IDS ITRF2013 activities at the European Space Operation Centre

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Overview

This presentation will give an overview of the various changes that have been made to our IDS processing from the ITRF2008 release (ESAWD03) to the final ITRF2013 release ESAWD10

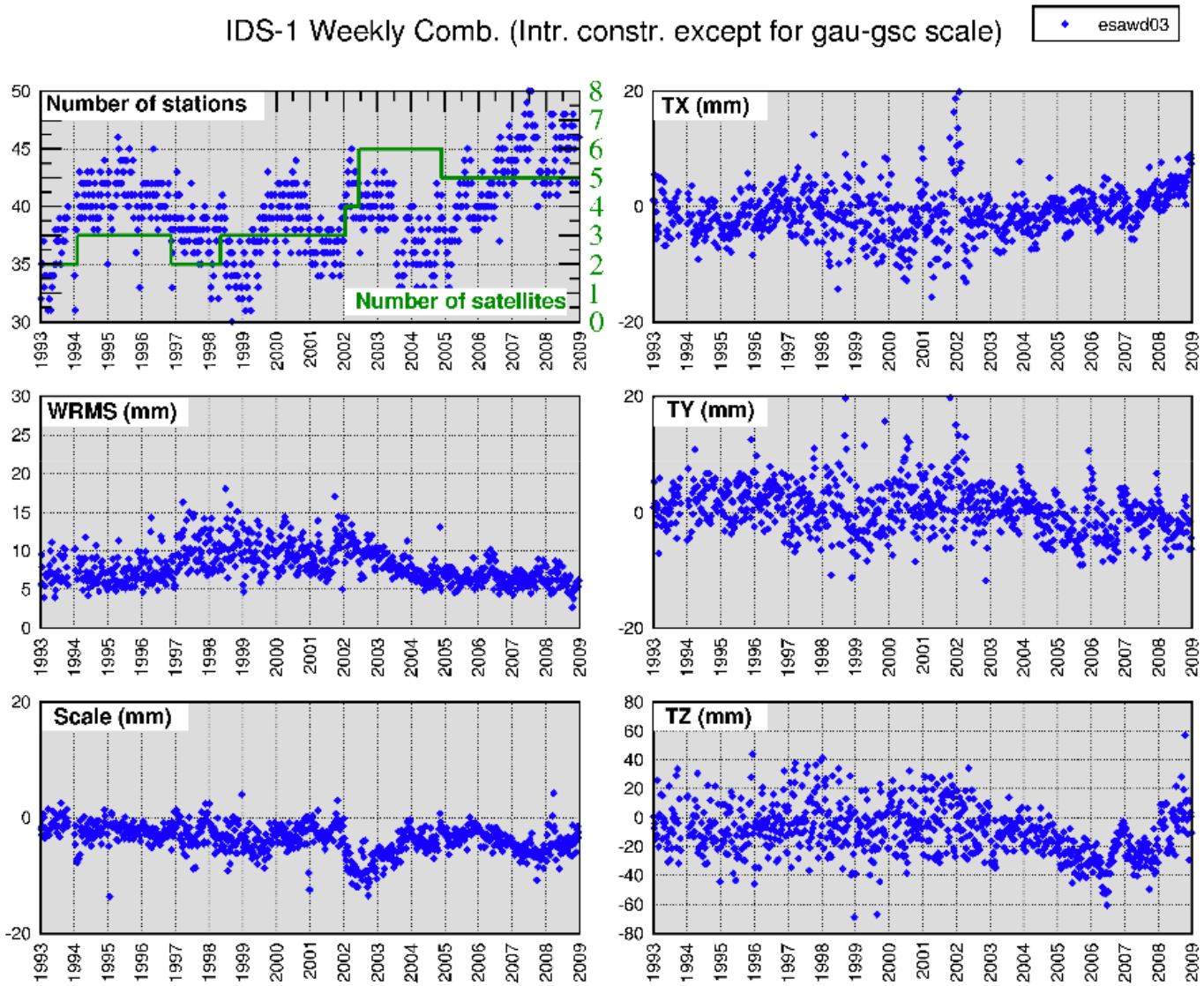
Not all changes will be shown but a selection has been made of the major changes that impacted the ESA/ESOC IDS solution

ESAWD03 First ESA/ESOC solution

- 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 ESA/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).

ESAWD03 solution compared to IDS-1 combination

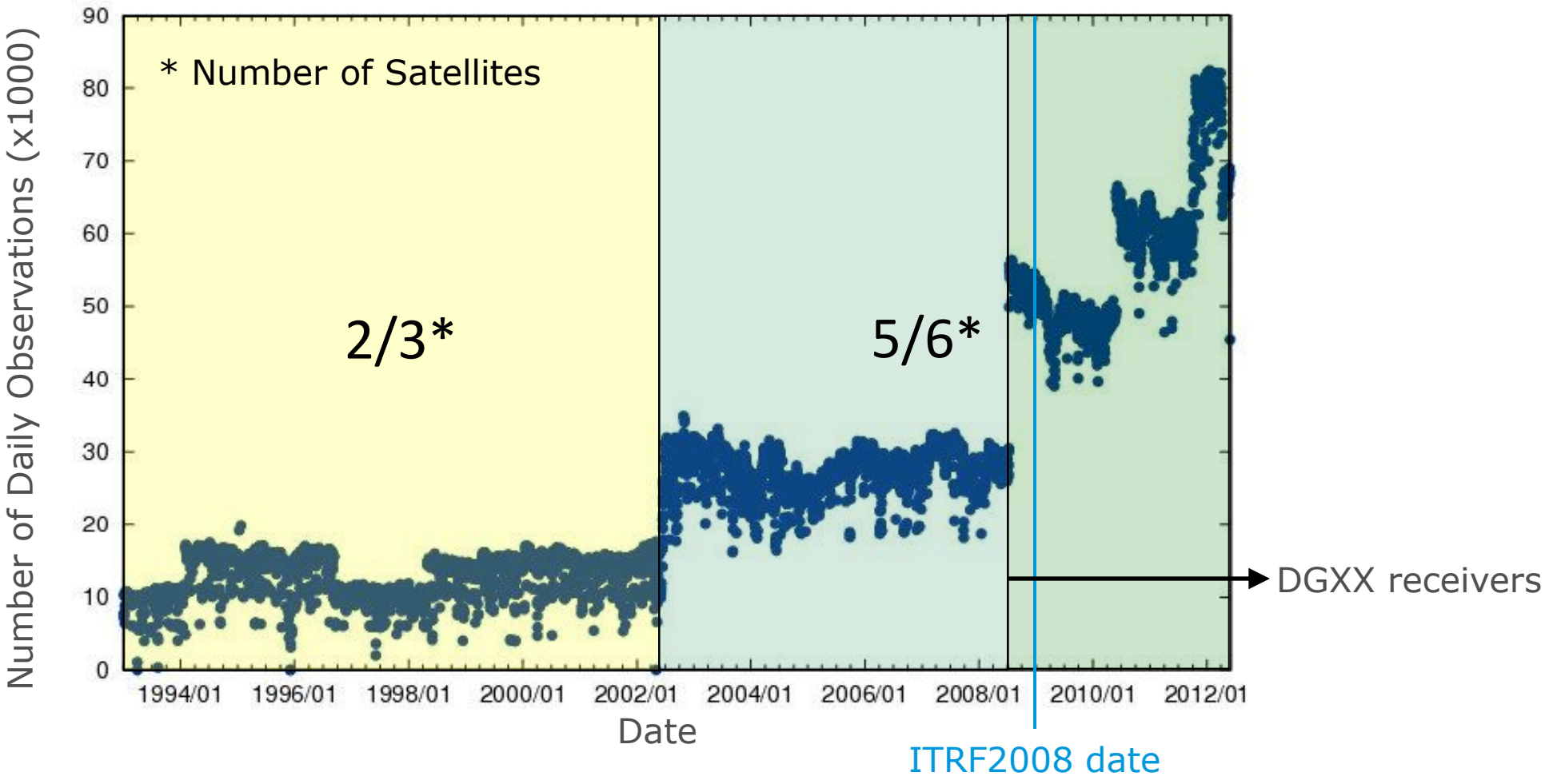
Plot provided by Guilhem Moreaux



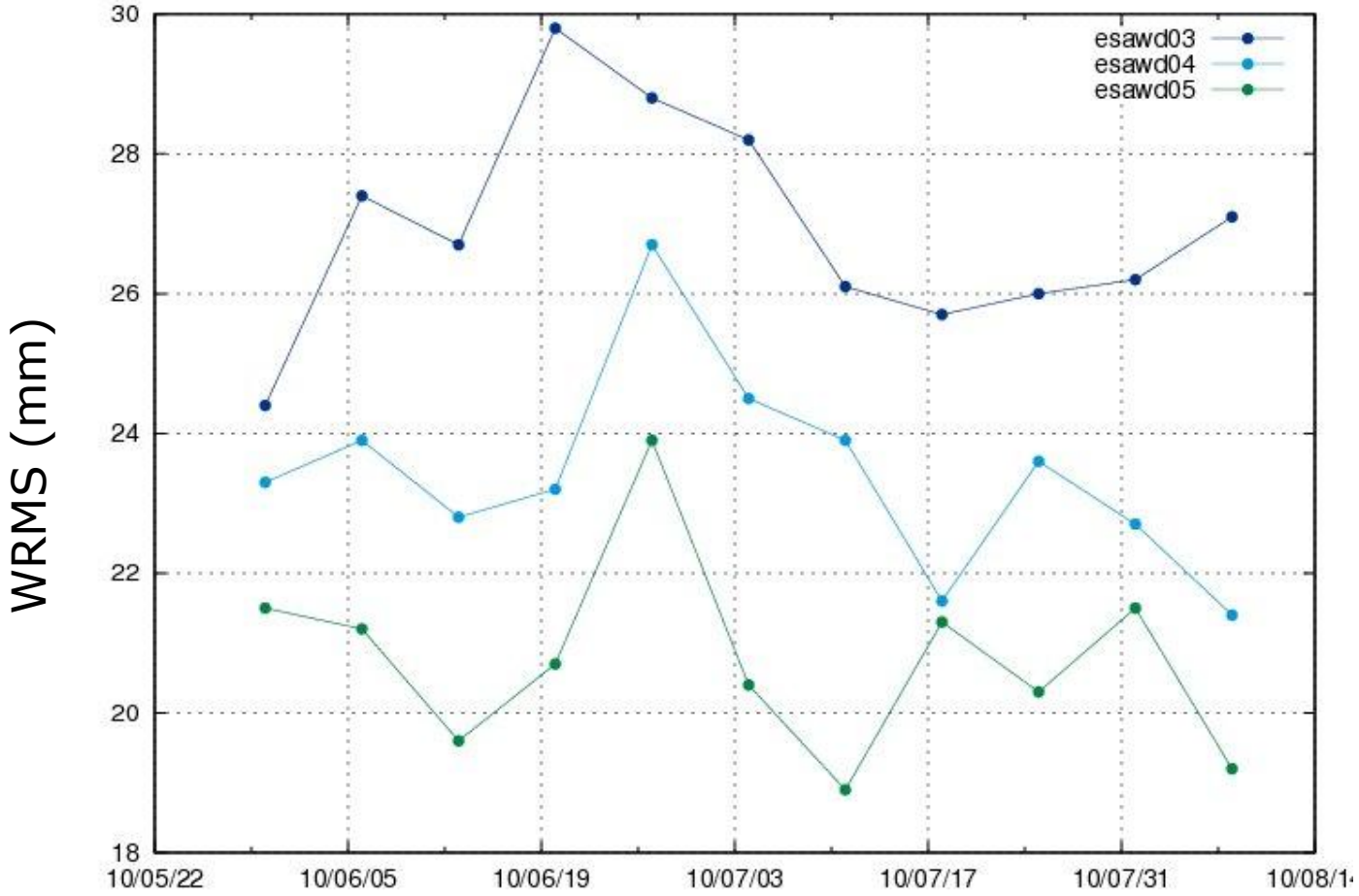
New Satellites: the DGXX receivers

- For the ITRF 2008 solution it was decided to not include Jason-2 as only half a year of data was available.
- With the launch Cryosat-2 in 2010 two DGXX receivers became available (the DGXX receivers allow for 7 trackable beacons instead of 2) which let to a significant increase in the number of available measurements especially at lower elevations.
- This let to two new solution at ESA namely ESAWD04 (which included Jason-2) and was further identical to the ESAWD03 and the ESAWD05 which is identical to the ESAWD04 solution but also includes Cryosat-2.
- The following slides shows the impact that the DGXX receivers have on the number of observations and station repeatability.

Number of observation – The big difference

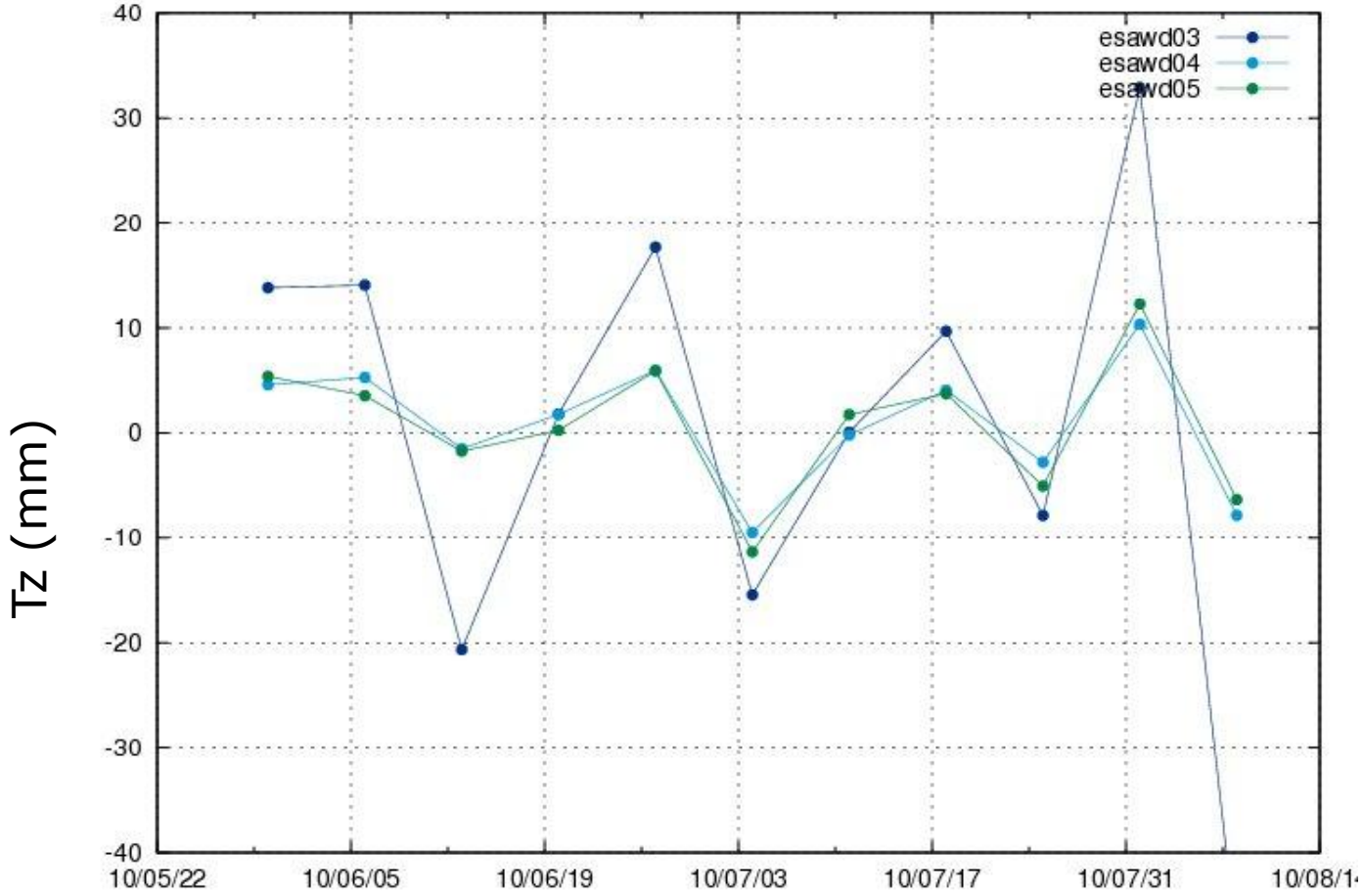


esawd04 and esawd05 - WRMS



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



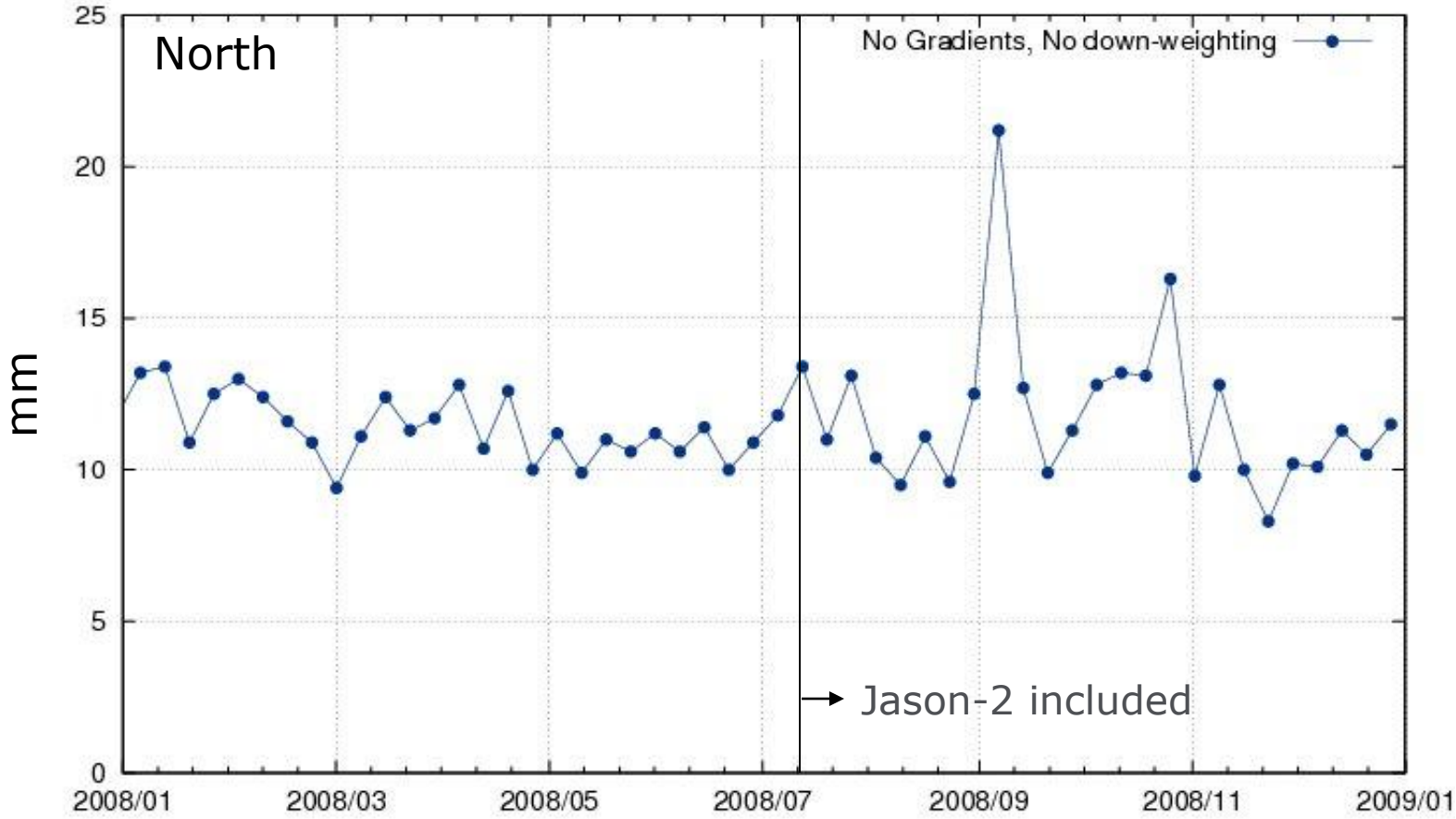
Plot on the left shows the week to week Tz helmert parameter for the same time period as the previous slide. Clearly visible is the big gain in Tz that is gained by including Jason-2. Including Cryosat-2 does not further improve the Tz parameter.

Low elevation data

- With the further launch of HY-2A the number of low elevation data has become a significant percentage of the total number of observation.
- This meant that in the ESA processing no longer all data could be waited equal.
- But it also meant that with the drastic increase of observation additional stations parameters could be estimated: tropospheric gradients.
- We include all data up to 7 degrees in our current processing and down-weight the data with the sin(elevation)
- and estimate a daily tropospheric gradient in North and East for each station
- The improvement of low elevation data and gradients is of the order of 3-5mm in 3D WRMS depending on the week for the period after the Jason-2 launch (July 2008).

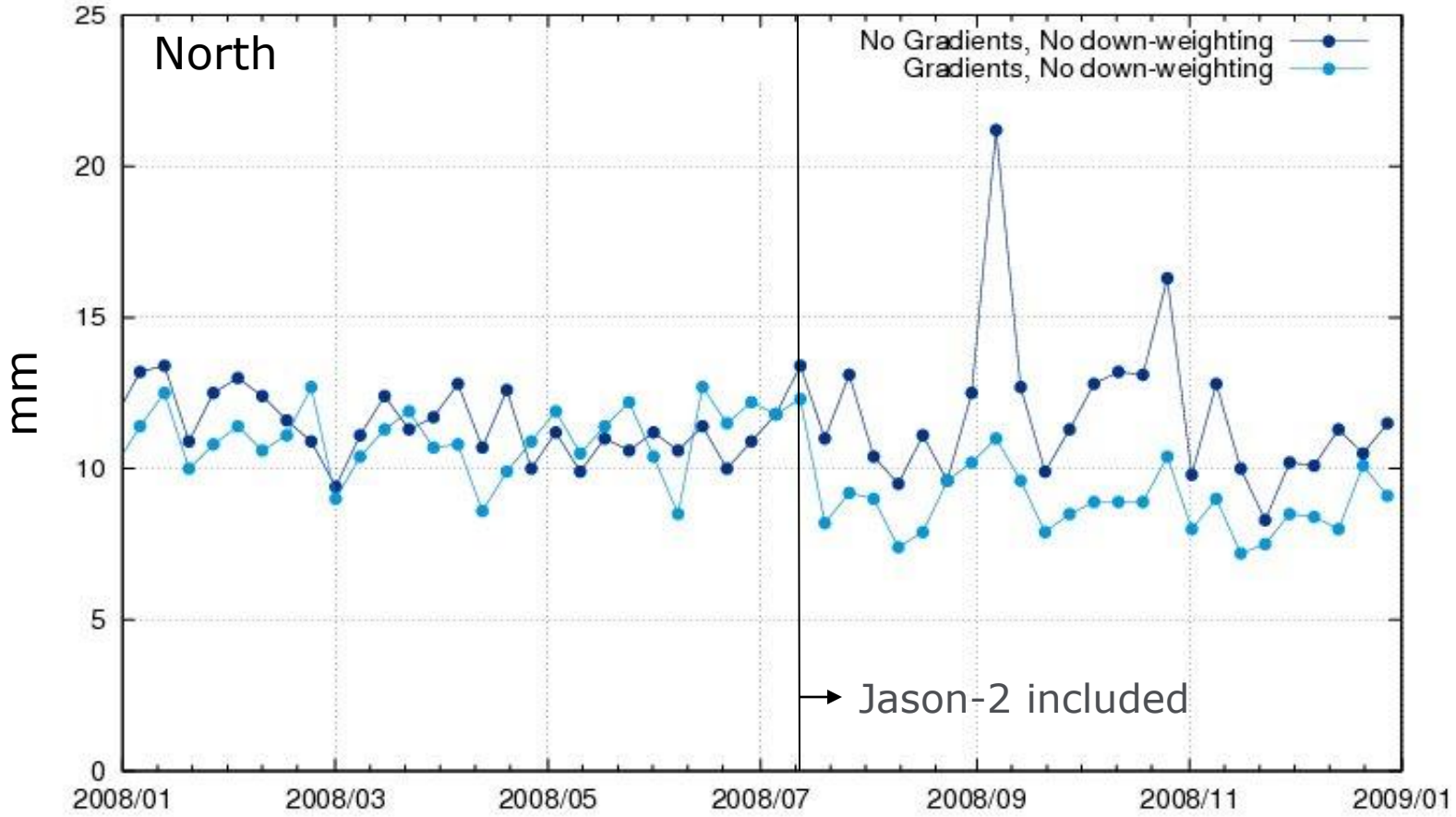
Low elevation and Tropospheric gradients

Week to week repeatability of stations coordinates in North



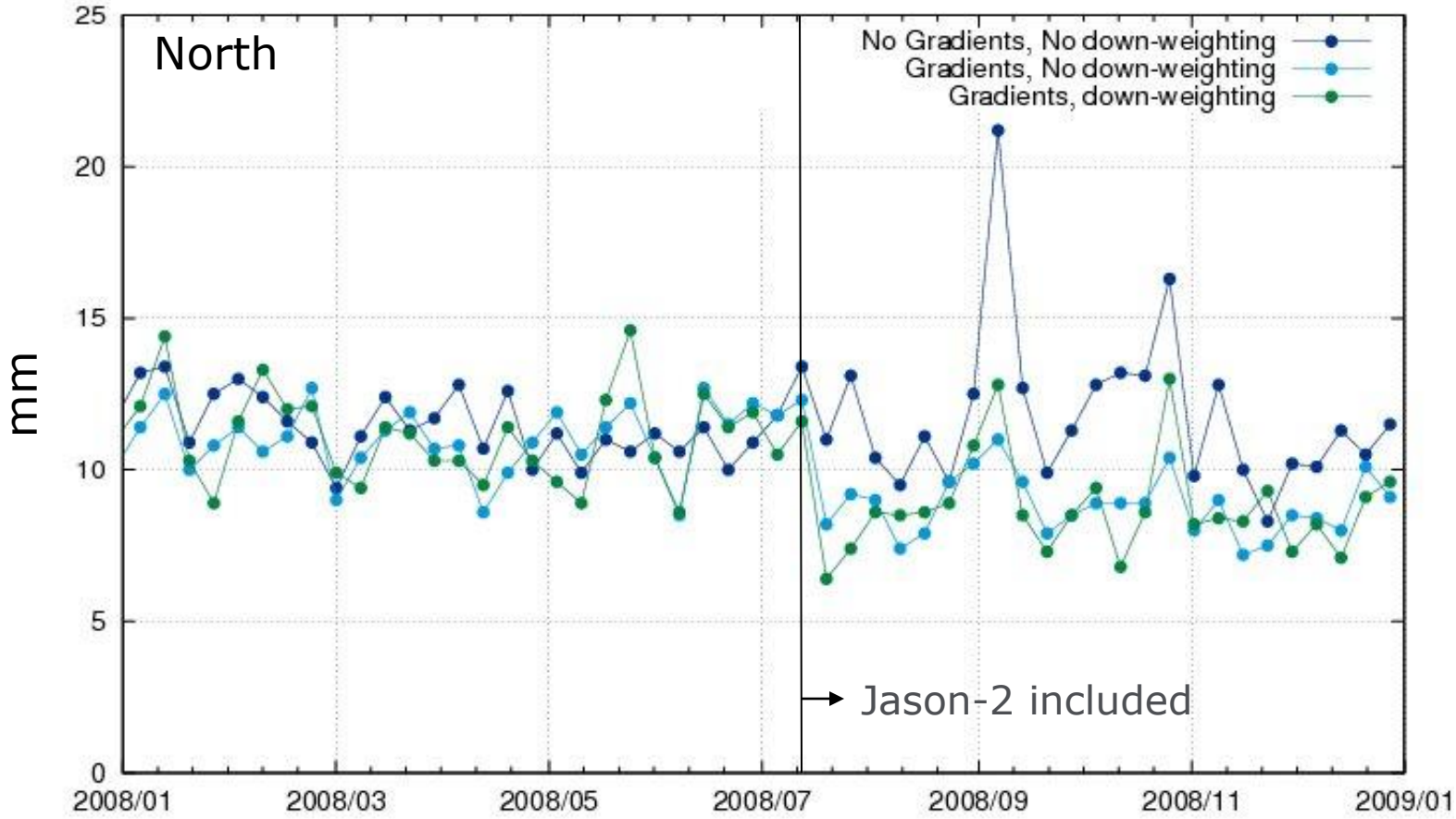
Low elevation and Tropospheric gradients

Week to week repeatability of stations coordinates in North



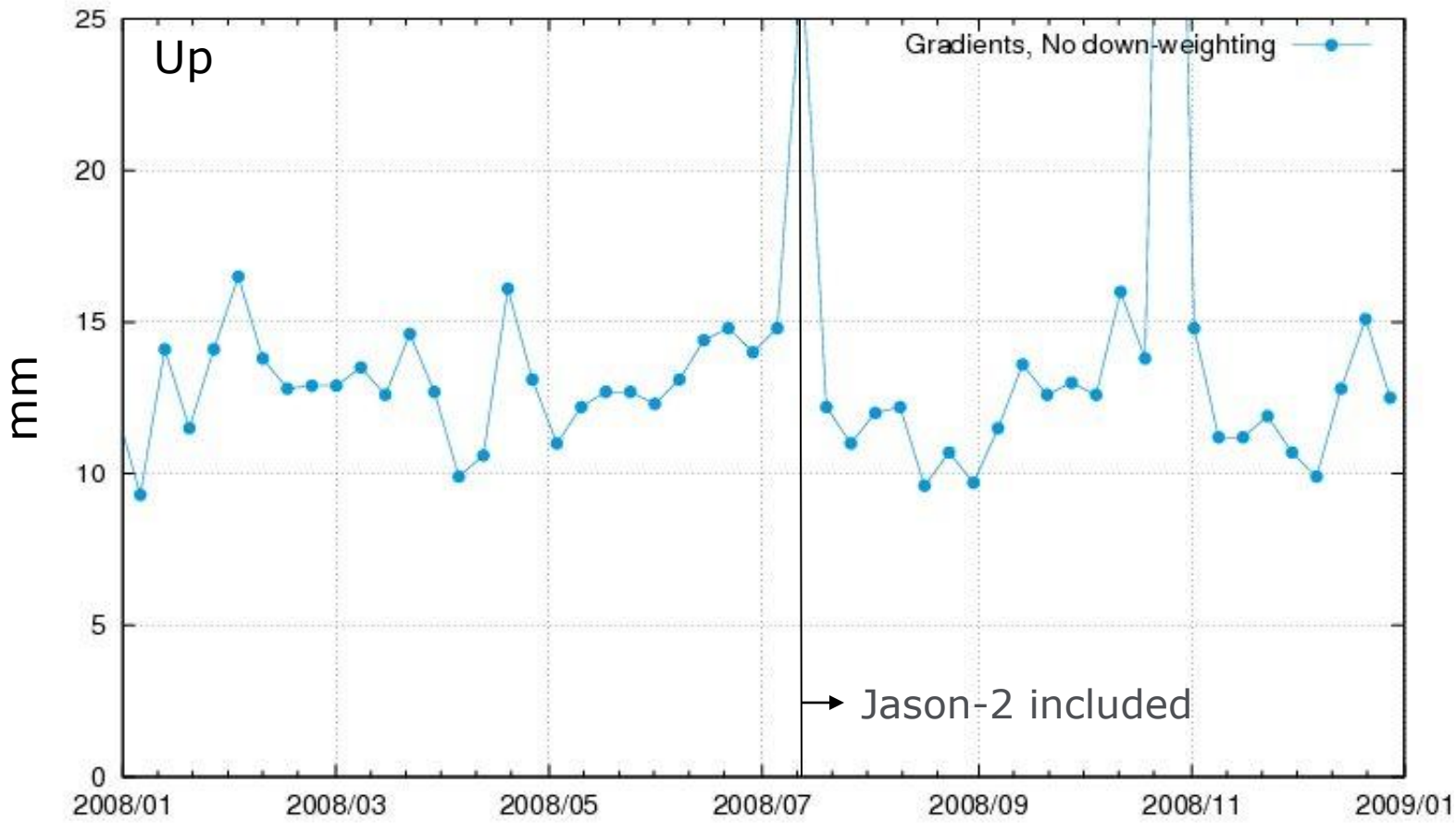
Low elevation and Tropospheric gradients

Week to week repeatability of stations coordinates in North



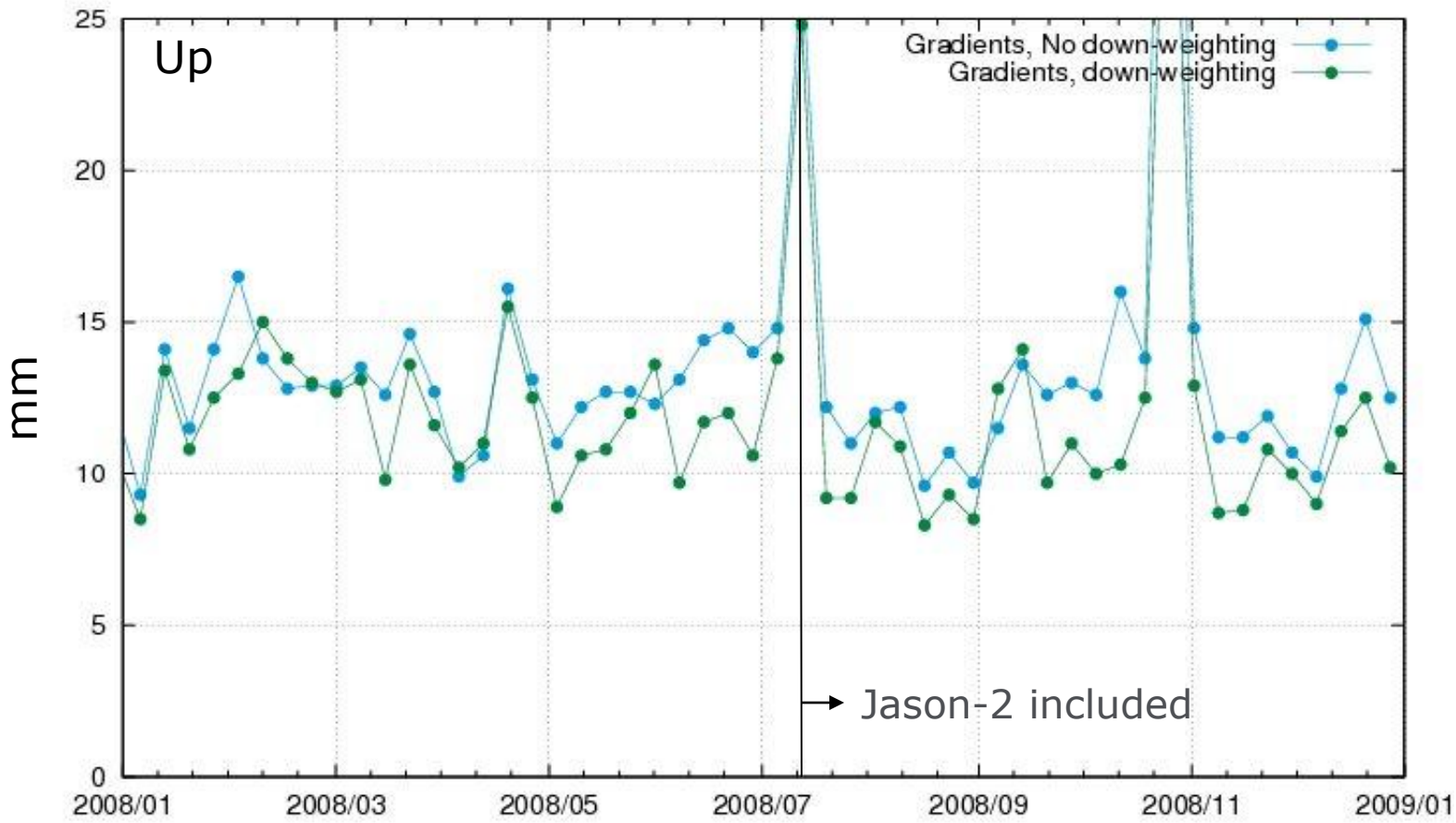
Low elevation and Tropospheric gradients

Week to week repeatability of stations coordinates in Up



Low elevation and Tropospheric gradients

Week to week repeatability of stations coordinates in Up

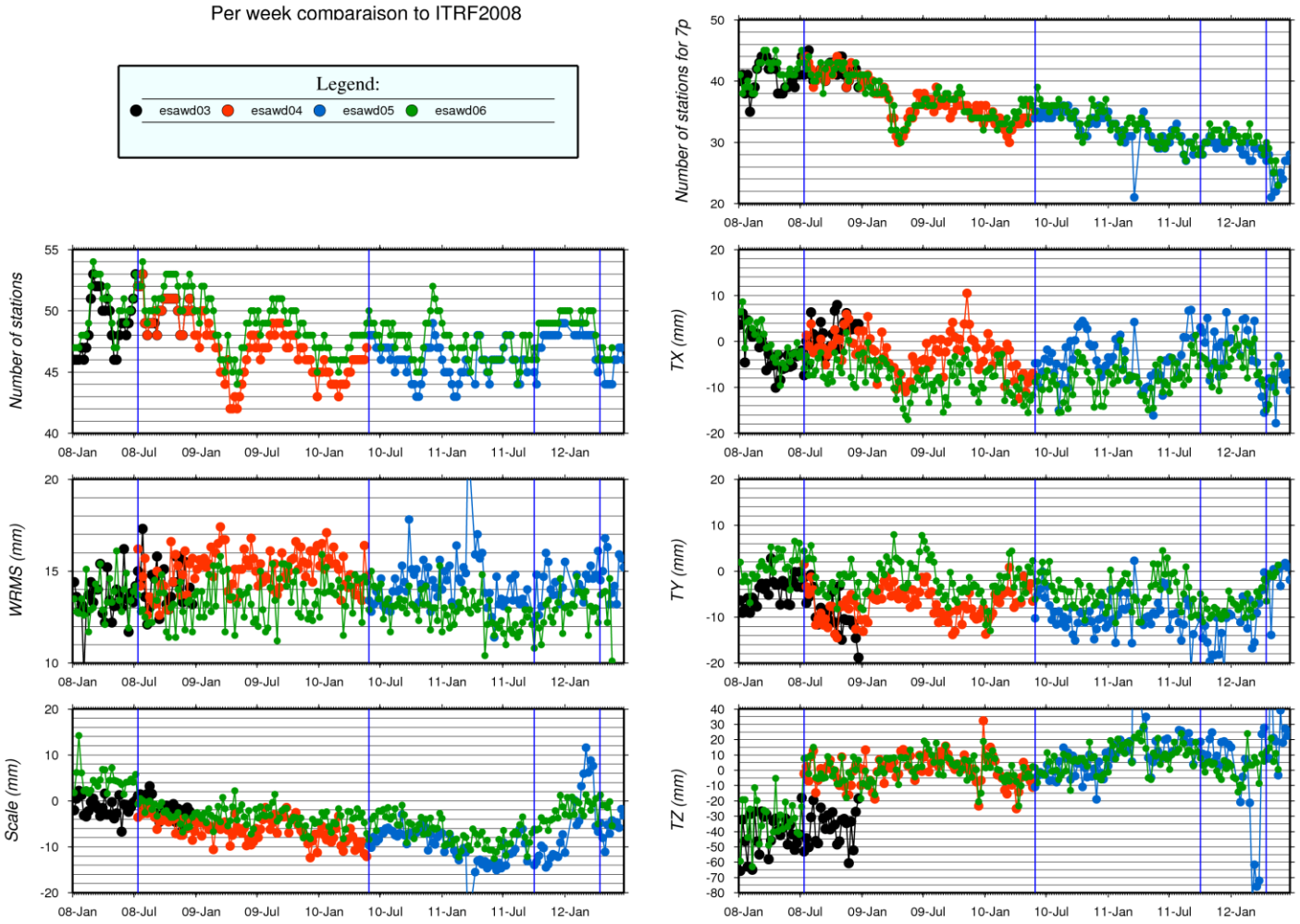


From ESAWD05 to ESAWD06 - Upgrades

- 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.
- Manoeuvre files are used and satellite is no longer excluded from the processing on a day with a manoeuvre (manoeuvre scale factor is estimated)
- Switch to GFZ-GRGS EIGEN-6C and including time varying gravity up to degree and order 50

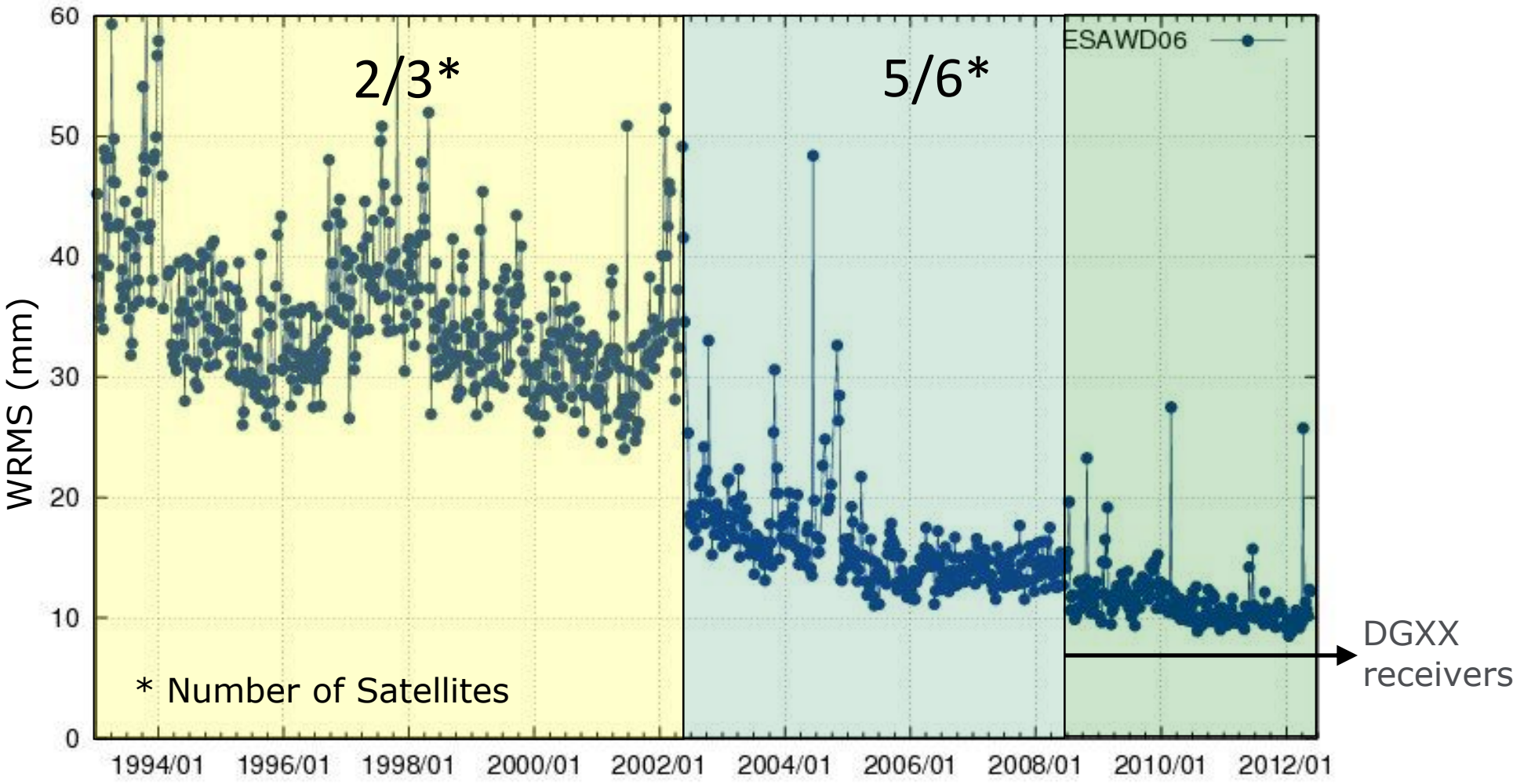
Results – ESAWD03 through 06

Plot provided by Guilhem Moreaux



Results – ESAWD06

Week to week repeatability of stations coordinates



From ESAWD06 to ESAWD10 (1)

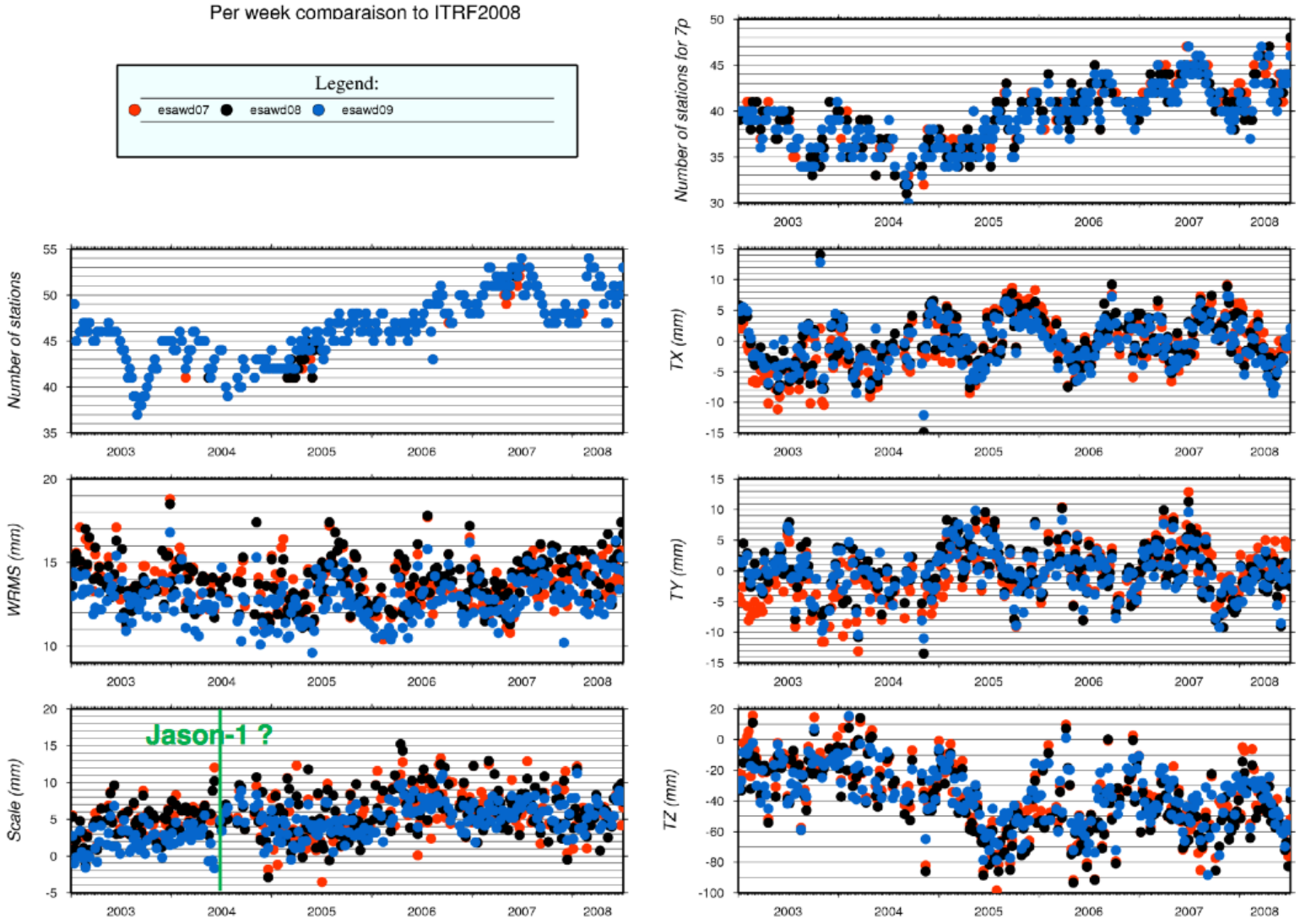
- Upgrade of NAPEOS to the IERS2010 conventions instead of IERS2003
- Upgrade to latest version of EIGEN-GRACE-6S2.5
- Upgrade ocean tide model to EOT11a (from FES2004) and inclusion of Atmospheric Tides (Ray-Ponte 2003)
- Retuned for all satellites the Solar Radiation coefficients. Previous tuning was done on 2 years of data the current tuning has been performed over the entire mission period for each satellite.

From ESAWD06 to ESAWD10 (2)

- Update from MSIS-90 density model to MSIS-2000
- Inclusion of Jason-1 from the end of Topex/Poseidon until the launch of Jason-2
- new SAA corrected data for Jason-1 and Spot-5 (>2006)
- Starec and Alcatel phase law correction applied
- Correct handling of DORIS frequency bias in observation modeling

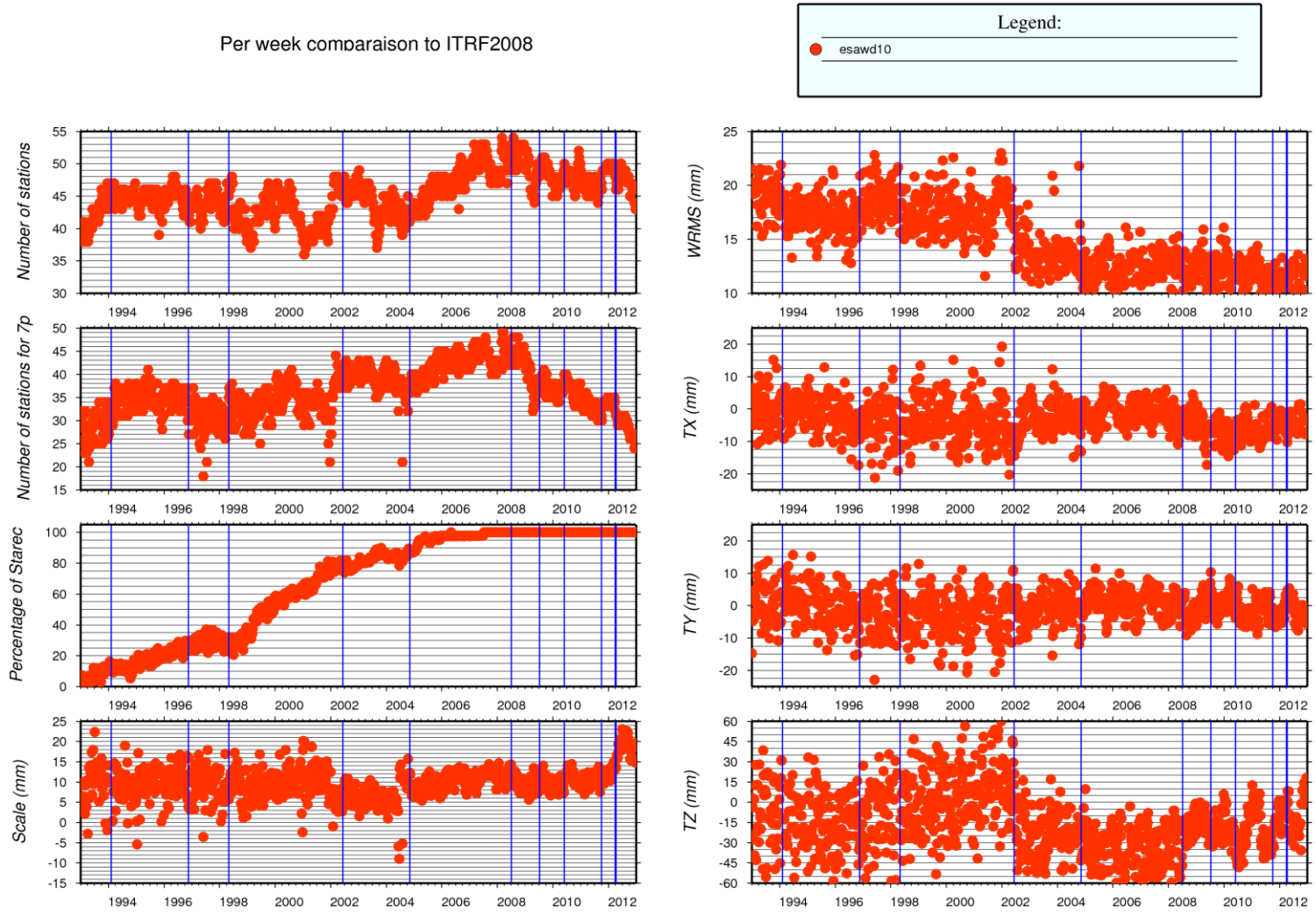
Results – ESAWD07 through 09

Plot provided by Guilhem Moreaux



Results – ESAWD10

Plot provided by Guilhem Moreaux



Summary

- With the availability of the new DORIS DGXX receivers and the resulting leap in daily measurement since mid 2008 allows for additional parameters to be estimated as shown in this presentation with the inclusion of daily atmospheric gradients in North and East.
- The improvement of low elevation data and gradients is of the order of 3-5mm in 3D WRMS for the period after the Jason-2 launch (July 2008).
- Significant improvements have been made to the force modeling like the latest EIGEN-6 gravityfield, EOT11a ocean tides and the IERS2010 conventions.
- Further two important improvement have been made to the DORIS observations modeling: the correct handeling of the station frequency bias correction and the inclusion of the Alcatel and Starec phase law correction.
- Last the inclusion of Jason-1 from the of the T/P period until the launch of Jason-2 and the updated SAA corrected files for Jason-1 and Spot-5 have improved the stability of the solution.

Thank you

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