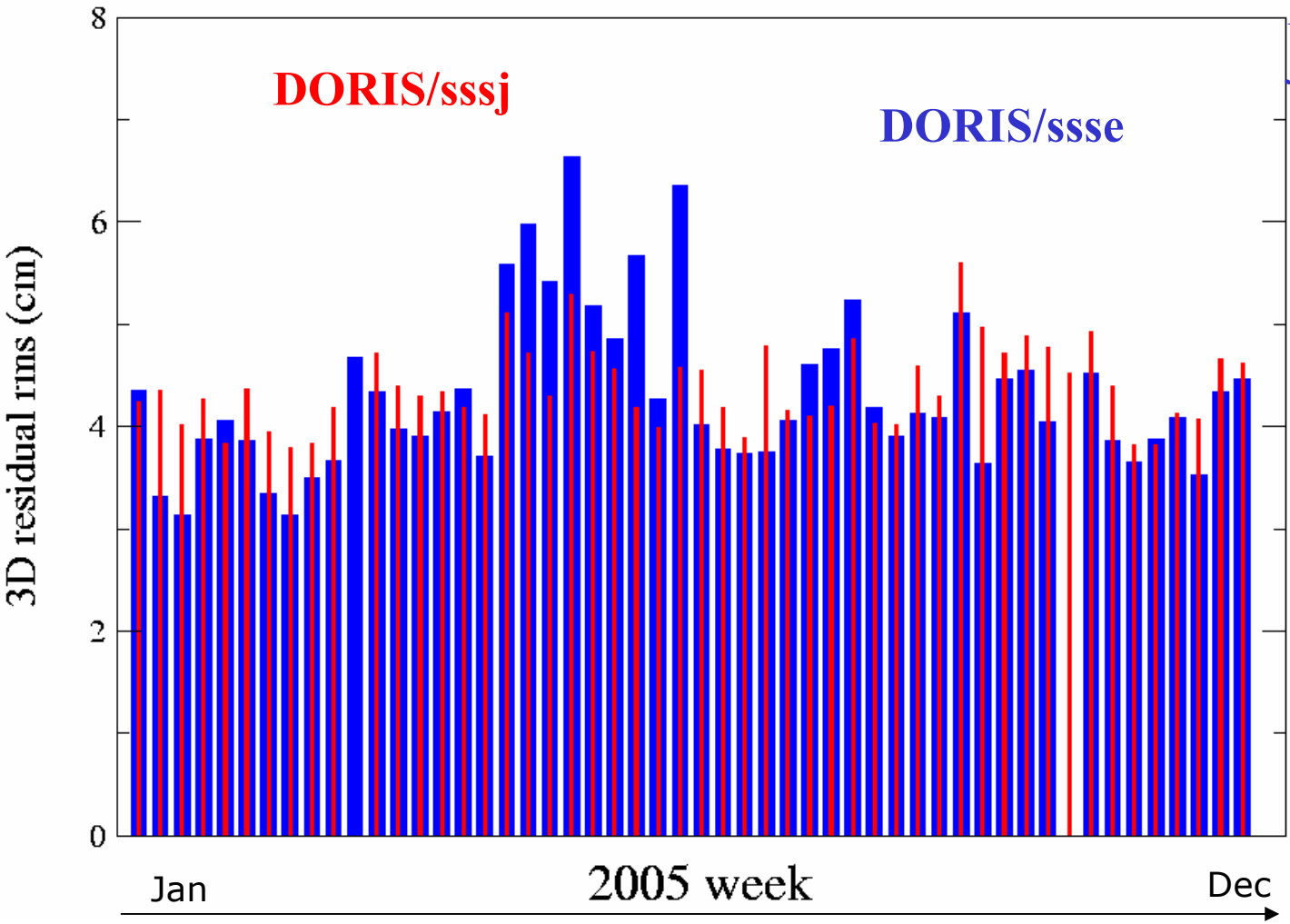
Year 2005
52 solutions hebdo



moy=2.11 cm
σ=0.6 cm
Min=0.97 cm
Max=4.95 cm

moy=1.98 cm
σ =0.58 cm
Min=0.68 cm
Max=3.8 cm

Chain 1 Model Assessment



Year 2005
52 weekly solutions

mean=4.2 cm
σ=0.97 cm
Max=6.64 cm

mean=4.3 cm
σ =0.72 cm
Max=5.6 cm

Model available on the IDS ftp site

SAA corrective model available on the CB ftp site under

ftp.cls.fr/pub/ids/satellites/CORRECTIVE_MODEL_JASON1

The directory provides:
- the corrective model of DORIS/Jason USO frequency (modele.tar.gz)
- the technical note (TechnicalmemoIDS.pdf) describing the model, how to implement it in a UNIX environment, and how to use it.
- a README file (readme.txt) given “first level” instructions:

1. Get the files modele.tar.gz and TechnicalmemoIDS.pdf
2. Implement the model according to the steps described in part 3 of the technical note
3. Use the model as described in part 3 of the technical note

Note that the program needs an input file "jason_cycle_dates" which contains, for each Jason cycle, the cycle number and the begin date of the cycle in CNES Julian day (more details below).The end of the "jason_cycle_dates" file included in modele.tar.gz is Jason Cycle 150 (01/31/2006). The Central Bureau will provide in this directory an updated version of the file on regular basis.

> see dorisreport 510 (22 Feb 2006)