

Simple empirical SAA data corrective model for SPOT-5

Petr Štěpánek, Vratislav Filler
Geodetic Observatory Pecný

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SPOT-5 and South Atlantic Anomaly –what is known

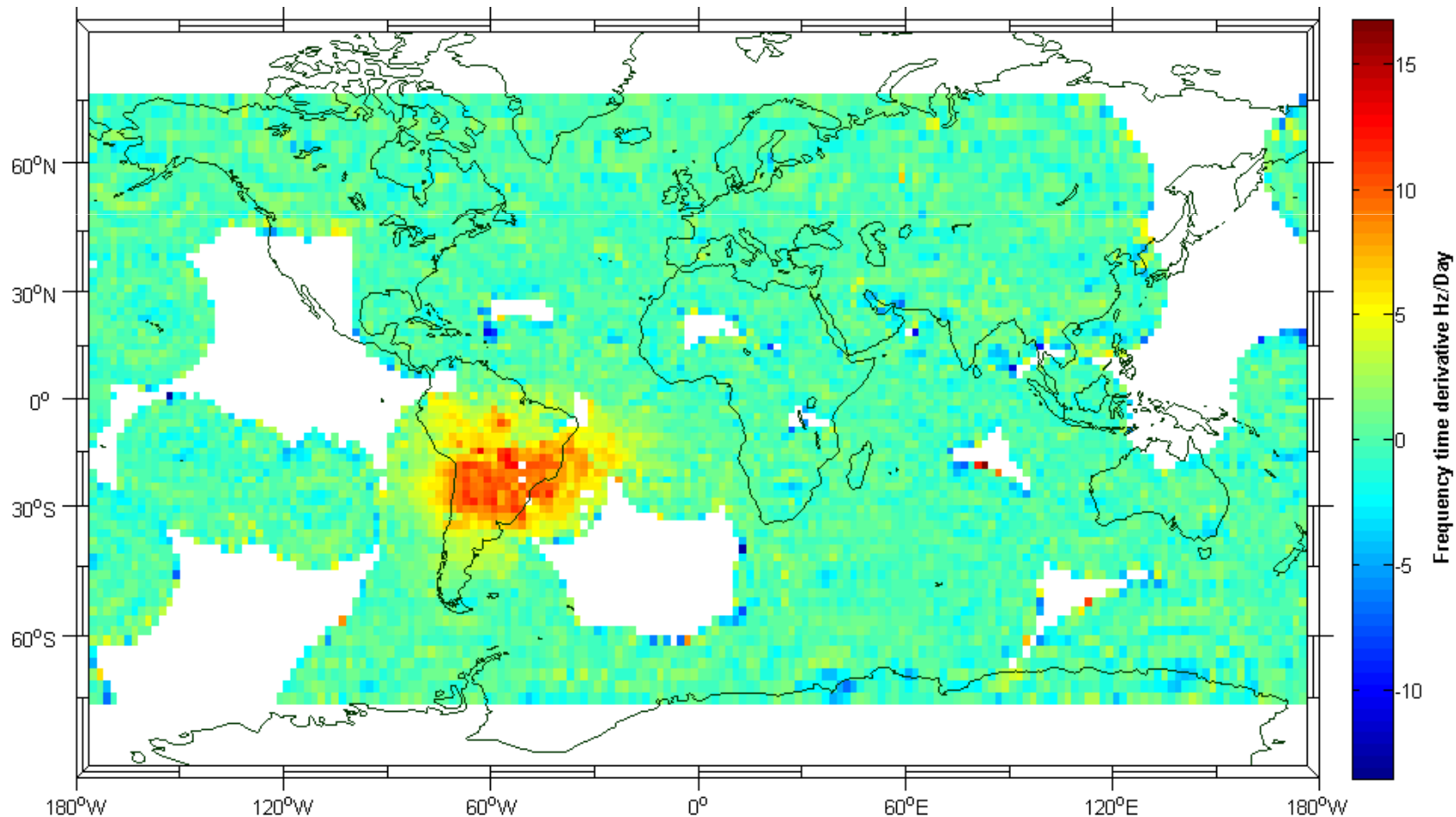
- ❑ SPOT-5 oscillator is affected by SAA, confirmed by many tests
- ❑ Size of the effect is lower than for Jason-1 (about one order of magnitude?)
- ❑ Effect is far from being negligible
- ❑ Strongly affected observations of stations in Brasil (CADB), Peru (ARFB) and Chille (SANB)
- ❑ In extreme case (CADB) decimeter offset of station height for single satellite solution
- ❑ How to deal with this problem: station selection or data corrective model

Empirical data corrective model

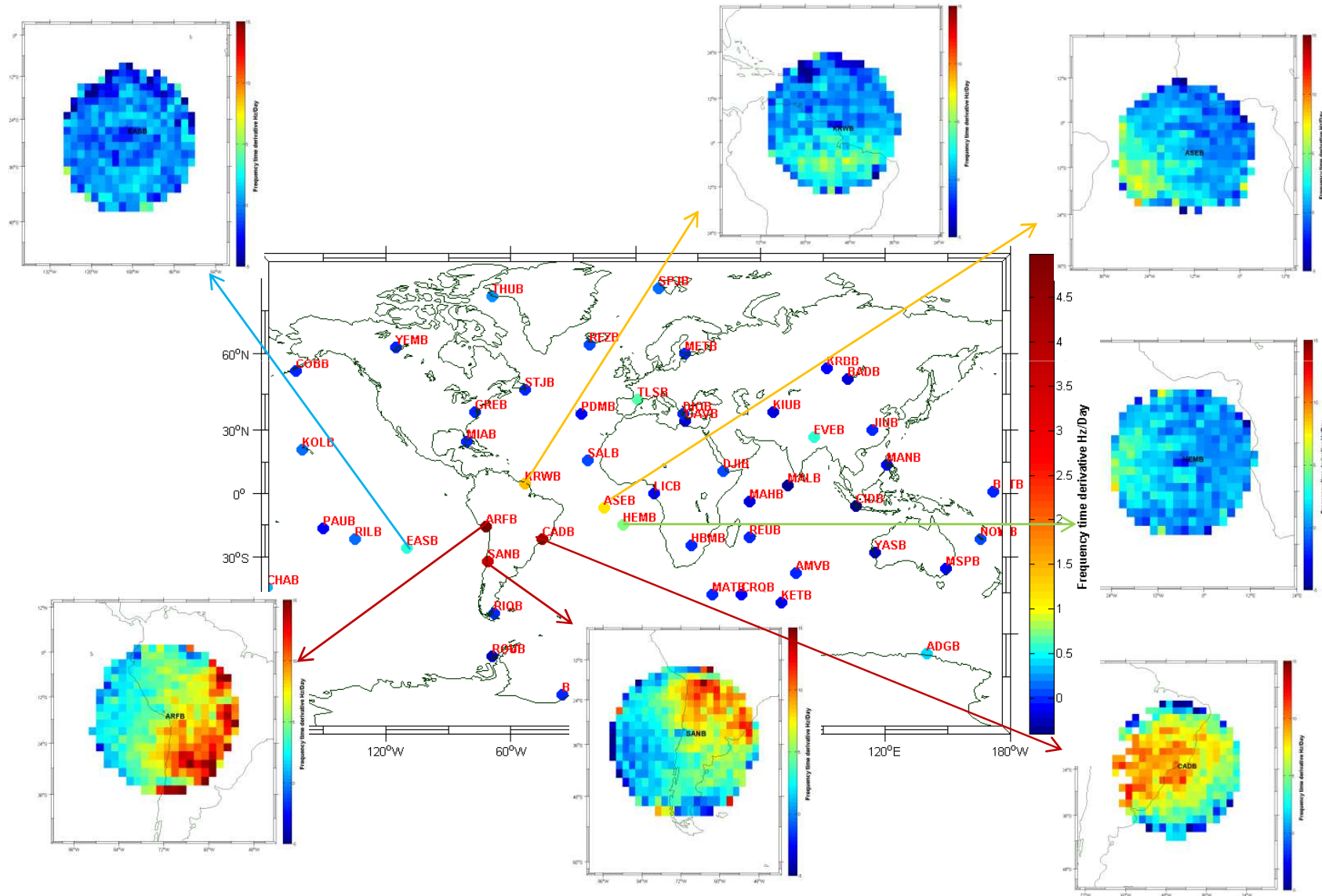
- ❑ we need to model an onboard frequency behavior during the satellite pass
- ❑ frequency offset is not a problem (estimated per pass)
- ❑ Jason-1 data corrective model developed by Lemoine and Capdeville (2006) –starting point
- ❑ Motivation: effect is much smaller for SPOT-5, even a simple model could work well
- ❑ Model then simplified for SPOT-5(no memory and recovery effects)
- ❑ At current step, model developed for 1 year (2011) – SAA effect considered constant
- ❑ Corrections applied only for stations from SAA region

2X2 deg. grid map of the frequency drift

- ❑ Derived from the solutions with fixed network, orbit and troposphere
- ❑ ZTD derived from other single-satellite solutions
- ❑ Frequency drift for each grid is estimated from the post-fit observation residuals
- ❑ Grid map very significantly corresponds to the geographical location of SAA
- ❑ Measurement corrections can be „backward“calculated using the grid map.

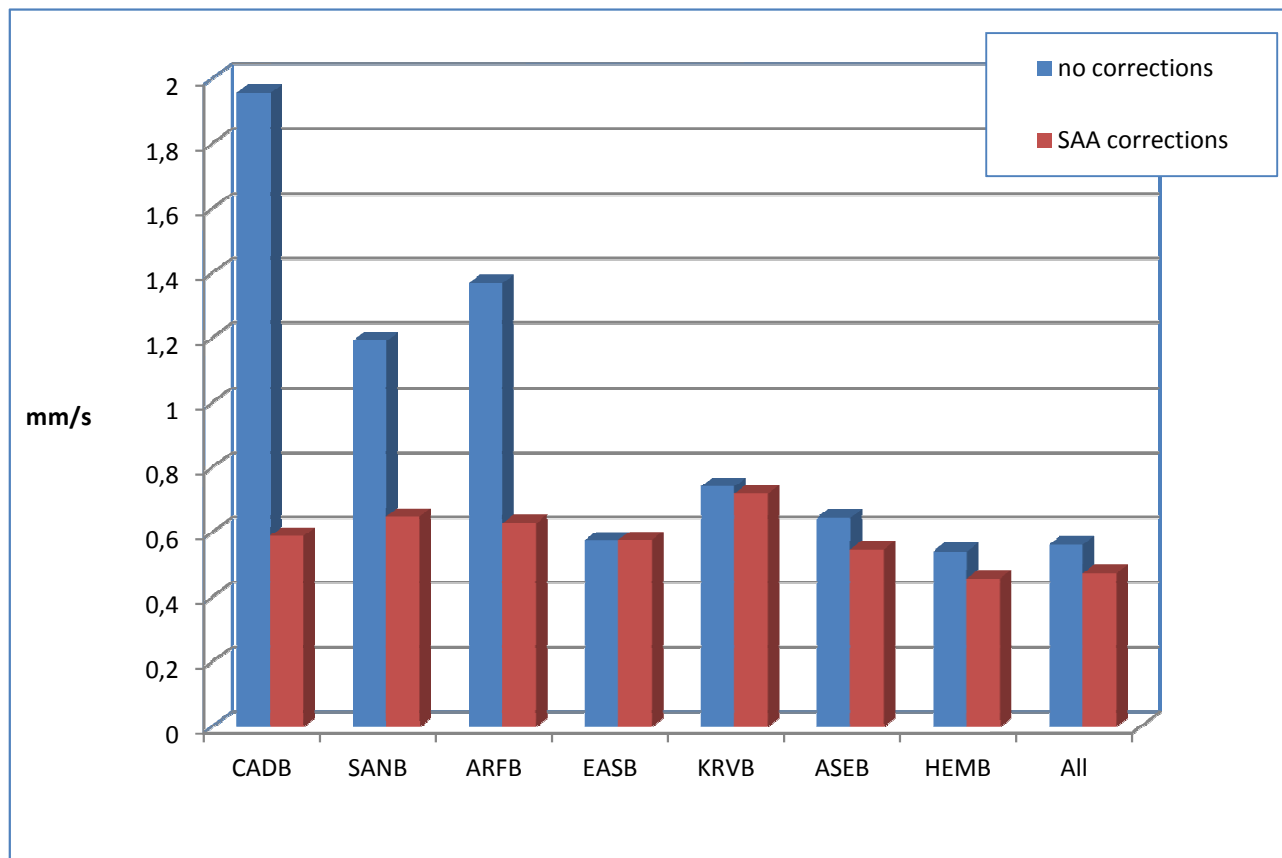


Frequency drift –average value and grid map for each station



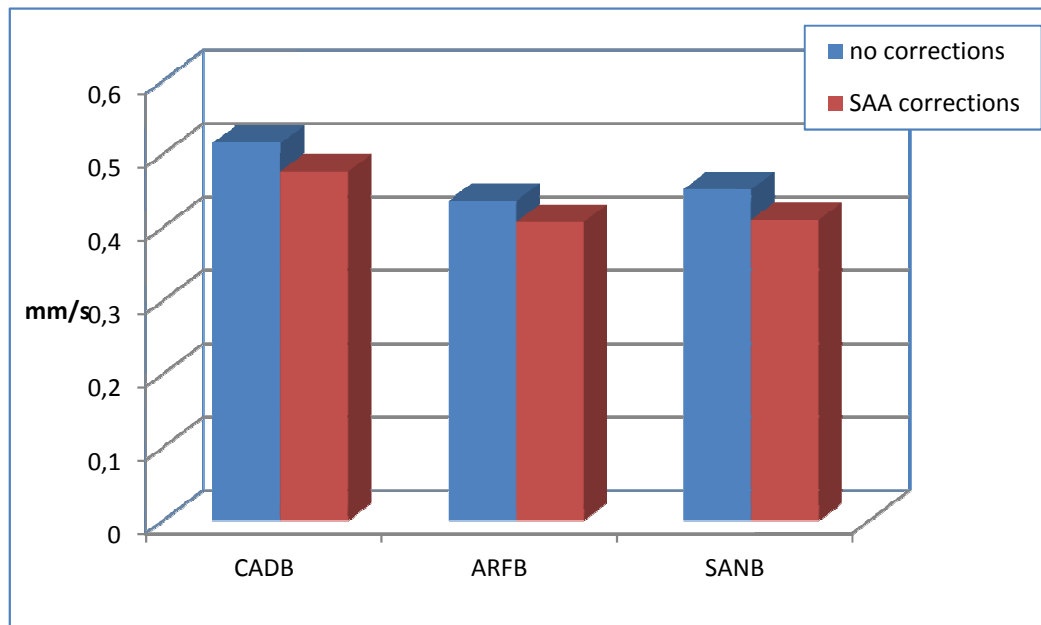
Residuals – solutions with and without data corrections

- ❑ Derived from the solutions with fixed network, orbit and troposphere
- ❑ Residuals for CADB, SANB,ARFB decreased very strongly (45-70%)
- ❑ Slight improvement also for KRVB,HEMB,ASEB (5-15%)



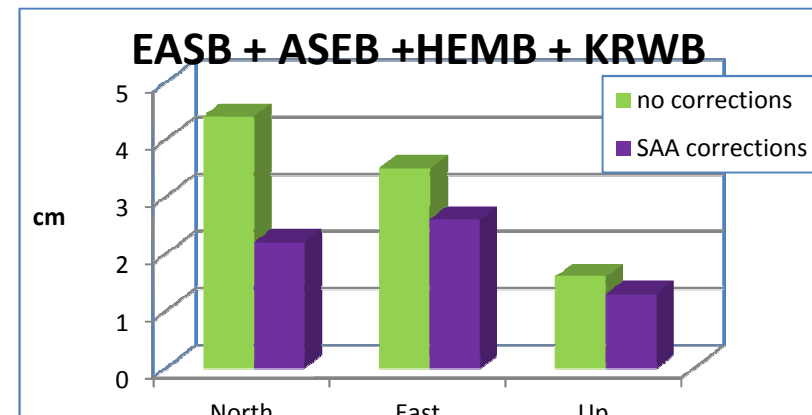
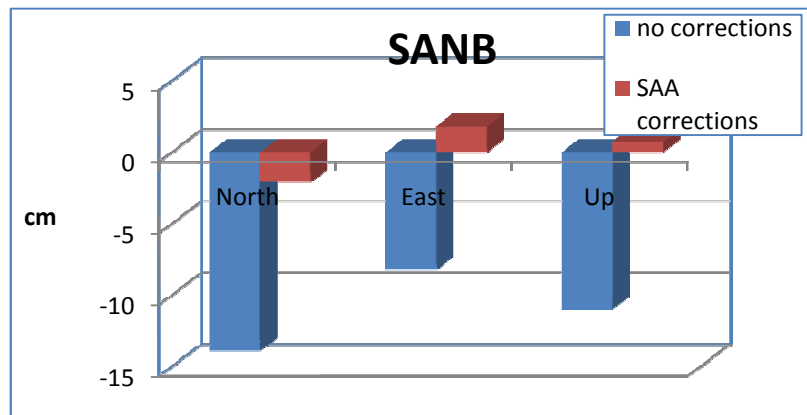
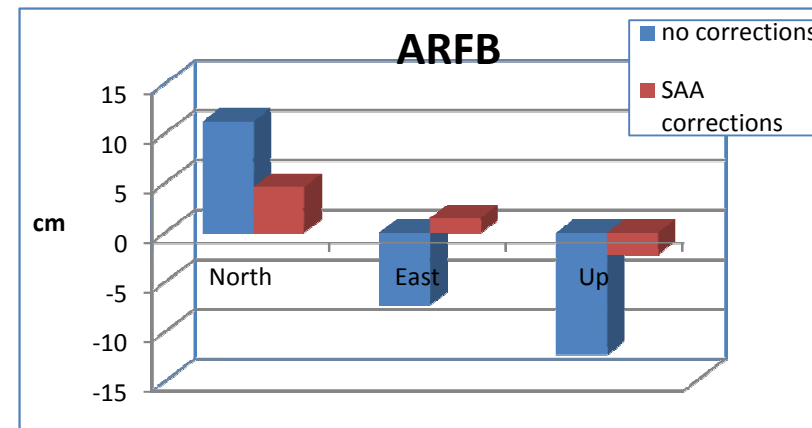
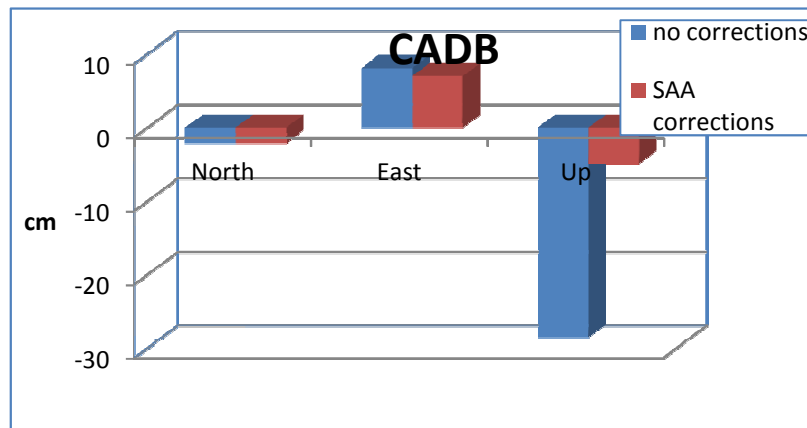
Residuals – solutions with and without data corrections

- ❑ Derived from the free-network solution
- ❑ Residuals less affected by SAA, most of the effect absorbed in estimated parameters
- ❑ Residuals decreased by 7-9% for CADB,ARFB,SANB



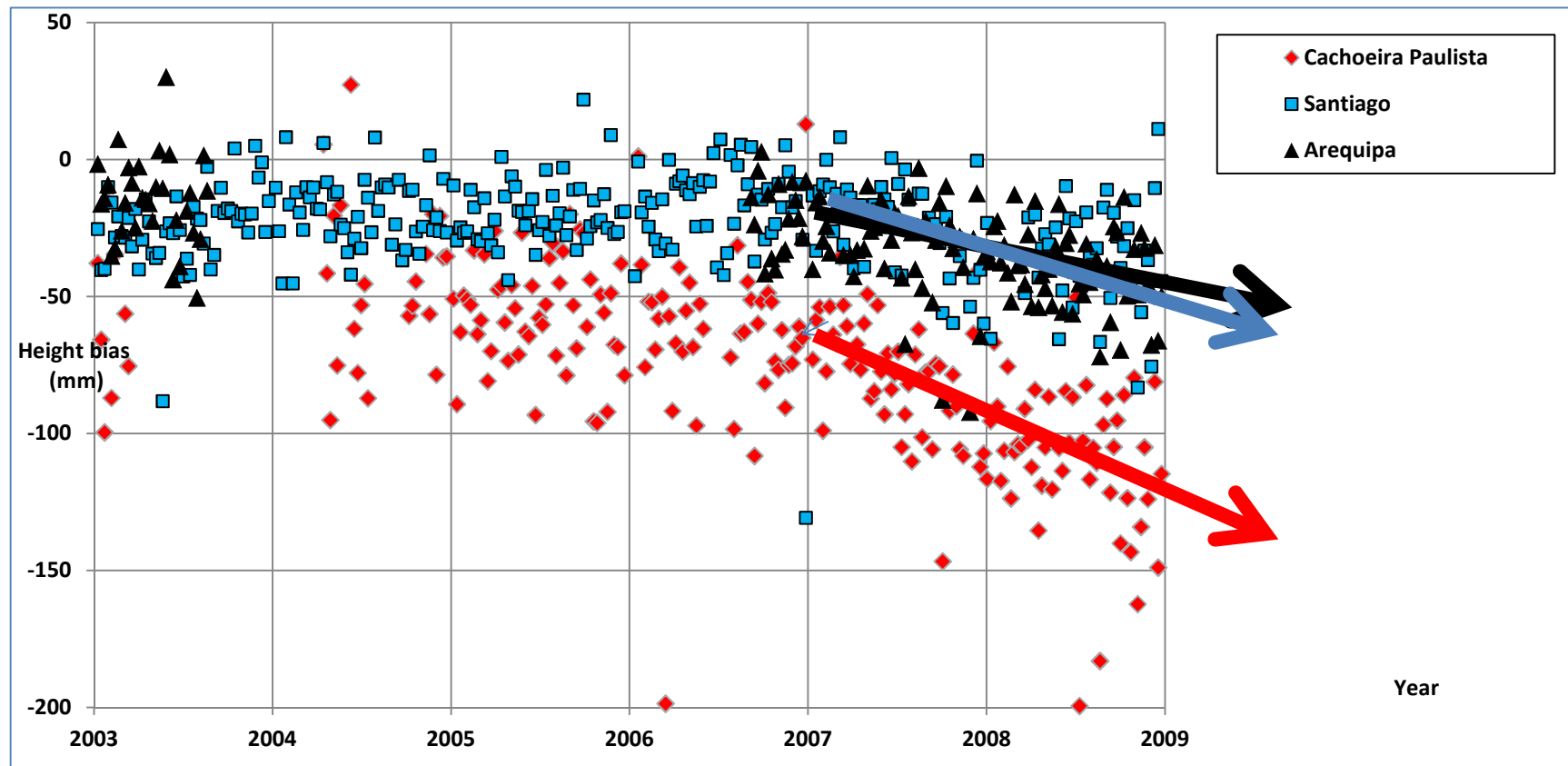
Estimated network

- ❑ Comparison of the SPOT-5 single satellite solution and multi-satellite solution (without SPOT-5)
- ❑ first half of 2011
- ❑ Coordinates offset for CADB,ARFB,SANB strongly decreased using data corrections
- ❑ Displayed average absolute offset for EASB,ASEB,HEMB,KRWB also decreased



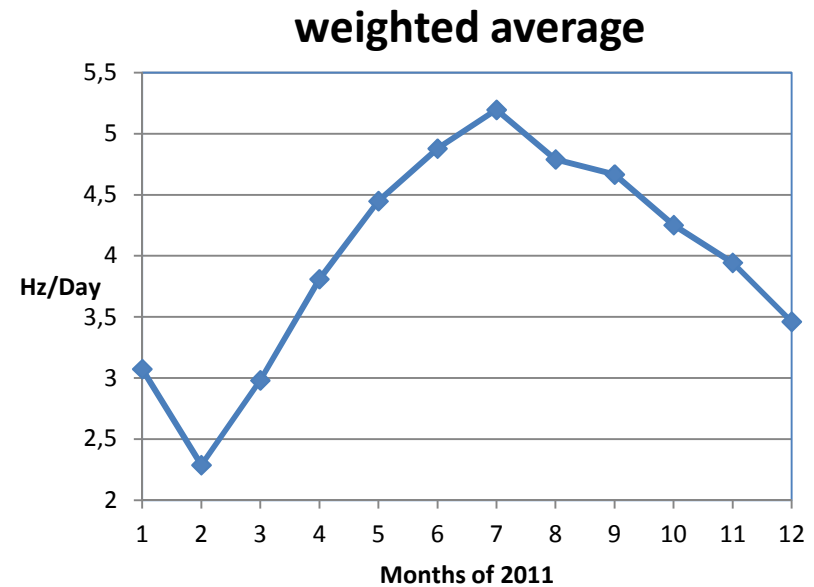
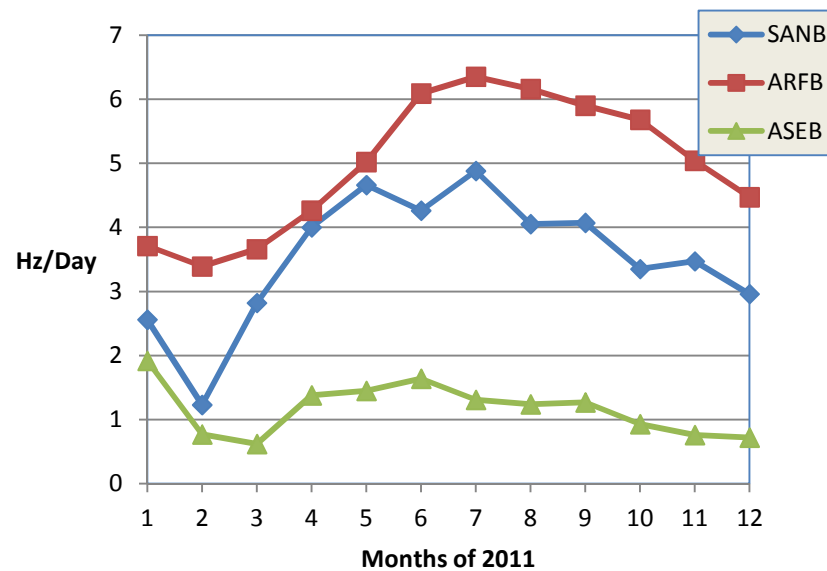
Change in the oscillator sensitivity from 2006/2007?

- Comparison of the SPOT-5 single satellite solution and multi-satellite solution



Seasonal variations?

- SANB, ARFB and ASEB observed each month of 2011
- Behavior of the average frequency drift during 2011 looks seasonal
- From 1 year of data not significant



Conclusions

We don't bring completely new, original modeling of SAA effect, but:

- Our presumption that simplified model could work well looks right
- Results are very promising (more significant than expected)
- We will be probably able to eliminate SAA effect on the SPOT-5 data with satisfying precision (which didn't completely succeeded for Jason-1)

Future prospects:

- confirmation processing a long time series
- model including long-term time dependent changes in the SAA effect and seasonal effects, if confirmed...

Thanks for the attention ...

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