Analysis of station coordinates via CATREF combination

Ph. Yaya[1] / J.-J. Valette[1]

IDS Workshop, Paris, 13-14 March 2008

[1] CLS – Collecte Localisation Satellites, France

Objectives of the analysis

- Check the quality and discrepancies for all the ACs solutions and the combined solution

- Detect systematic errors : good and bad stations, their origins

- Recommandation for the analysts and best strategy for the weekly combination

- Operational monitoring (instrument & network, earthquakes, …)

Analysis of the individual cumulative combination (1/2)

For each file of pos/vel residuals resulting of the individual combination within each AC, the following steps have been processed :

- Separation in files per year

- Processing of the mean and sigma of the weekly 3D-RMS

- Creation of yearly plots including :
  - A histogram of the 3D-RMS statistics per station
  - The number of solution per station
  - The geographical location and value of the RMS

➔ Some problems on stations have been detected (next slide)

2006 : mean 3D residuals, CATREF weekly cumulative combin., datum, same network, LCA

IDS Workshop
13-14 March 2008
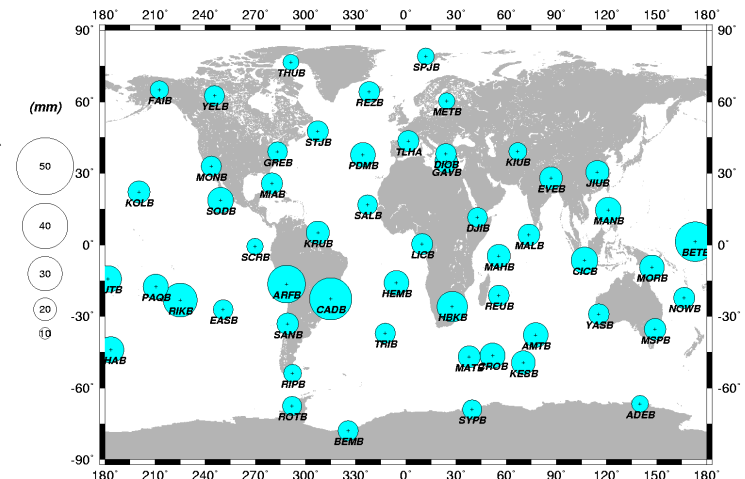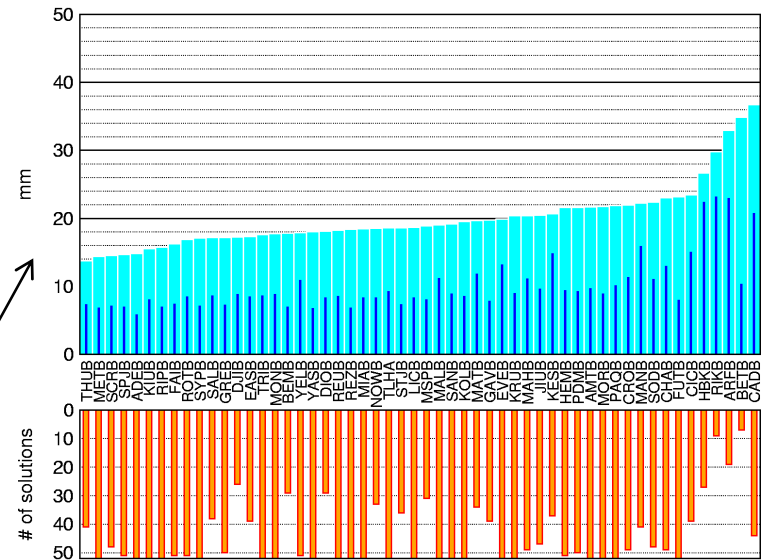
Analysis of the individual cumulative combination (2/2)

CADB : very high RMS in all ACs

REZB : not as good as beacons with equal latitude (multi-path ?)

KRVB : high RMS in 2005, decreasing (ionospheric scintillations ?)

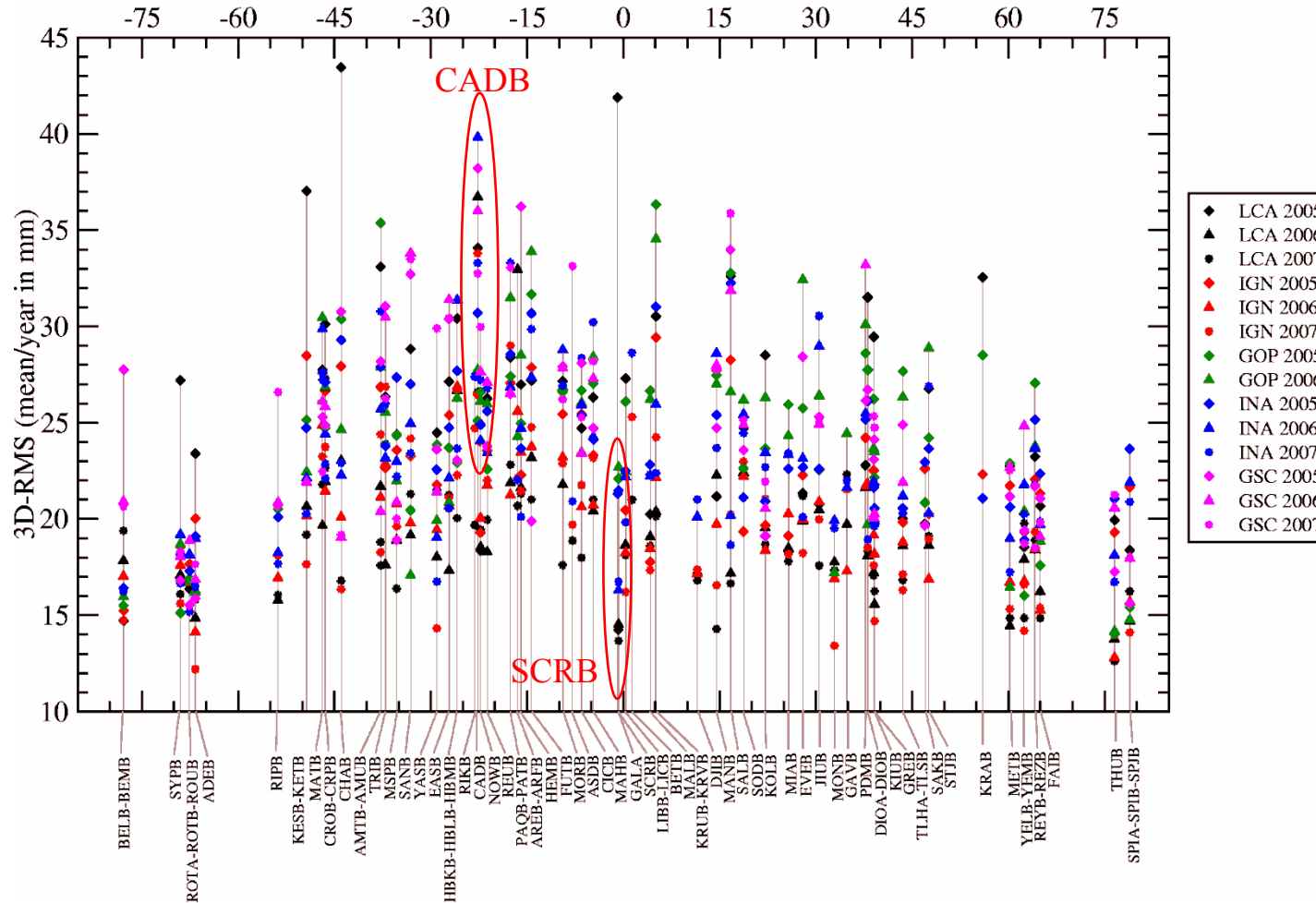KRAB : high sigma in 2005

RIPB : bad sigma in 2007

YELB/YEMB : high RMS in 2007 (link with the Maser)

It seems that the RMS depends on the **latitude** (next slide)

Correlation with latitude

MEAN OF THE 3D-RMS PER YEAR AND PER A.C.

Threshold : > 10 solutions/yr.

The highest latitude have a better RMS :

High latitudes ($|\lambda|>60°$) :
South ~17 mm with a good repetition
North ~18 mm with more dispersion

Low & mean latitudes ($|\lambda|<30°$) :
South ~25 mm lot of dispersion
North ~23 mm, same dispersion

This figure allows pointing out bad or good stations. Ex :
Tropical CADB : very bad
Equatorial SCRB : very good

Example of Santa Cruz

2006 : mean 3D residuals, CATREF weekly cumulative combin., datum, same network, LCA

All the solutions give an 3D-RMS between **14 and 23 mm** (except LCA 2005), while equivalent latitude beacon RMS range from **18 to 35 mm.** Example here for LCA 2006.

The same behaviour is observed in orbit Doppler RMS from the POE solutions : in 2006 (all satellites except Jason-1) its RMS is **0.40 mm/s** (equivalent latitude RMS is **0.45-0.55 mm/s**). Reasons : good monumentation ? no multi-path ?

Mean of POE RMS (mm/s) in 2006, SPOT 2-4-5 & ENVISAT
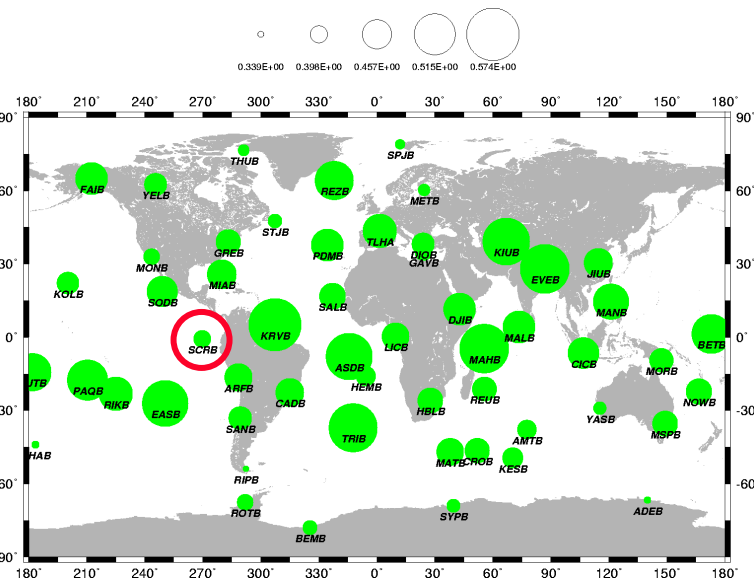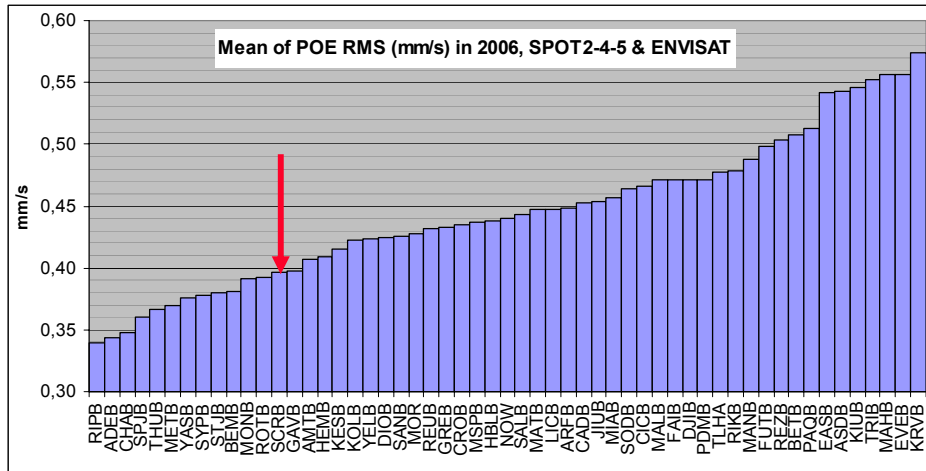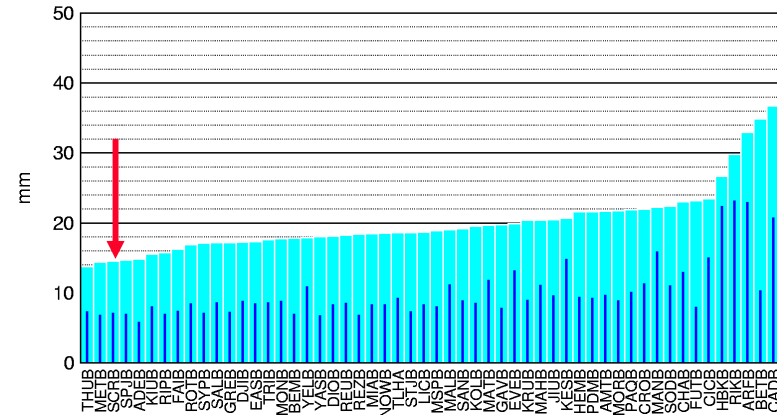
Analysis of the weekly combination

In the following slides, we used the LCA/IGN/GOP weekly combined solutions (2005-2006) in order to correlate them to :

- the system behaviour (DORIS/ENVISAT incident)

- the geophysical approach (earthquakes)

Relation with Envisat orbit

Instrument incident period

ADEB (S)

BEMB (S)

FAIB (N)

ROTB (S)

SPJB (N)

SYPB (S)

THUB (N)

2006
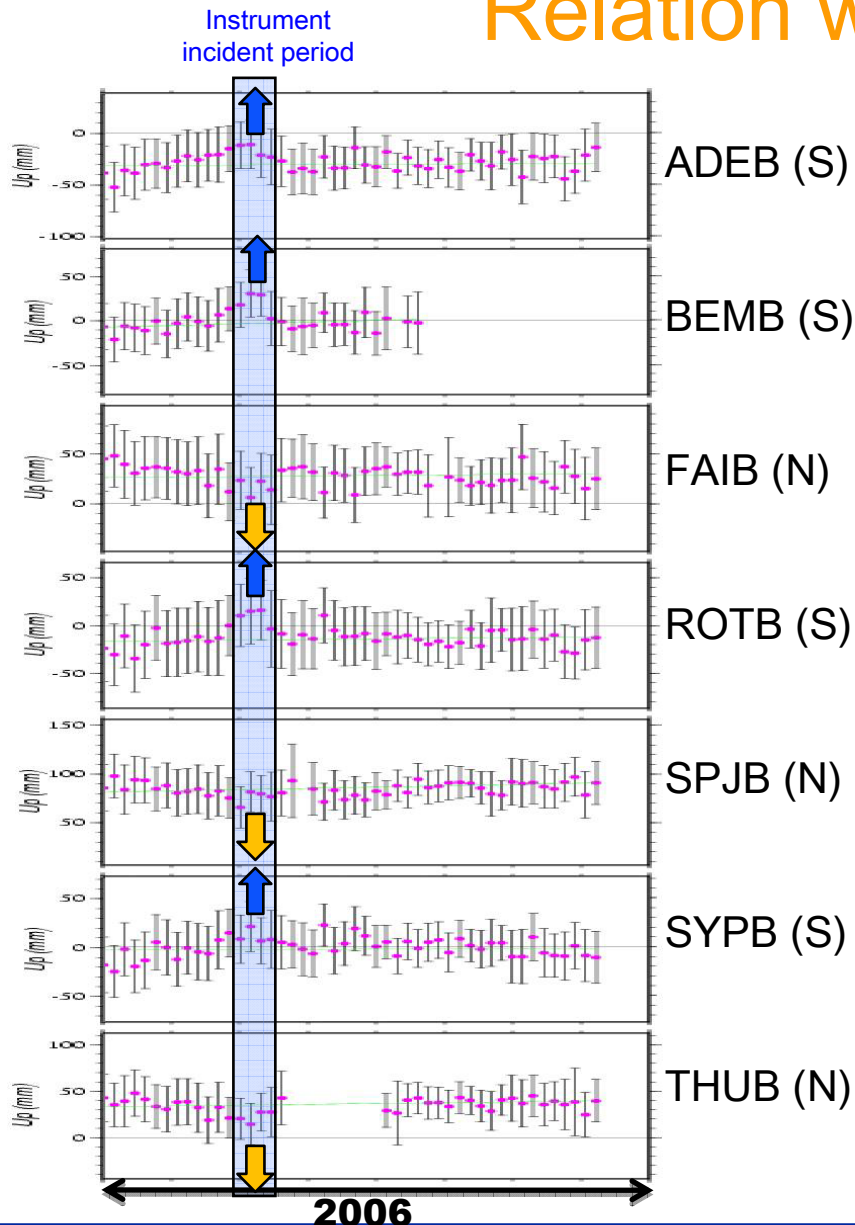
Correlations with DORIS/ENVISAT incident period for high latitude stations :

Week 14 : DORIS incident → 2 days without measurements

Week 15 : « waiting mode » + ICU & DORIS Restart

Week 16 : 5 days without measurements + « waiting mode »

Week 17 : 2 days of « waiting mode » + back to nominal mode

Southern stations have a positive vertical bias

Northern stations have negative vertical bias

→ **Orbit bias of +2 cm in the Z direction during the incident period ??**

IDS ● CLS

Earthquakes

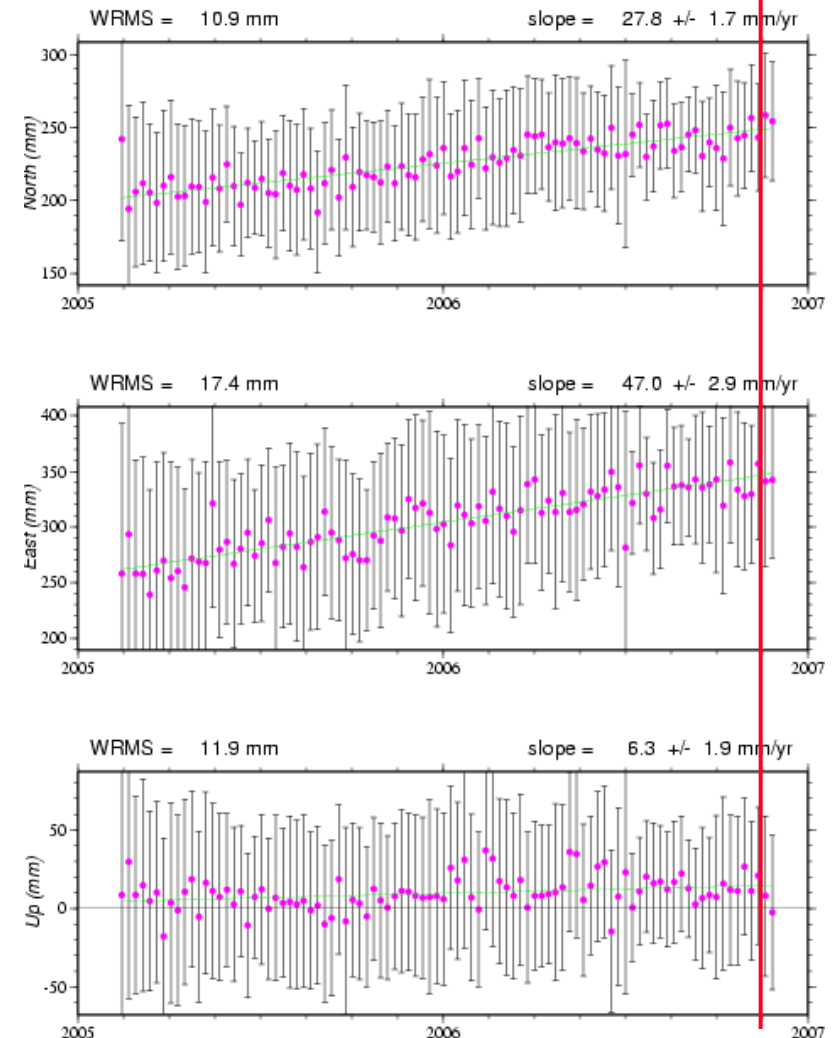IDS WEEKLY COMBINATION (LCA, IGN, GOP solutions, CATREF software)

com08wd00 EVEB

Since 2006, an operational detection of earthquakes near DORIS beacons is installed. An alarm is sent to the operator if the epicenter is nearest than a given distance.

Example of alarm :

```
Seisme le 2006/11/18 a 13:55
Magnitude : 5.8
A MOINS DE  3000Km de :
Mnemonique station        : EVEB
Nom du site               : EVEREST
Distance station/epicentre :   50Km
```

No break in the time series has been detected

earthquake

WRMS = 10.9 mm   slope = 27.8 +/- 1.7 mm/yr

WRMS = 17.4 mm   slope = 47.0 +/- 2.9 mm/yr

WRMS = 11.9 mm   slope = 6.3 +/- 1.9 mm/yr

IDS CLS

Future analysis

Some subject of interest might be analyzed :

- **USO warming** : a coming study will analyze the newly installed beacon behaviour in the combined solutions

- Analysis of **tie residuals** : some problematic stations have been detected in all the ACs : LIBB/LICB and AMTB/AMUB present a tie RMS > 3 cm.

All these analysis could lead to recommandation to analysts