



# CROSS-CALIBRATION between ENVISAT and JASON-1/2

Y Faugere, JF Legeais, A Ollivier, P Femenias (ESA), N Picot (CNES)



# Plan

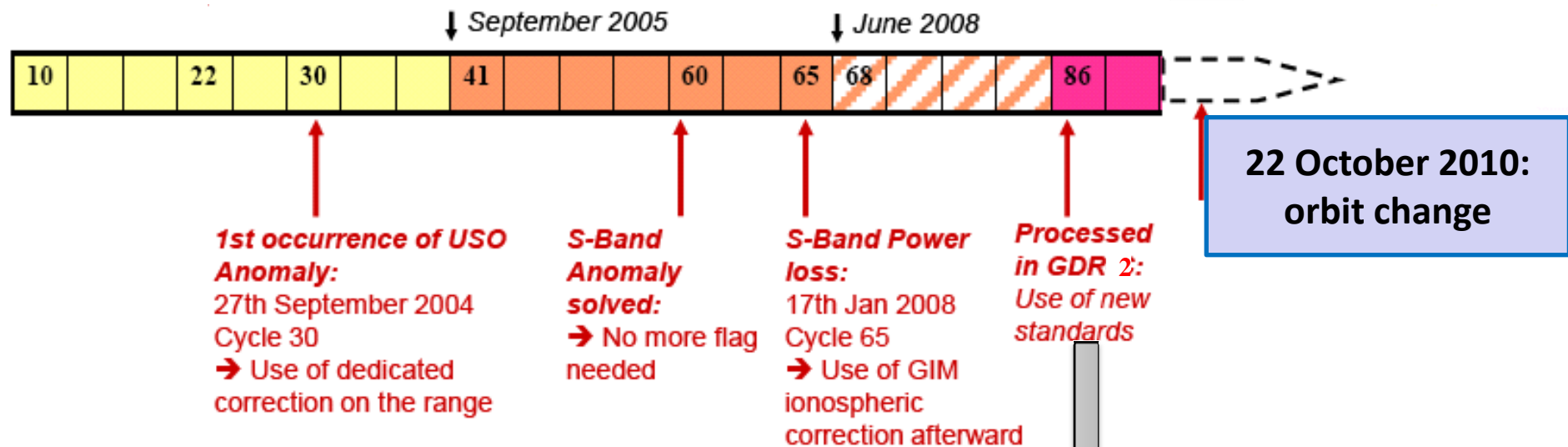


- Data and processing
- SSH performances and geographically correlated biases
- SLA Stability
- Impact of the ground track change in October 2010



In this work:  
 All SSH Correction have been homogenized  
 USO auxiliary correction used  
 Reprocessed CNES/GDRC orbit used

## Envisat GDR dataset



Envisat since cycle 86 on 11/01/2010 : New version of ground segment (IPF V6.02L04 and CMA V9.3.02)

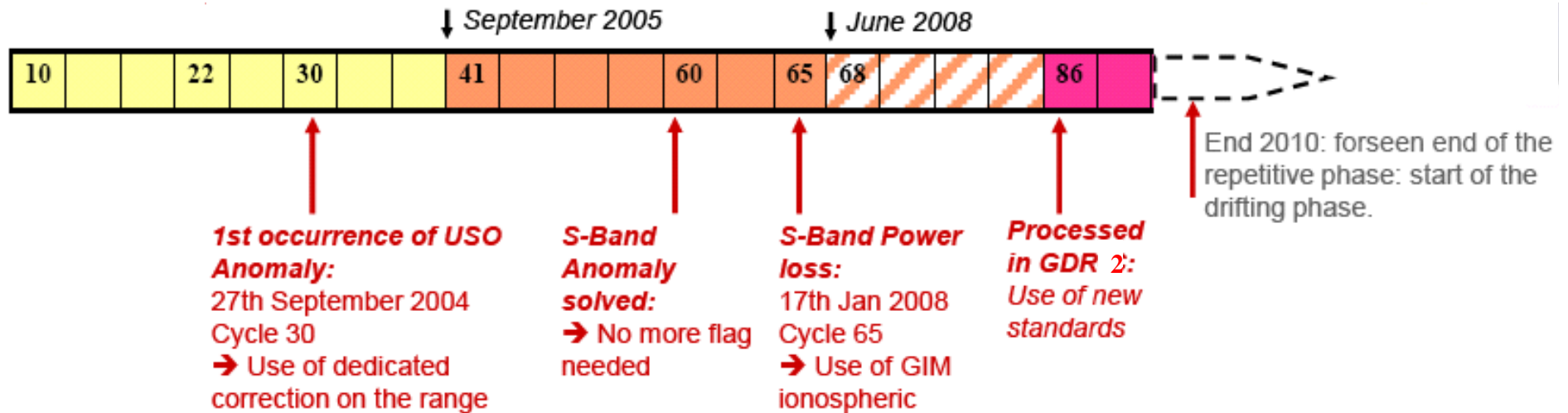
•Main changes:

- new PTR processing with increased resolution
- Change on SWH: -13cm bias
- new SSB Table

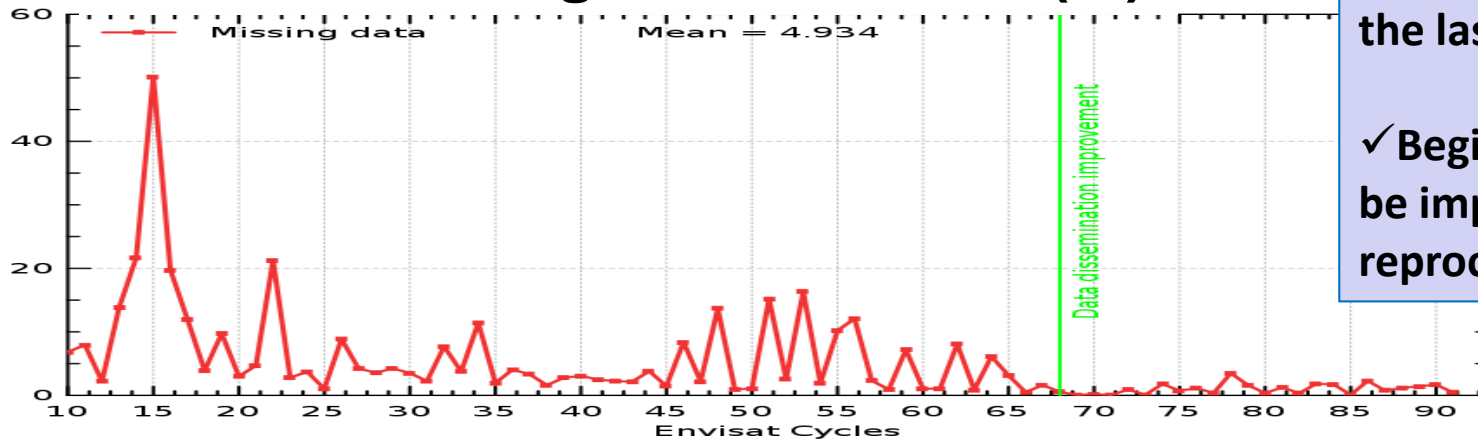
Impact of -10.5mm on SLA when using USO Auxiliary corrections supplied with the GDR



## Envisat GDR dataset



## Ratio of missing measurement (%)



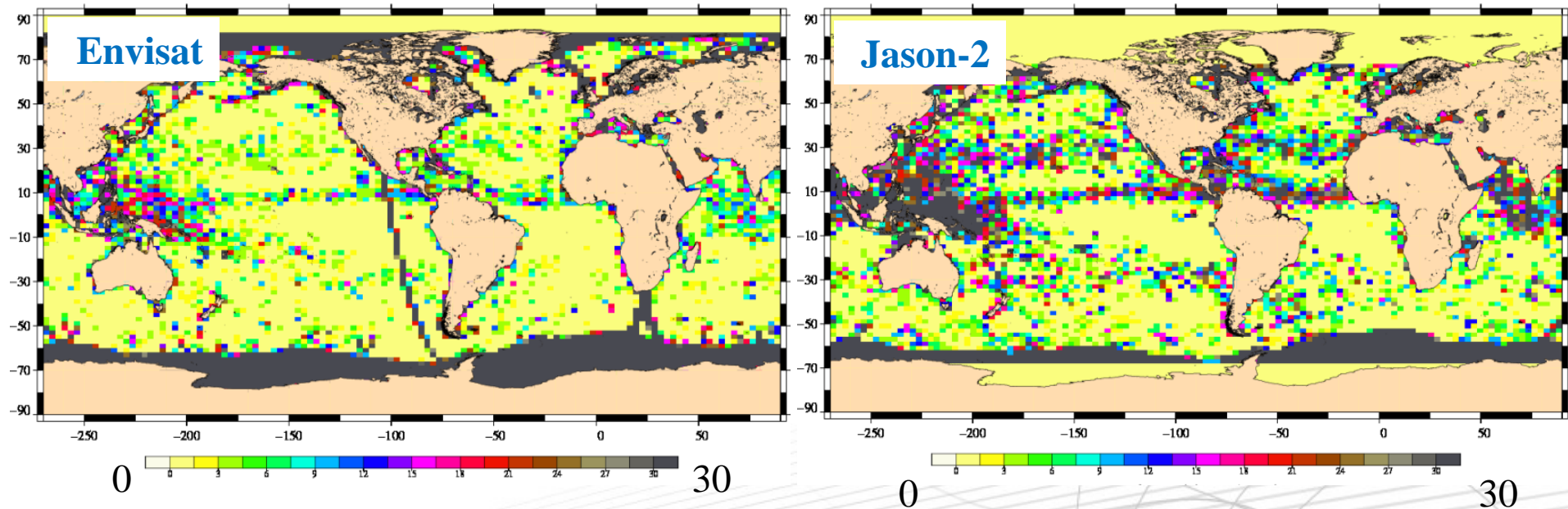
✓ Excellent coverage for the last 2 years

✓ Beginning of mission will be improved by the reprocessing



## Editing ratio cross comparison

Number of measurements edited for a 10 day period

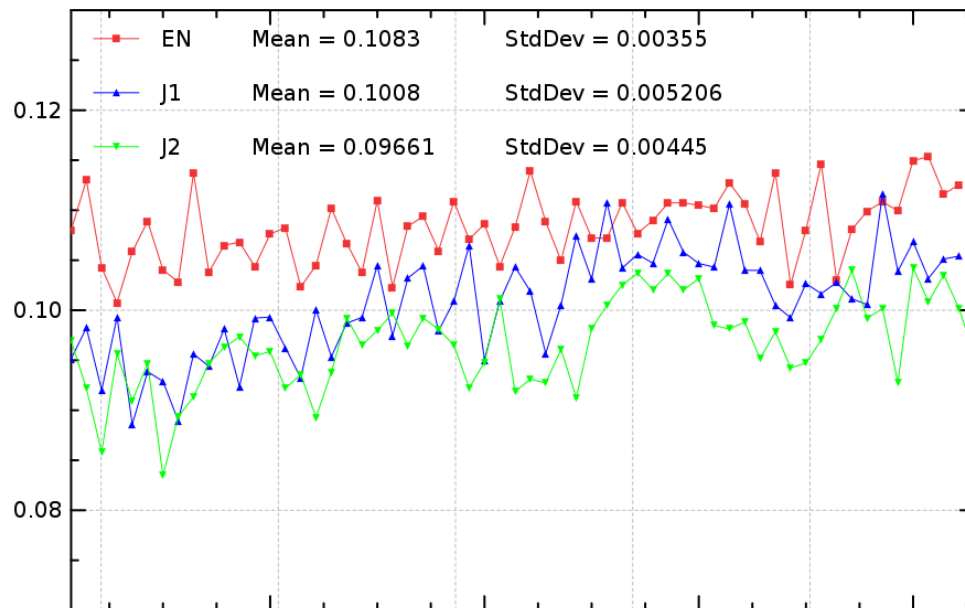


- ✓ the editing ratio is particularly low on Envisat even in rain areas
- ✓ Could be related to the altitude of the satellite (smallest foot print size)



## Monitoring of Envisat and Jason-1 and Jason-2 IGDR Monitoring

Standard deviation of EN/J1/J2 IGDR SLA per day over the last 2 month (m)



SALP / DUACS key Performances Indicators 2010/16/10



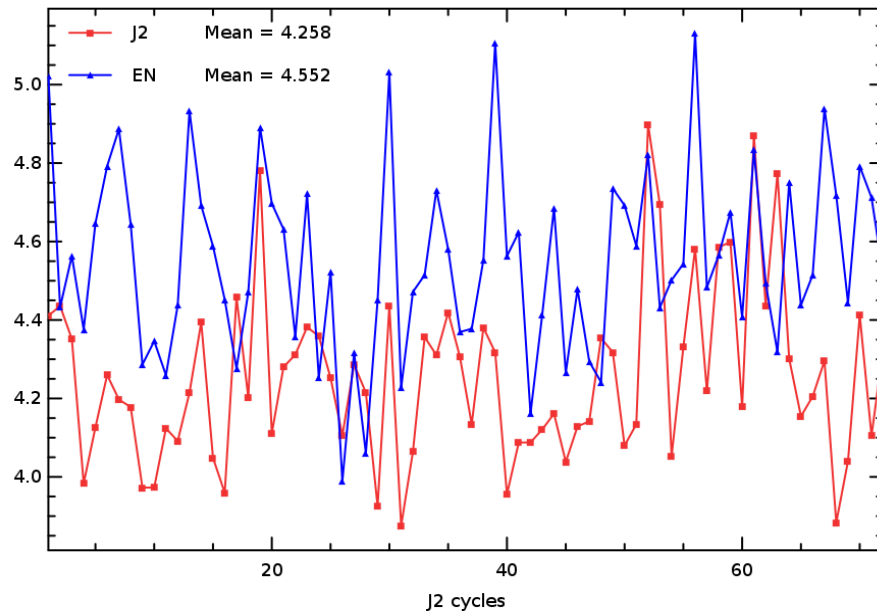
- ✓ Good performances of Envisat, Jason-1 and Jason-2 IGDRs products thanks to a good MOE quality
- ✓ Information IGDR and RT data available on [avis.oceanobs.com/en/data/product-information/duacs/key-performance-indicators/index.html](http://avis.oceanobs.com/en/data/product-information/duacs/key-performance-indicators/index.html)



## Envisat /Jason-2 GDR crossovers analysis over 2 years

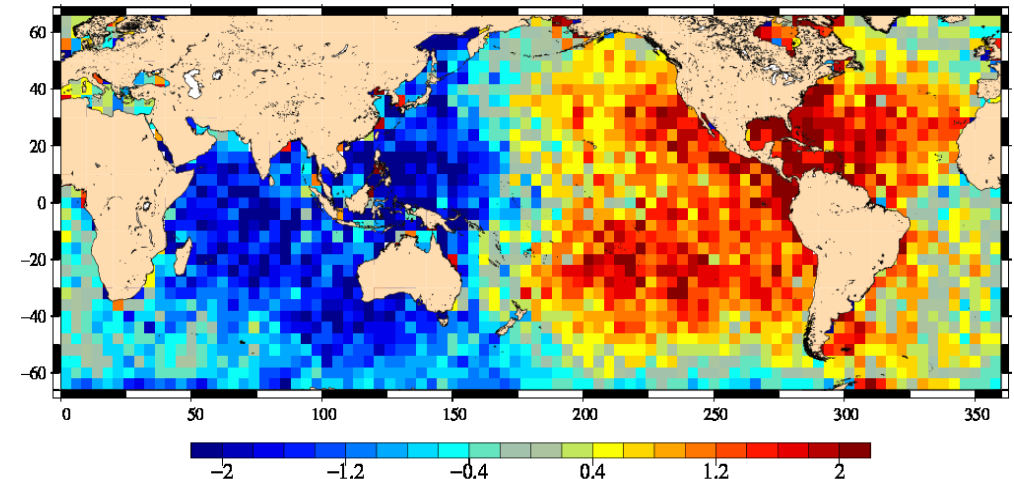
### Std of SSH differences(cm) - (box averaged)

Std Dev of SSH differences at crossovers (selection on Lat, Bathy, variability)



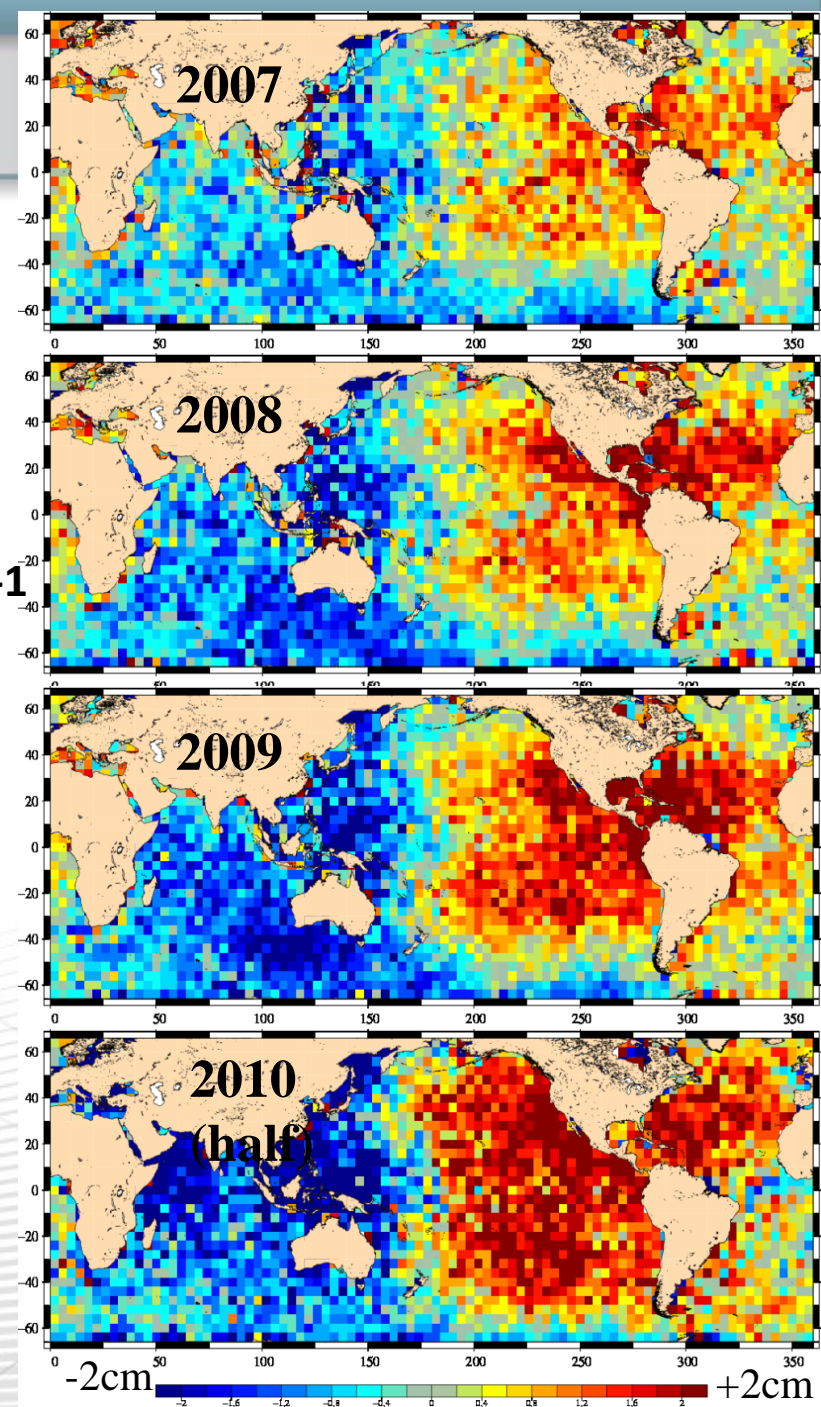
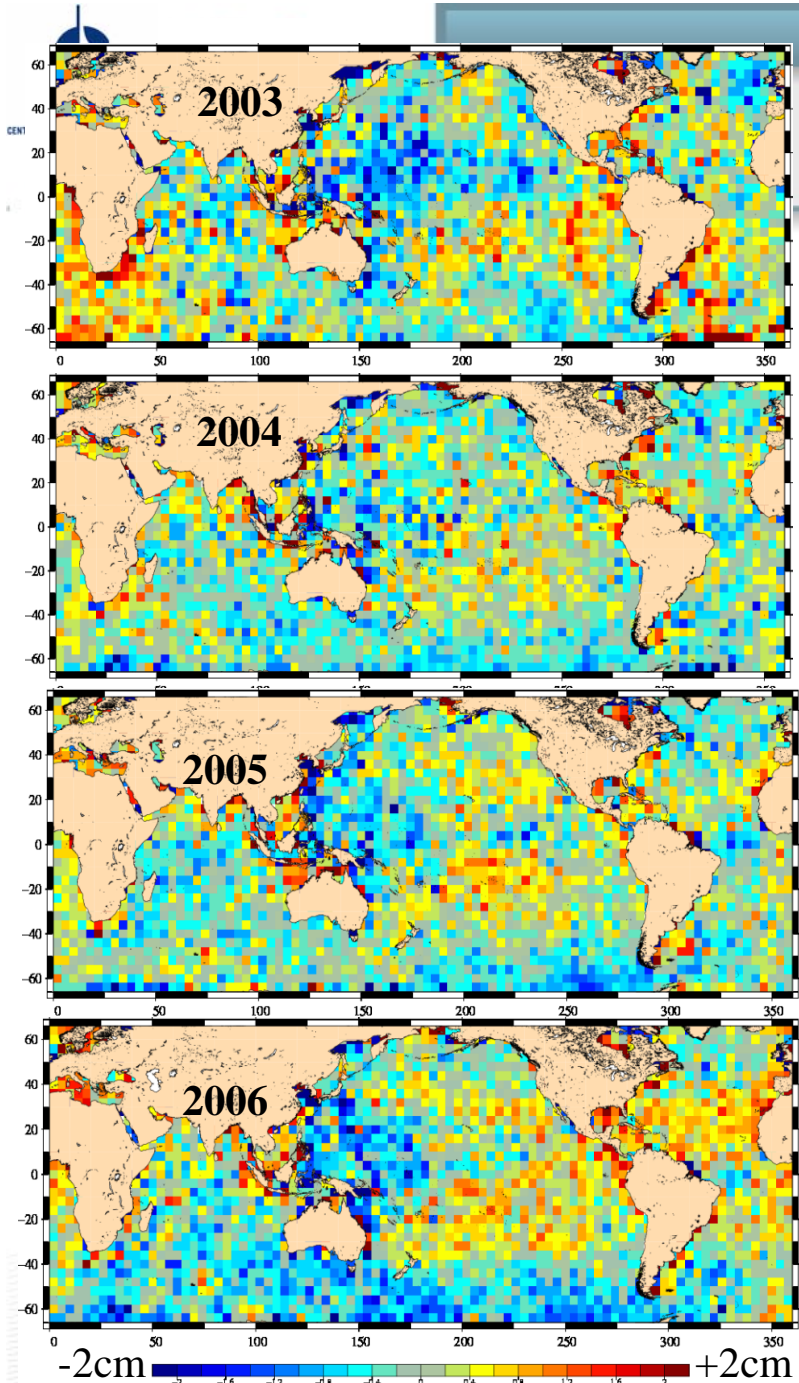
- Similar performances for the 2 satellites at crossovers
- impact of the Loss of S-Band not yet visible (low solar activity period)

### MEAN (Envisat – Jason-2) SSH



**East/west Pattern** with a maximum about 2cm around Mexico Gulf  
 Where does it come from? Is it systematic?

=> For mesoscale applications, the error level associated to Envisat data is very close to the one from Jason series



Envisat - Jason-1  
at  
crossovers

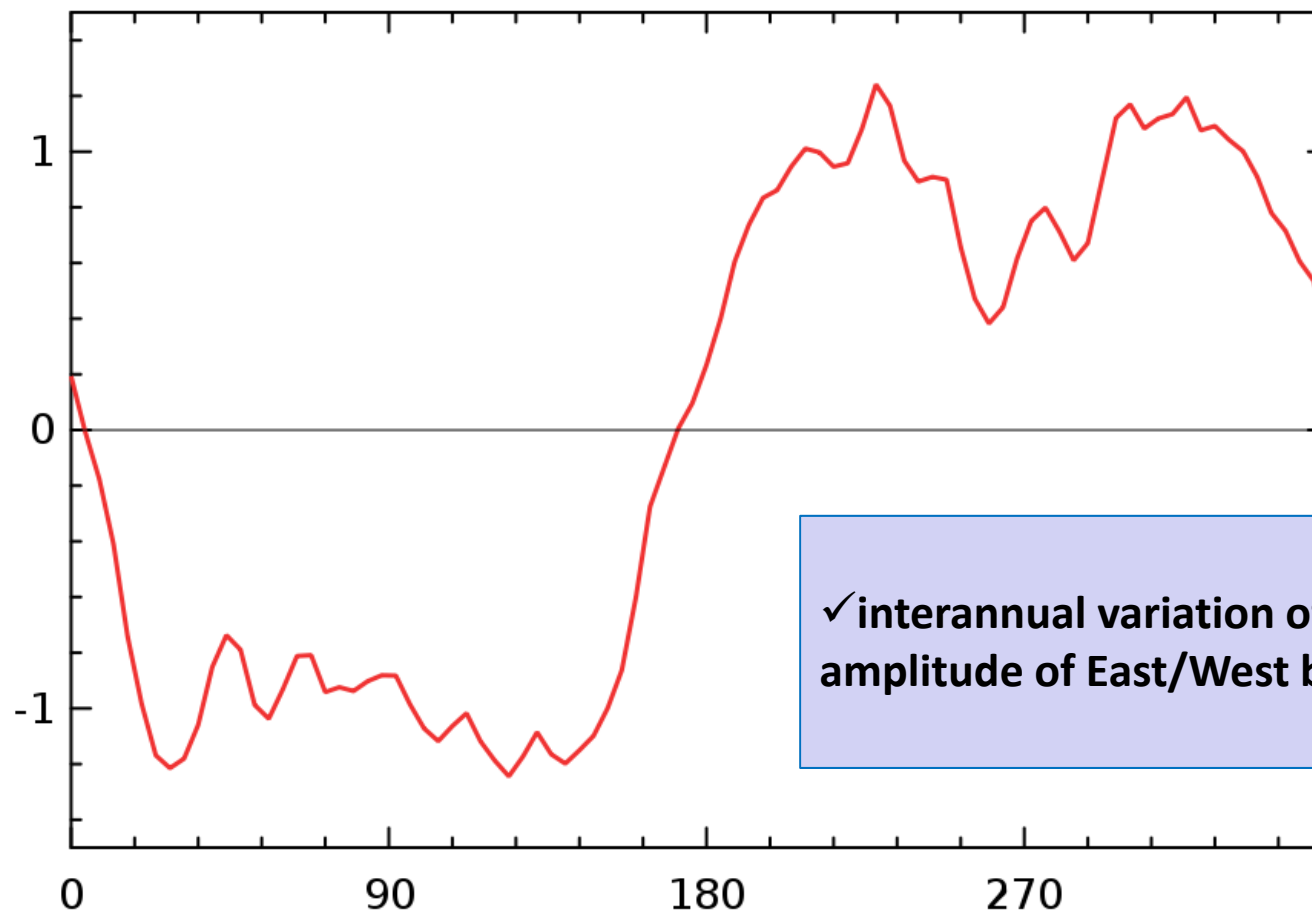


# Ra2 altimetry system performance



Mean (Envisat – Jason-1) SSH at crossover (cm) per longitude

2010



✓ interannual variation of the amplitude of East/West biases

# Ra2 altimetry system performance



Extract from Lucas Cerri presentation at OSTST 2009 (Seattle).

Differences between 2 orbit solutions on Jason-1:

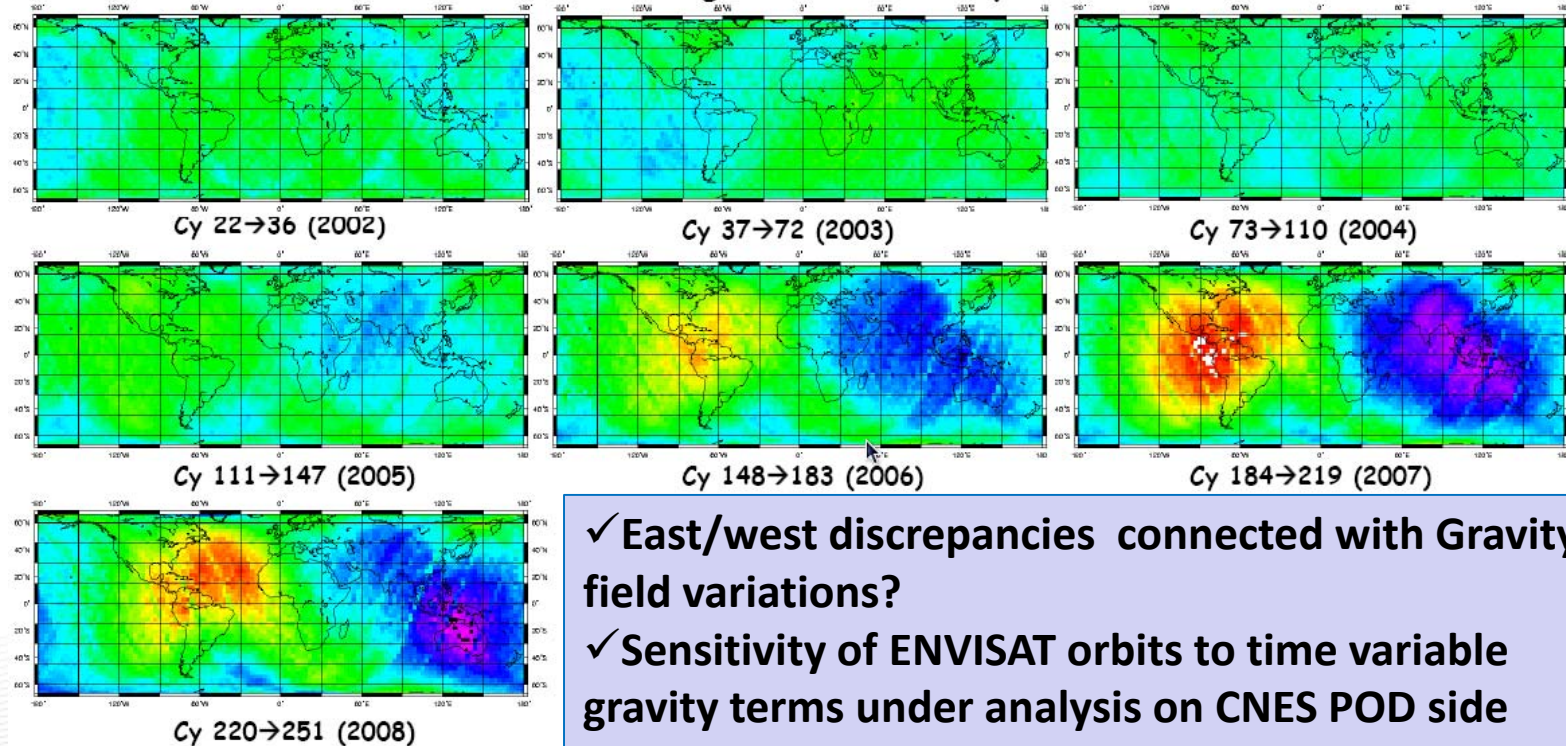
Eigen4An: GDRC

GC\_10d\_r02: CNES-GRGS Grace derived 10 day gravity fields (release 2)



## Orbit difference – Geographically correlated difference

GC\_10d\_r02 - Eigen4An Jason-1 cy 22→251



- ✓ East/west discrepancies connected with Gravity field variations?
  - ✓ Sensitivity of ENVISAT orbits to time variable gravity terms under analysis on CNES POD side
- Need to test other orbit solutions**

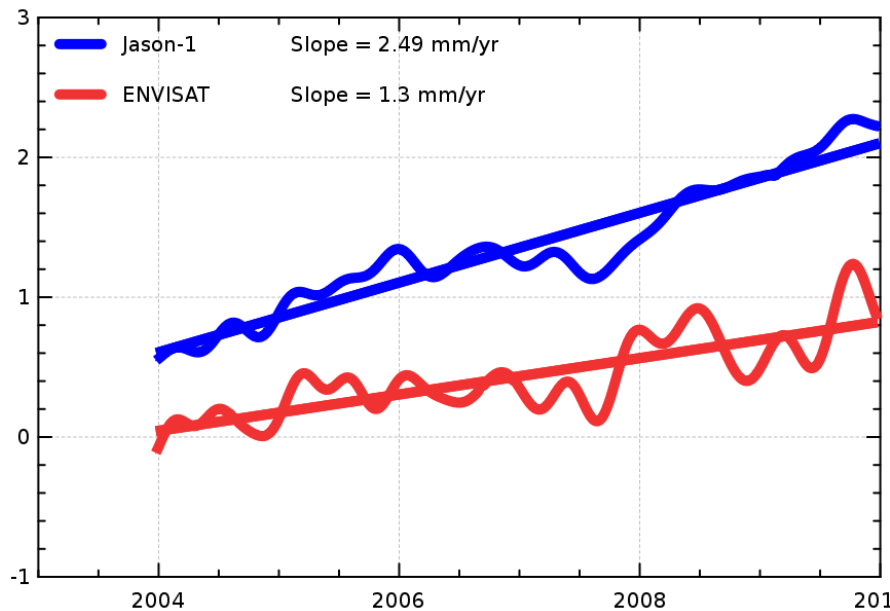
OSTST – POD&Geoid Splinter – Seattle, June 22-24



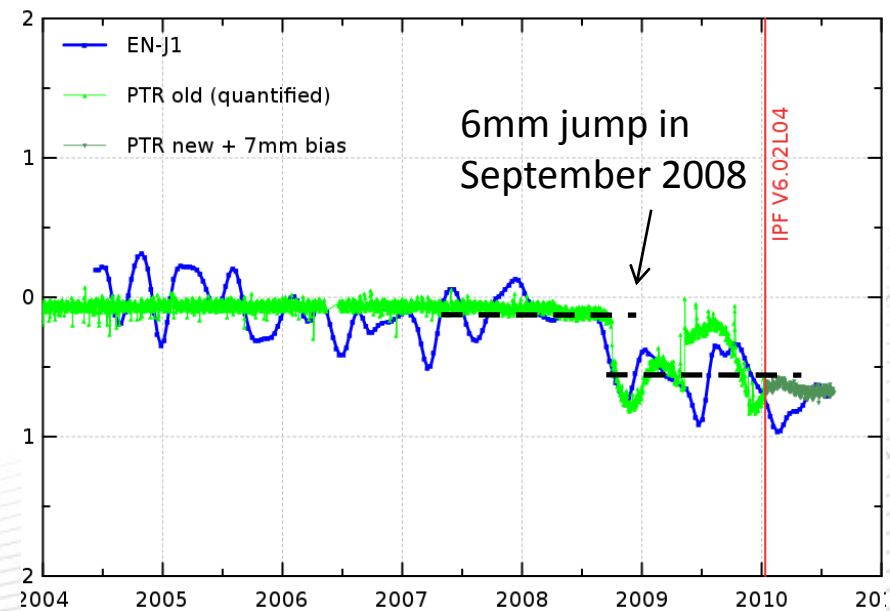
## Envisat Mean Sea level rise

- The difference with Jason-1 is  $>1\text{mm/year}$  over 2004-2010 using radiometer correction
- For Jason-1/Topex : the error budget on Jason-1 is estimated to  $0.6\text{mm/year}$  (Ablain , 2009)

Mean Sea Level trend (cm)



Envisat – Jason-1 MSL (cm)



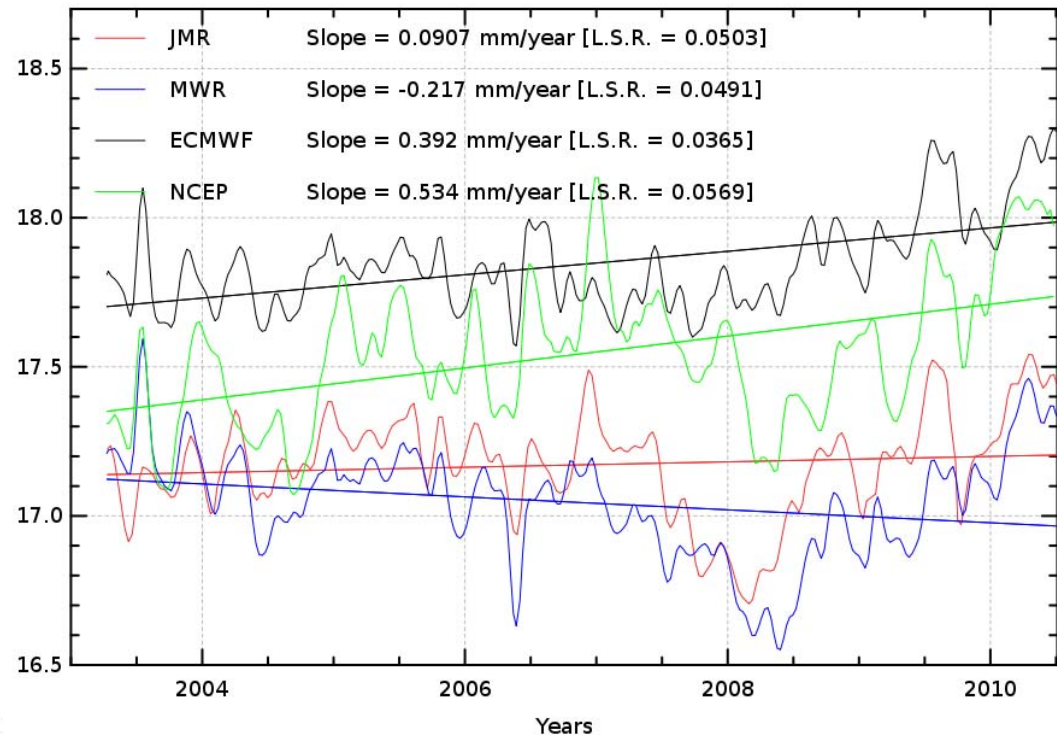
- ✓ This fine behaviour is only visible using comparison with other mission or In Situ data
- ✓ The coming reprocessing will cancel the quantification effect but not the trend difference



## Wet Troposphere correction trends on 2003-2010 (cm)

- Strong trend differences :
  - EN MWR (GDR): -0.2 mm/year
  - J1 JMR (GDR) : 0.1mm/year
  - ECMWF : 0.4 mm/year
  - NCEP : 0.5 mm/year
- Differences on interannual signals

see E Obligis talk for more details

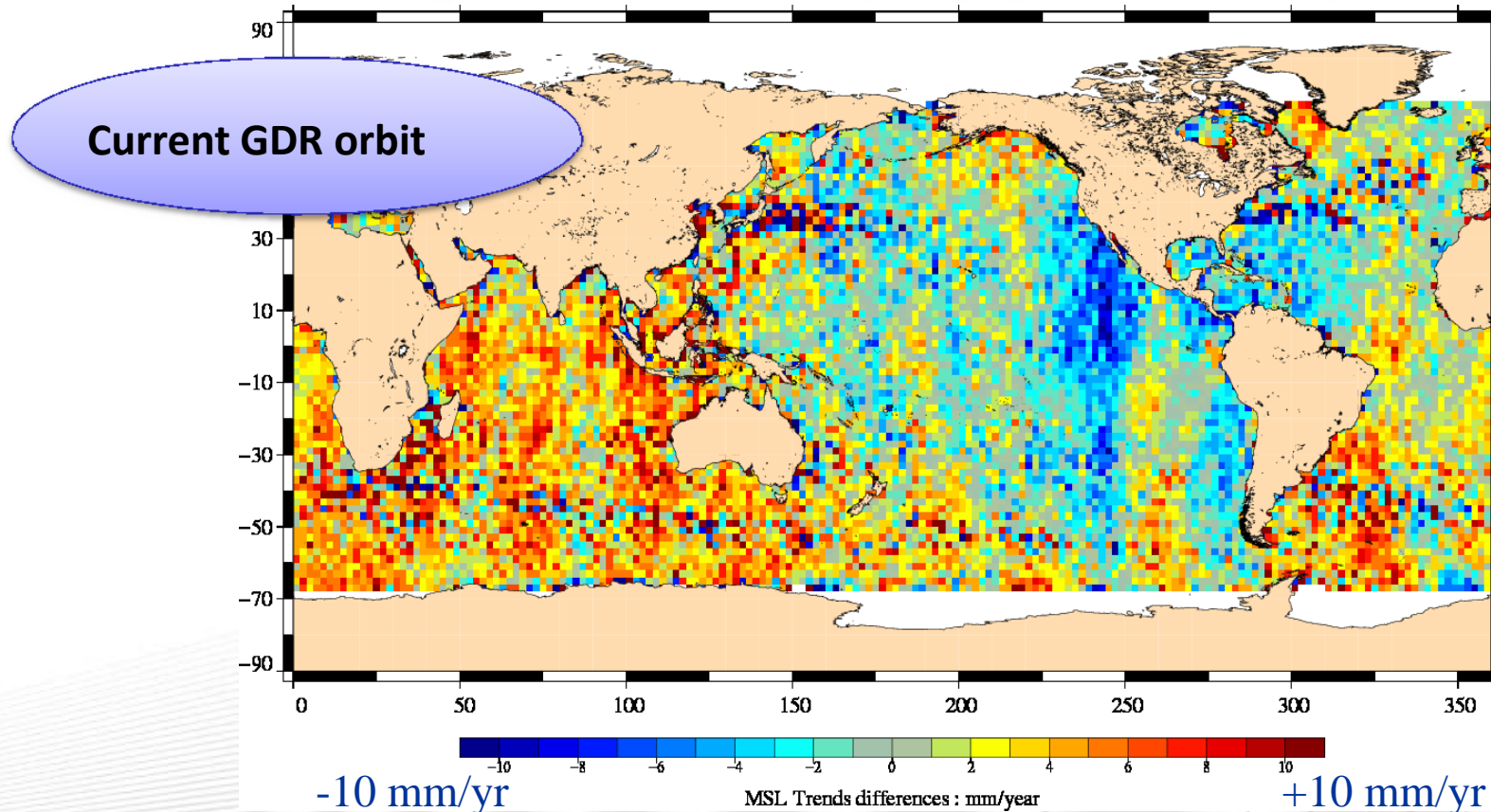


- ✓ Envisat wet troposphere correction trend is probably underestimated in Envisat product
- ✓ Correcting this effect would increase slightly EN MSL



## [MSL trend map Jason-1] - [MSL trend map Envisat]

- Jason-1 Current orbit Configuration : CNES GDR-C
  - Envisat Old orbit Configuration: CNES GDR-A/GDR-B/GDR-C
- =>Strong features are observed, ranging from +/- 5 mm/y

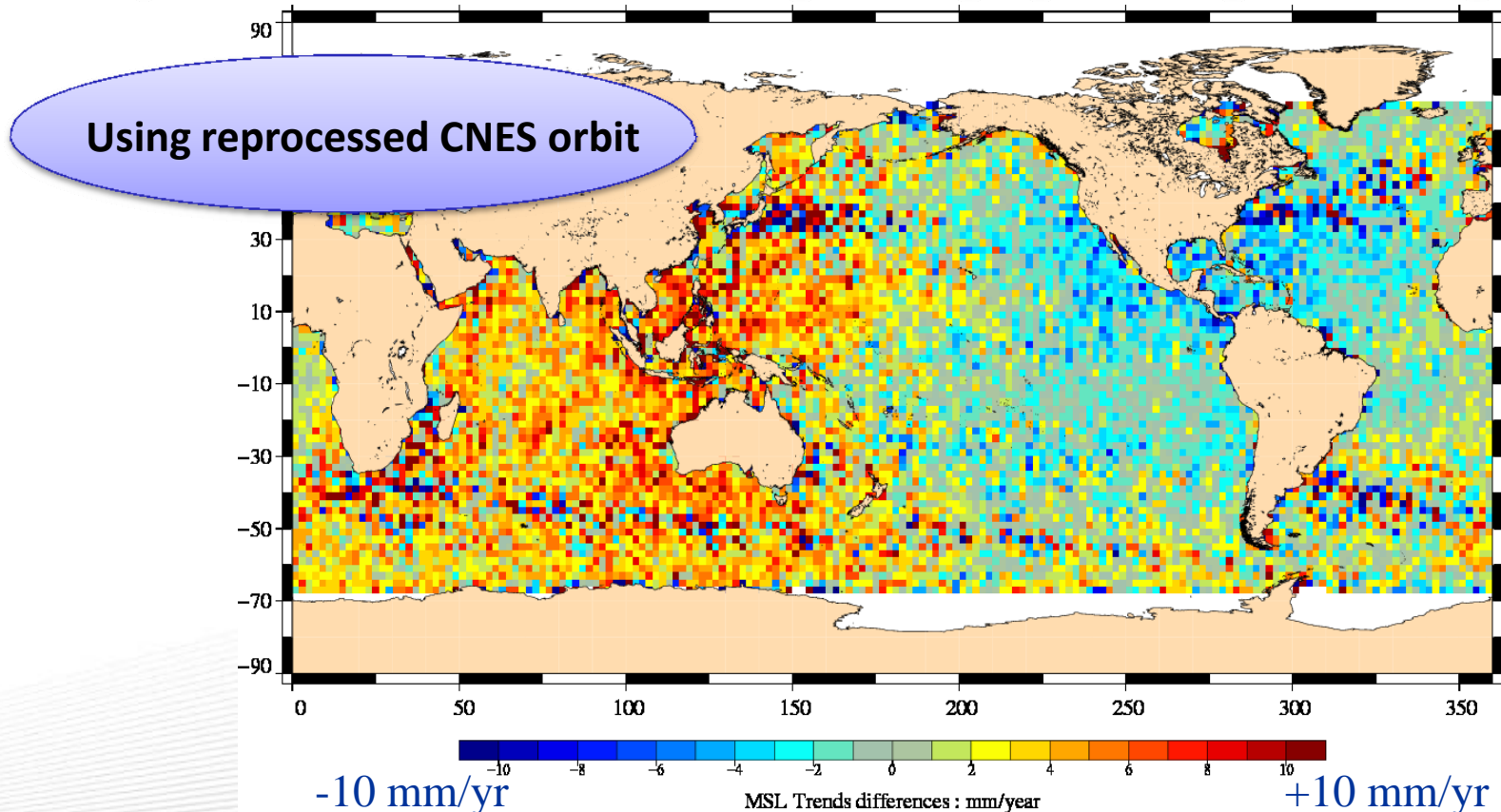




## [MSL trend map Jason-1] - [MSL trend map Envisat]

- Jason-1 Current orbit Configuration : CNES GDR-C
- Envisat Reprocessed orbit Configuration: CNES GDR-C (see <http://ids-doris.org>)

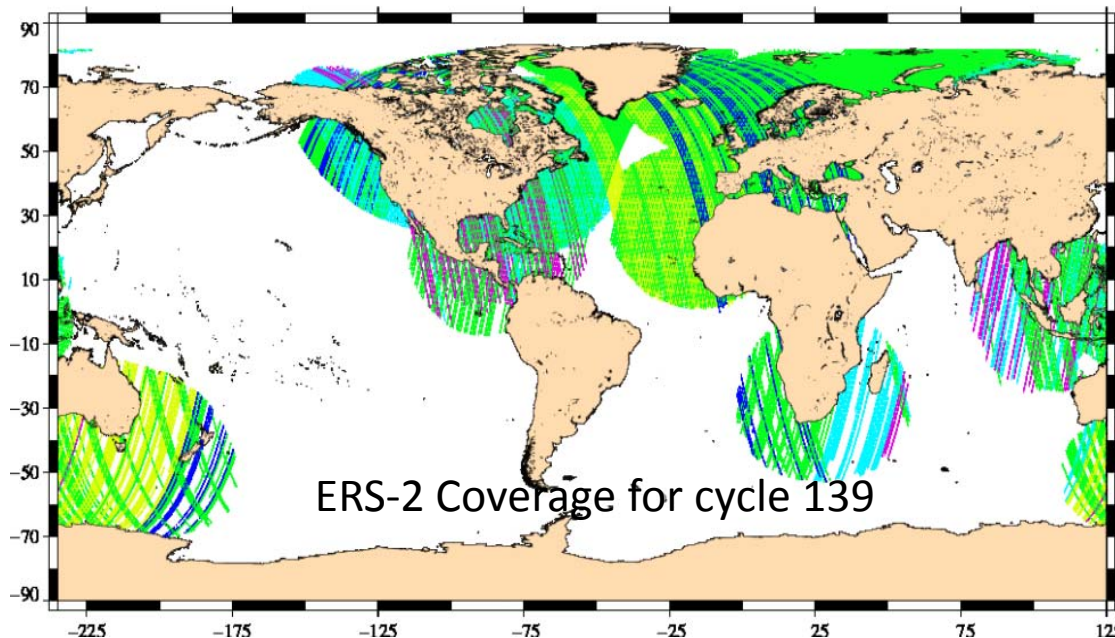
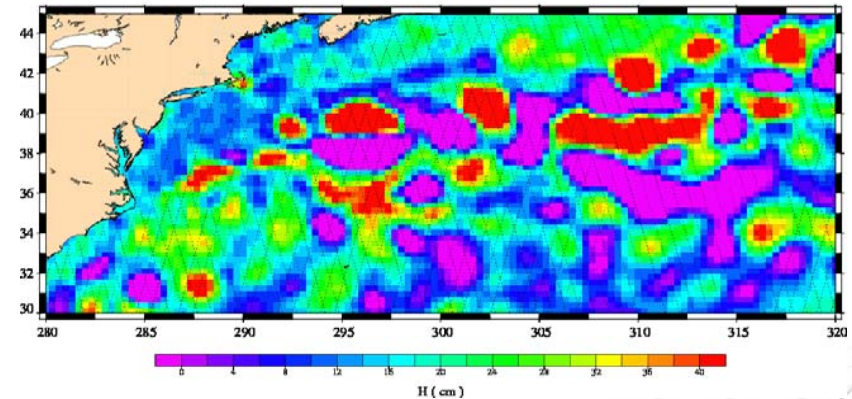
=>Some patches have been removed allowing us to highlight a strong east/west signal better



# Impact of the ground track change in October 2010

- After 26 October 2006 Envisat data will be on a new ground track with a 30 day repeat cycle
- The first impact is: **ERS-2 altimetry data interesting again.** It will bring useful additional information for altimetry applications in North Atlantic (mesoscale mapping)

Jason-1+Jason-2+ ERS-2 SLA map in the Gulf Stream

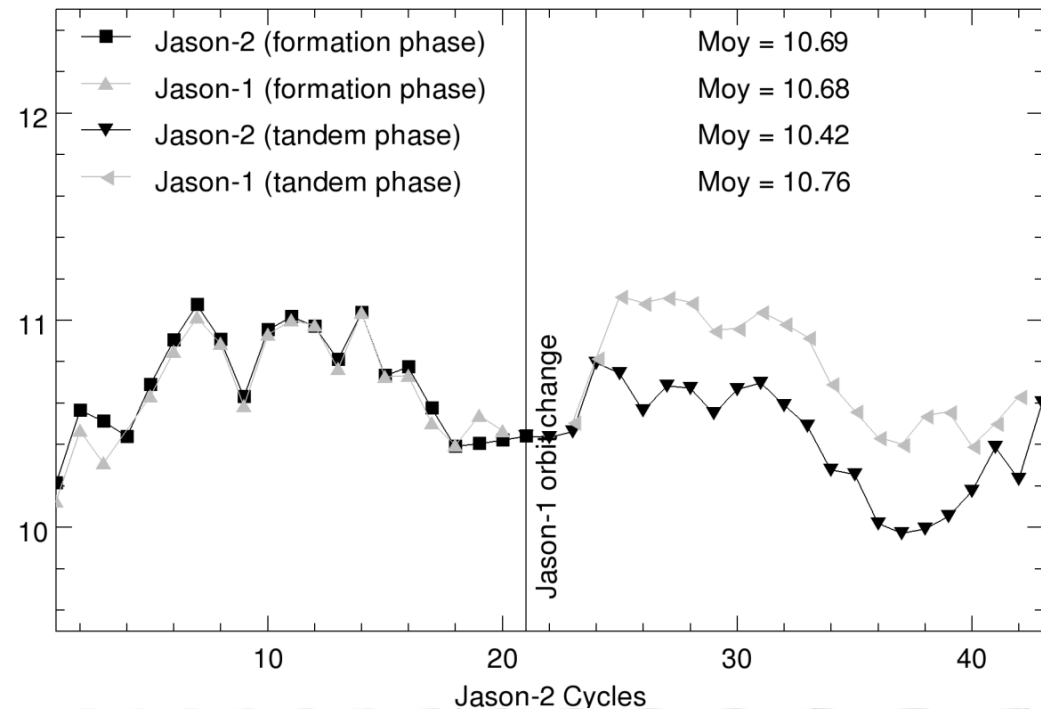


- On this reduced coverage **5 altimeter missions will be flying on 5 different ground tracks => never happened!**
- See Poster on calval results Mertz et al

# Impact of the ground track change in October 2010

•For the new Envisat mission phase, the SLA will not be computed using a mean profile. MSS will be used instead. What is the impact on the SLA performances?

For Jason-1 in 2009 after the ground track change, the Sea Level Anomaly variance **increased by 2-3 cm rms** (from Ablain et al 2010)



- ✓ Envisat SLA performances are expected to be impacted after 26 October 2010
- ✓ Announcement on the Envisat orbit change has been published under the Envisat News on Earthnet Online - <http://earth.esa.int>
- ✓ See also Envisat related web sites for news on the change :  
<http://envisat.esa.int>  
<http://earth.eo.esa.int/pcs/envisat/ra2/>



## Conclusion



- **Ra-2 altimetry system has good performances**

- ✓ A very good availability
- ✓ Good metrics at crossovers, at the same level as Jason series
- ✓ Fine Cross calibration with Jason-1 and 2 highlighted millimetric jumps on Envisat Mean Sea Level.

- **Use of a homogeneous CNES orbit**

- ✓ Shows that reprocessing data is crucial. Envisat reprocessing has started.
- ✓ highlight a strong East/west signal on Envisat/Jason-1 SSH regional differences impacting the Mean Sea Level Trend

- **Impact of the ground track change in October 2010**

- ✓ ERS-2 altimetry data interesting again
- ✓ Sea Level Anomaly variance will increase due to residual MSS errors. It will be quantified when first products are delivered after the maneuvers