

# Recent Improvements in DORIS Processing at the European Space Operations Centre

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- ITRF2008: esawd03 summary of solution
- Upgrades performed to our IDS processing
- Inclusion of the new satellites Jason-2 and Cryosat-2 and the new esawd04 and esawd05 solution plus some results from the esawd06 test solution
- First results from Envisat COM study
- Routine delivery
- Summary

- With the ITRF2008 call for participation ESA/ESOC decided to participate in all three geodetic satellite tracking techniques: IGS, ILRS and the IDS
- ESOC has been involved in routine DORIS processing since the launch of Envisat in March 2002.
- The esawd03 solution is the solution submitted by ESOC to the IDS for the ITRF2008 call. It covered at the time of the ITRF2008 submission the period from January 1993 until January 2009. It is fully homogeneous and uses all available data with the exception of Jason-1 (SA anomaly).
- This solution is routinely updated and the latest SINEX file delivered to CDDIS is week 34 of 2010 (22/08/2010).
- This presentation will give an overview of the upgrades performed to our IDS processing since the ITRF2008 submission.

# Upgrades to our IDS processing (1)



- Antenna phase centre to Centre of Mass correction is no longer taken from the DORIS data product but is calculated.
- Further the centre of mass history for the satellites is now taken from the history files as provided on the IDS ftp server (4cm change in COM of Envisat over mission duration).
- Satellite box-wing modeling is now used for all satellites and all non-conservative forces (i.e., drag, solar ,albedo and infrared radiation) expect for Envisat were internal validation show a better performance from the more detailed ANGARA model.
- New manoeuvre files are used and satellite is no longer excluded from the processing on a day with a manoeuvre (manoeuvre scale factor is estimated).

# Upgrades to our IDS processing (2)



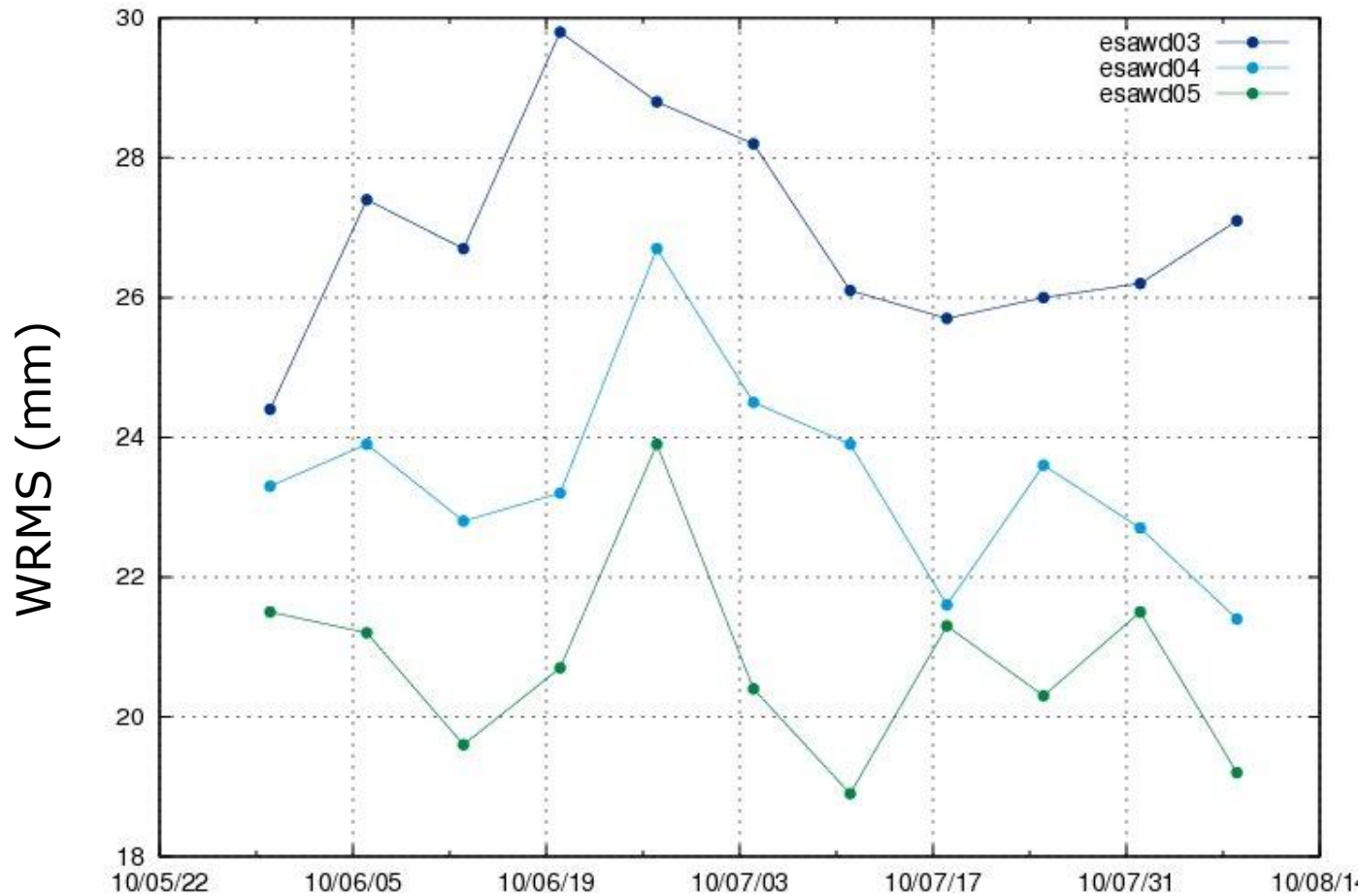
- Update of EIGEN-GL05 gravity field which includes low order linear drift terms (C20, C30 and C40).
- New version of our processing software is being used (NAPEOS version 3.5) main enhancements to the IDS processing are the better handling of EOP estimation (LOD) on the daily level and during the stacking of our daily NEQ's to generate our weekly SINEX files.
- All these improvement have been included in the esawd03 processing in the last 18 months.
- Further two new solutions have been generated: esawd04 and esawd05. These new version numbers reflect the inclusion of the new satellites that have become available namely: Jason-2 and Cryosat-2.

# Upgrades to our IDS processing (3)



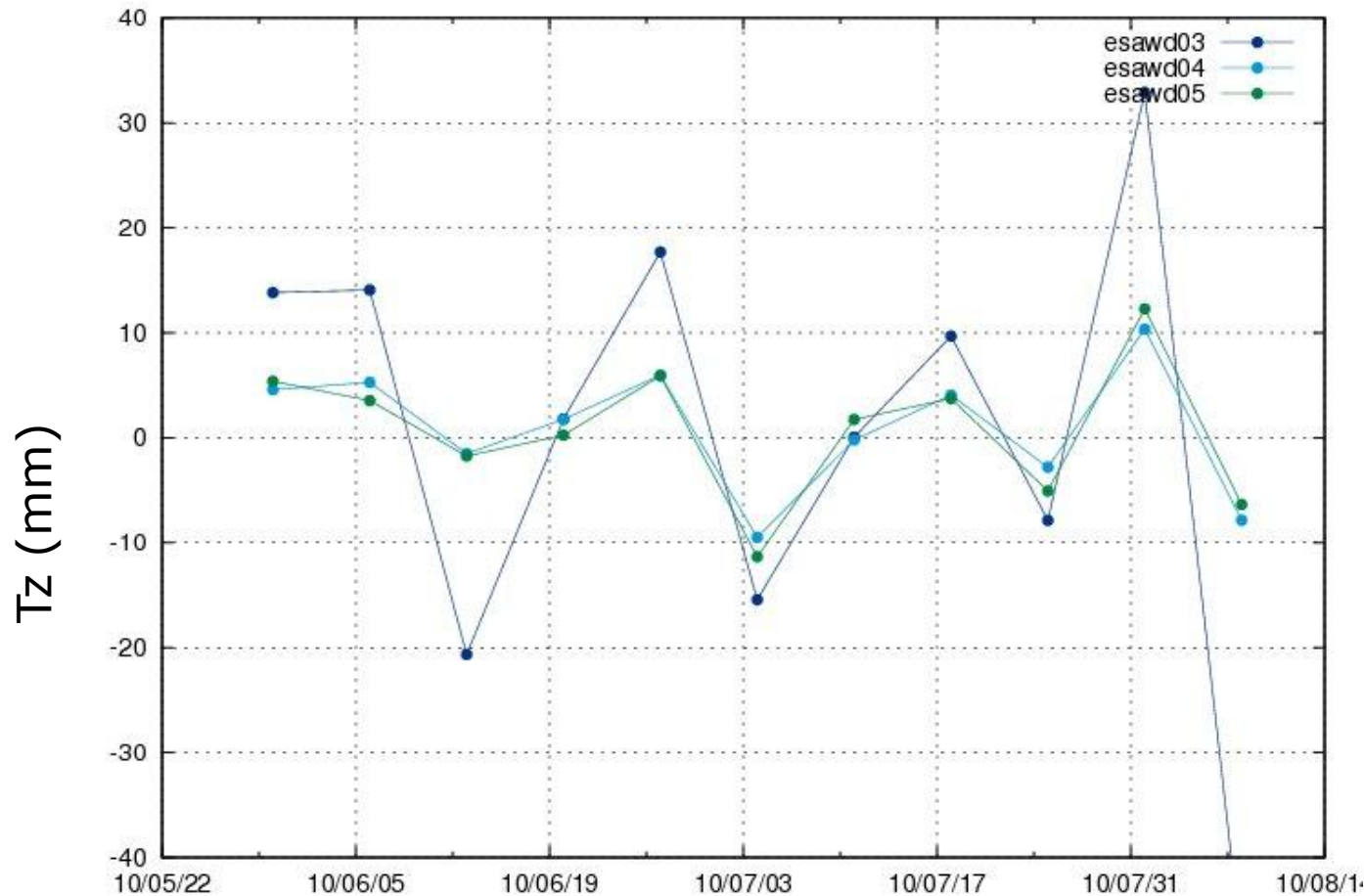
- The esawd04 solution is identical to the esawd03 solution but includes Jason-2 and the esawd05 solution is identical to the esawd04 solution but also includes Cryosat-2.
- The esawd04 solution is generated in parallel to esawd03 and is made routinely available on CDDIS (at the same time as esawd03).
- The esawd05 solution is currently under evaluation but will be made available as soon as possible.
- The following slides show the improvement seen for esawd04 and esawd05 compared to esawd03 based on our internal validation.

# esawd04 and esawd05 - WRMS



Plot on the left shows the week to week repeatability of the various ESOC solutions for the period that the Cryosat-2 data has been made available. The WRMS is the total 3D RMS of the station positions based on inverting our NEQ's using no-net rotation and loose constrains on the EOP parameters. Clearly visible is the big improvement gained from including both Jason-2 (esawd04) and also Cryosat-2 (esawd05)

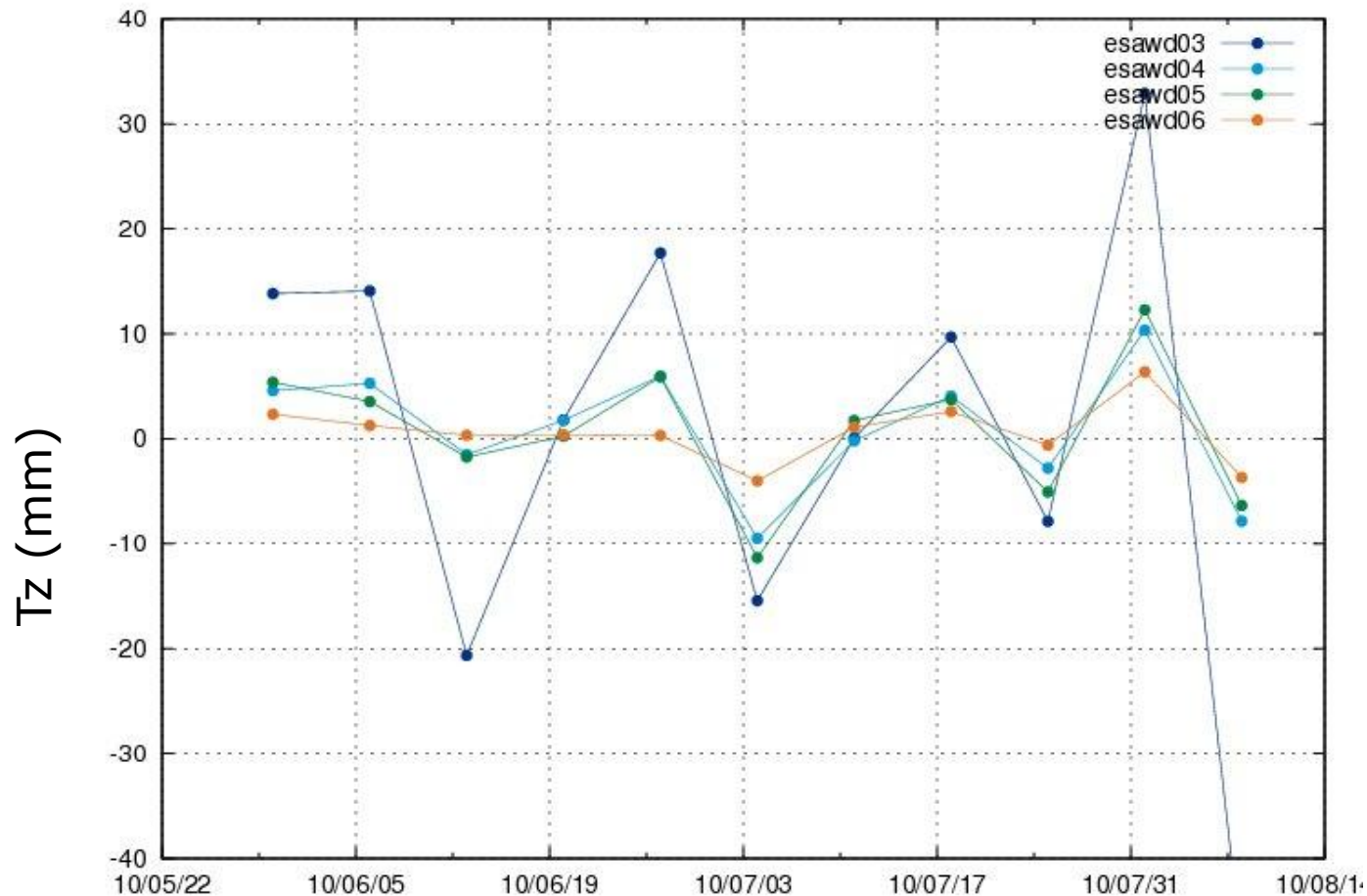
# esawd04 and esawd05 – Tz Helmert



Plot on the left shows the week to week Tz helmert parameter for the same time period as the previous slide. Clearly visible is the big gain in Tz that is gained by including Jason-2 (as already reported at the workshop in Darmstadt earlier this year). In this case including Cryosat-2 does not further improve the Tz parameter.

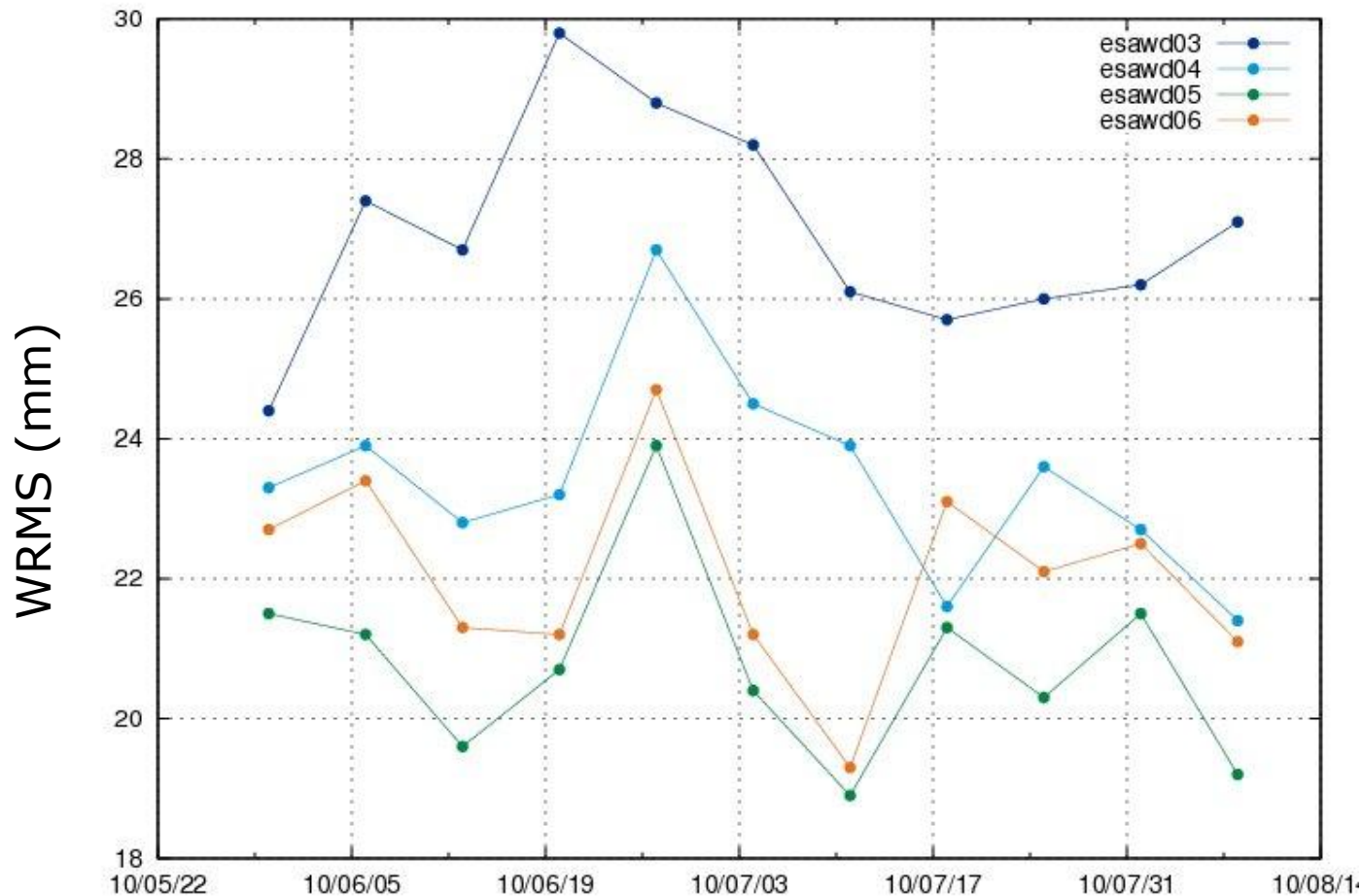


# Daily to weekly processing: esawd06



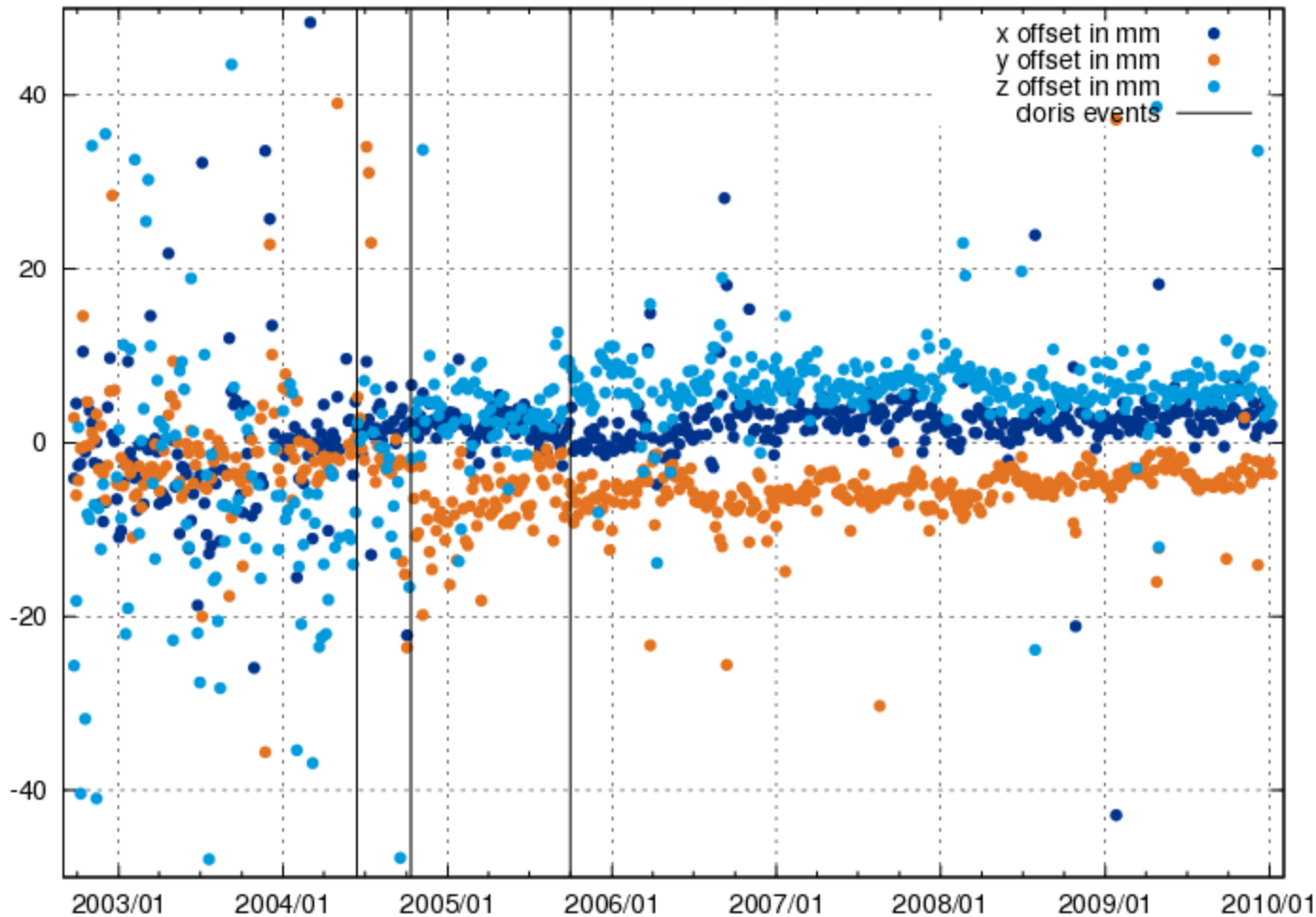
Plot on the left shows again the week to week Tz helmert parameter for the same time period as the previous slide. Included now is the esawd06 solution which is a test solution in were no longer daily NEQ's are stacked into weekly NEQ's but directly weekly NEQ's are computed. The difference is in the orbit parameters especially the statevector which is now only estimated one a week i.e. from daily to weekly.

# Daily to weekly processing: esawd06



Plot on the left shows now again the WRMS residual for the previous solutions and the new esawd06 weekly solution. Although switchin from daily to weekly processing improves the Tz component of the solution it does lead to a degradation in the station WRMS. This degradation may be caused by orbit errors are transformed to the stations positions due to the reduction in estimated orbit parameters (weekly statevector versus daily)

# Envisat DORIS Phase Centre

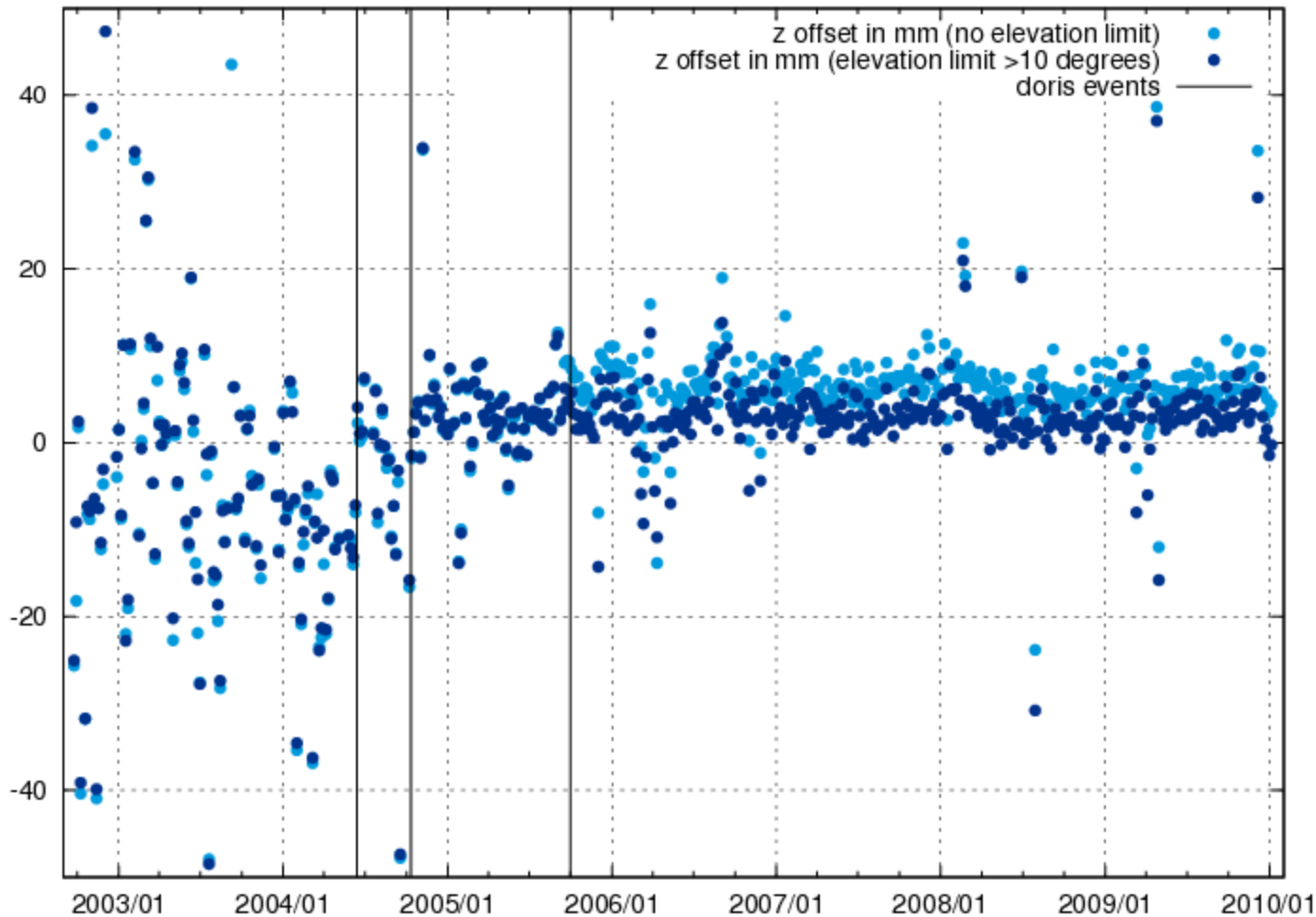


Plot on the left shows the DORIS phase centre offset estimation as derived from the ESOC POD processing (DORIS+SLR). Notice the clear correlation with the switch of the DORIS instrument from waiting mode to chain mode.

The change observed at the last vertical bar is caused by inclusion of low elevation data in processing (see next slide).

Envisat DORIS phase centre estimation over time. Black vertical bars indicate DORIS events

# Envisat DORIS Phase Centre



The last vertical bar indicates the change in DORIS processing at CNES. After October 2005 CNES processing edited out less data especially the low elevation data. The inclusion of this low elevation data has a minor impact on the z offset estimation.

Envisat DORIS phase centre estimation over time. Black vertical bars indicate DORIS events

- Since September this year the IDS processing at ESOC is running successfully in a routine and automatic way.
- The SINEX files are delivered to CDDIS manually but will be done automatically after completion and testing of the automatic validation tool (before the end of the year).
- Latest data that has been delivered to CDDIS is week 34 of 2010 (DOY 234 week starting 22/08/2010).

- Using both the Jason-2 and Cryosat-2 data clearly improves the performance of the ESA IDS solution. Routine processing will include both missions and esawd05 will become the default ESA solution. Depending on the need both esawd03 and esawd04 delivery can be continued.
- Seven day arc processing shows a improvement in the SINEX week to week stability (Tz) but does increase the station WRMS. The cause is still under investigation.
- Using different elevation cut-off angles does seem to have an impact on the phase centre estimation which may explain part of the difference seen in scale by the different analysis centres.
- The ESA solution is being generated routinely and before the end of the year will be delivered to CDDIS automatically as soon as the DORIS data is available.

# Thank you



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