17 years of altimeter products entirely reprocessed

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Abstract

An overview of the SSALTO/DUACS system is given : key features and processing used, last reprocessed products performances, upgrades scheduled for 2011 …

Project Overview

Objectives: To provide operational applications with homogeneous and directly usable high quality altimeter data from all missions (Jason-1, Jason-2, T/P, ENVISAT, GFO, ERS1/2 and even GEOSAT). The system uses common processing facilities for global and regional applications. It ensures that upgrades are consistently applied on all products to better serve the altimetry user community.

Delayed Time (DT): DUACS-DT products are composed of global data sets of along track and gridded Sea Level Anomaly, Absolute Dynamic Topography, and geostrophic currents, but also of regional-specific products (higher resolution, optimized parameters). DUACS recently reprocessed all past altimeter data. The data set is in the validation phase and will be delivered soon.

Real Time (RT): DUACS-RT provides GODAE and climate forecasting centers with global Real Time altimeter data, including IGDR as well as OGDR/FDGDR measurements. The products are generated and distributed on a daily basis.

The DUACS system also provides a long term monitoring of RT data it has used. Quality Control reports are released twice per week.

DT data set entirely reprocessed

Main important changes:

- Use of up-to-date standards (GDR-C or equivalent) [1]:
  - GDR-C products for Jason1/Jason2
  - GDR-C orbit for Envisat
  - GSFC orbits for Topex and GFO (except during maneuver periods)
  - GOT4v7 tide solution for all missions
  - New SSB solution from Labroue and Tran for TP and GFO
- Bias from TP/Jason1 and Jason1/Jason2 were revised in order to correct geographical discrepancies affecting MSL observed with DUACS multi-mission MSLA. Use of the more accurate reference mission as soon as it is possible (Fig 1).
- Improved editing process, especially for the costal areas, for all missions.
- Reference Mean profile updated in order to take into account the new standards and to improve the quality near the coast. Extended temporal coverage offered by twin mission (TP/Jason and ERS/Envisat) was also exploited, but the product is still referenced to the 7-year [1993-1999] mean. [2]
- Optimization of the optimal interpolation parameterization.
- Computation of SLA maps with a daily resolution
- Use of the new Mean Dynamic topography CNES-CLS-09 using the recent EIGEN-GRGS.RL02.MEAN-FIELD and improved processing method [2,3]
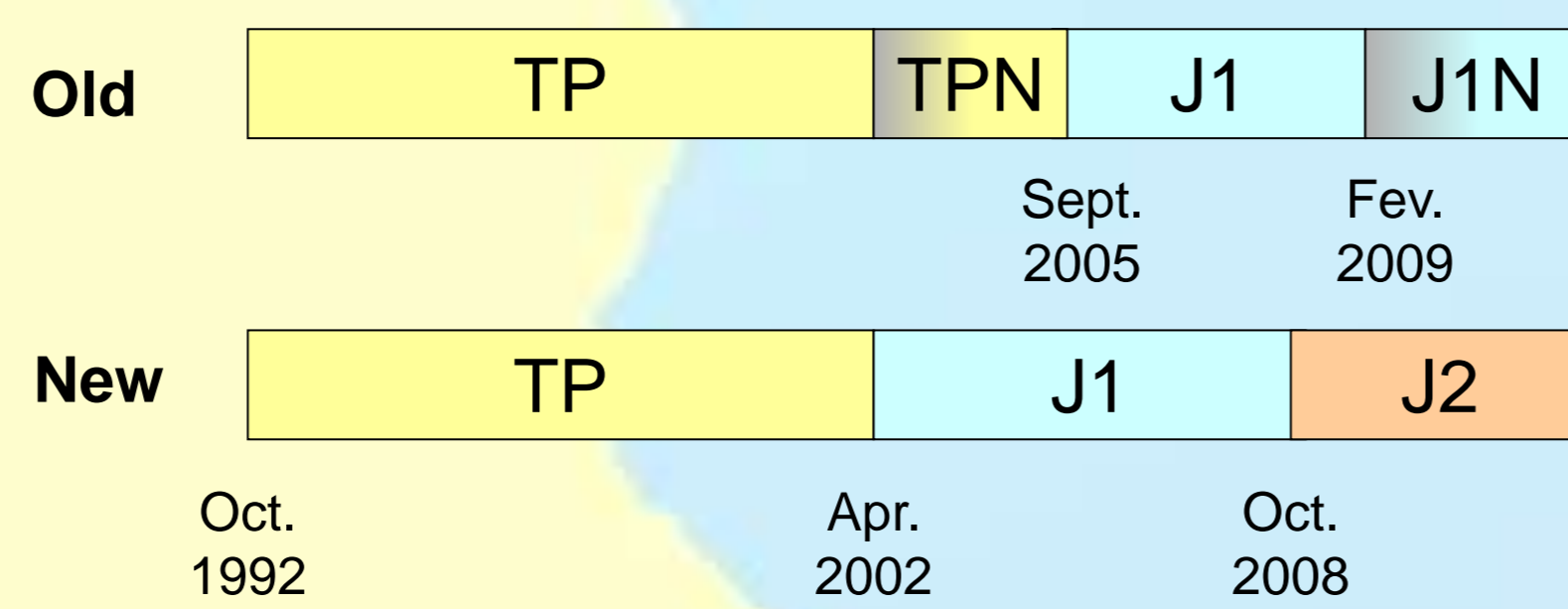
Fig 1: Reference mission used

| Old | TP | TPN | J1 | J1N |

Sept. 2005   Fev. 2009

| New | TP | J1 | J2 |

Oct. 1992   Apr. 2002   Oct. 2008

Fig 2: Variance reduction induced by the updated DT data set over the 16-year period [1993,2008] (« ref » version)

Impact on MSL trend:

The reprocessed data set don't significantly change the global MSL trend observation over the [1993,2009] period. However, local significant changes can be observed (Fig 4). They are in the range of MSL trend errors defined by Ablain et al. [4]. They are mainly connected to the improved orbit solutions and change in reference mission.
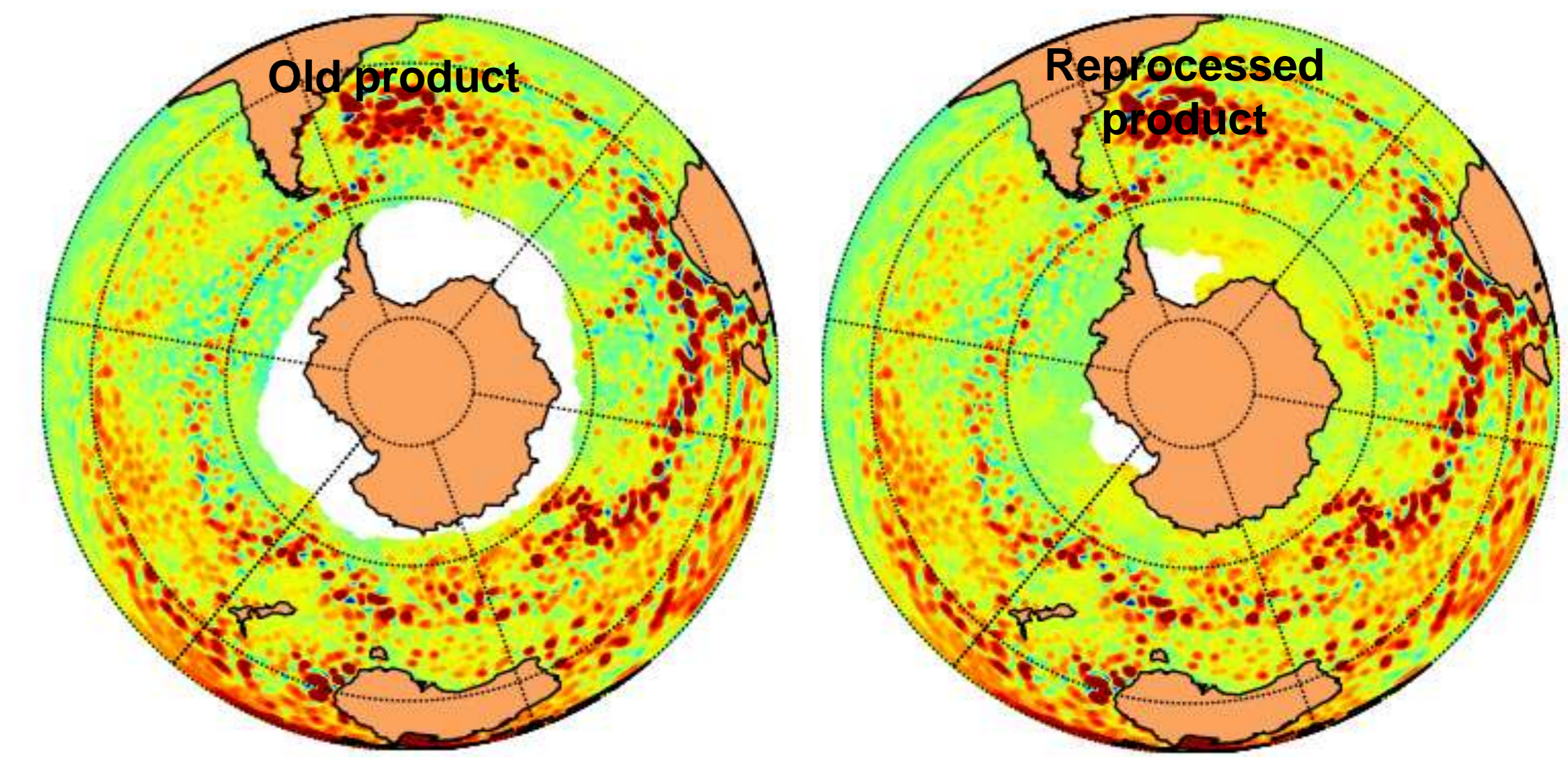

Fig 3: Example of MSLA maximal spatial coverage in the Antarctic.

Better Products:

First validation diagnostics show the improved quality of the reprocessed DUACS DT MSLA data set.

The global reduction of the variance (Fig 2) traduces the impact of improved quality of the geophysical corrections, combined with improved orbits determination and changes of the reference missions.

Data quality allows to better estimate the SLA in difficult areas such as the high latitudes. This was taken into account in order to optimize spatial coverage of MSLA product (Fig 3 and 6).

Mean = -2.3 cm²
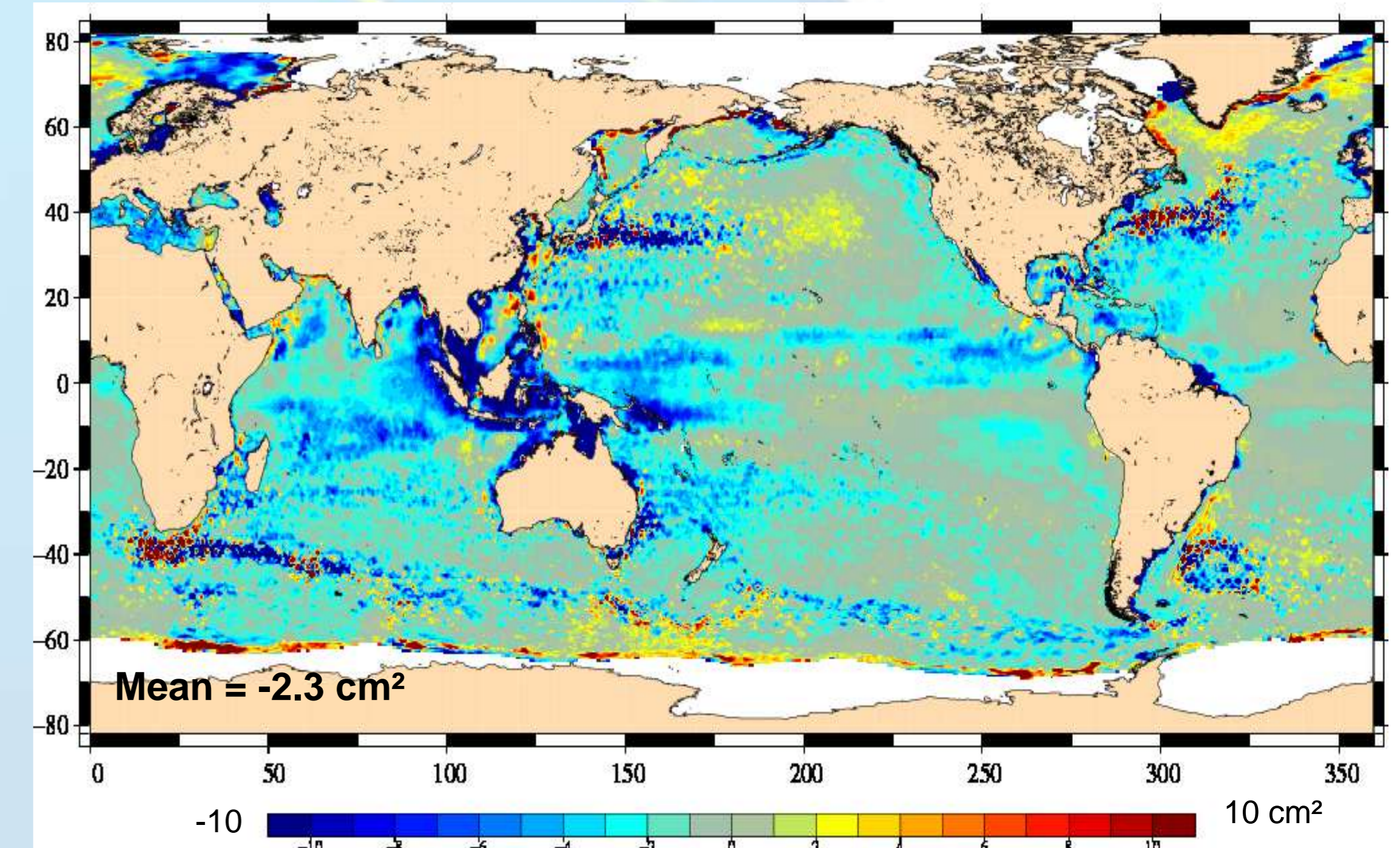
Impact on Coastal areas:

Improved corrections, improved editing process and more accurate mean profiles allow a better observation of coastal areas (Fig 6). Moreover, Absolute Dynamic Topography product constructed with MDT CNES-CLS-09 allows an improved restitution of major currents, also better defined near the coast (Fig 5).

Fig 5: Example of ADT obtained with reprocessed and old DT data set.

Old DT MADT 14/01/2009

Reprocessed DT MADT 14/01/2009

-60   140 cm
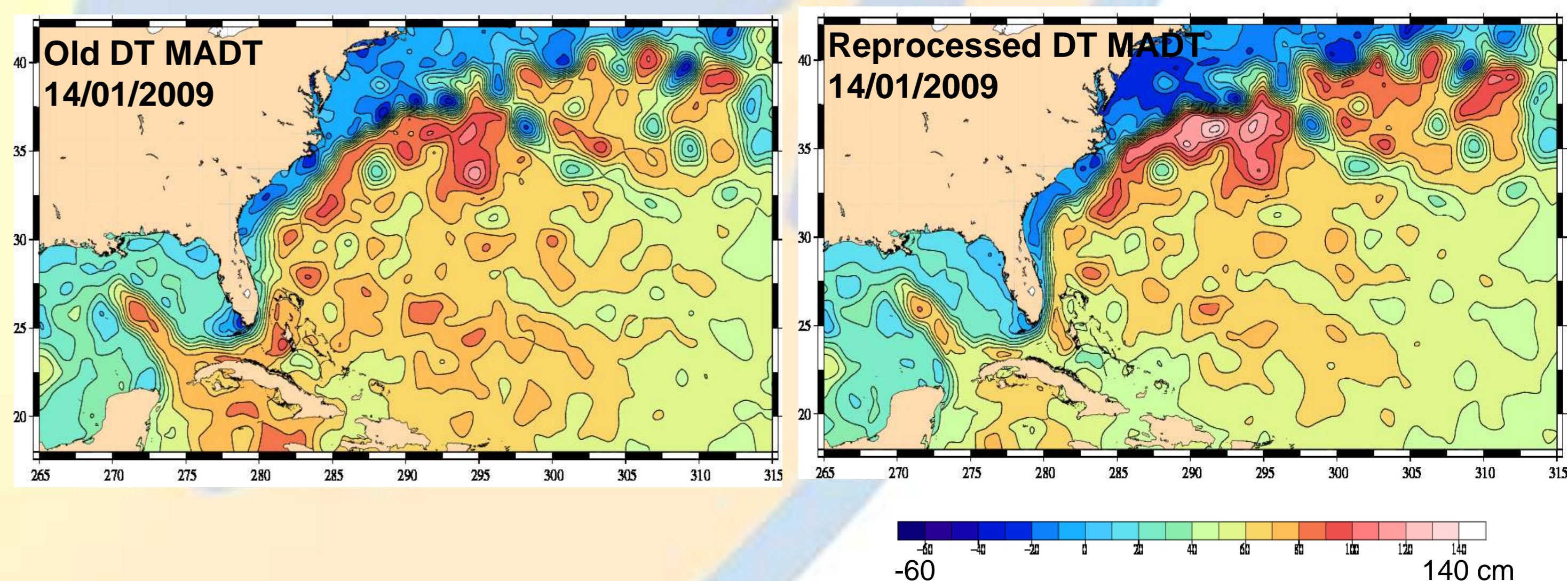
The entire time series is available with weekly resolution.
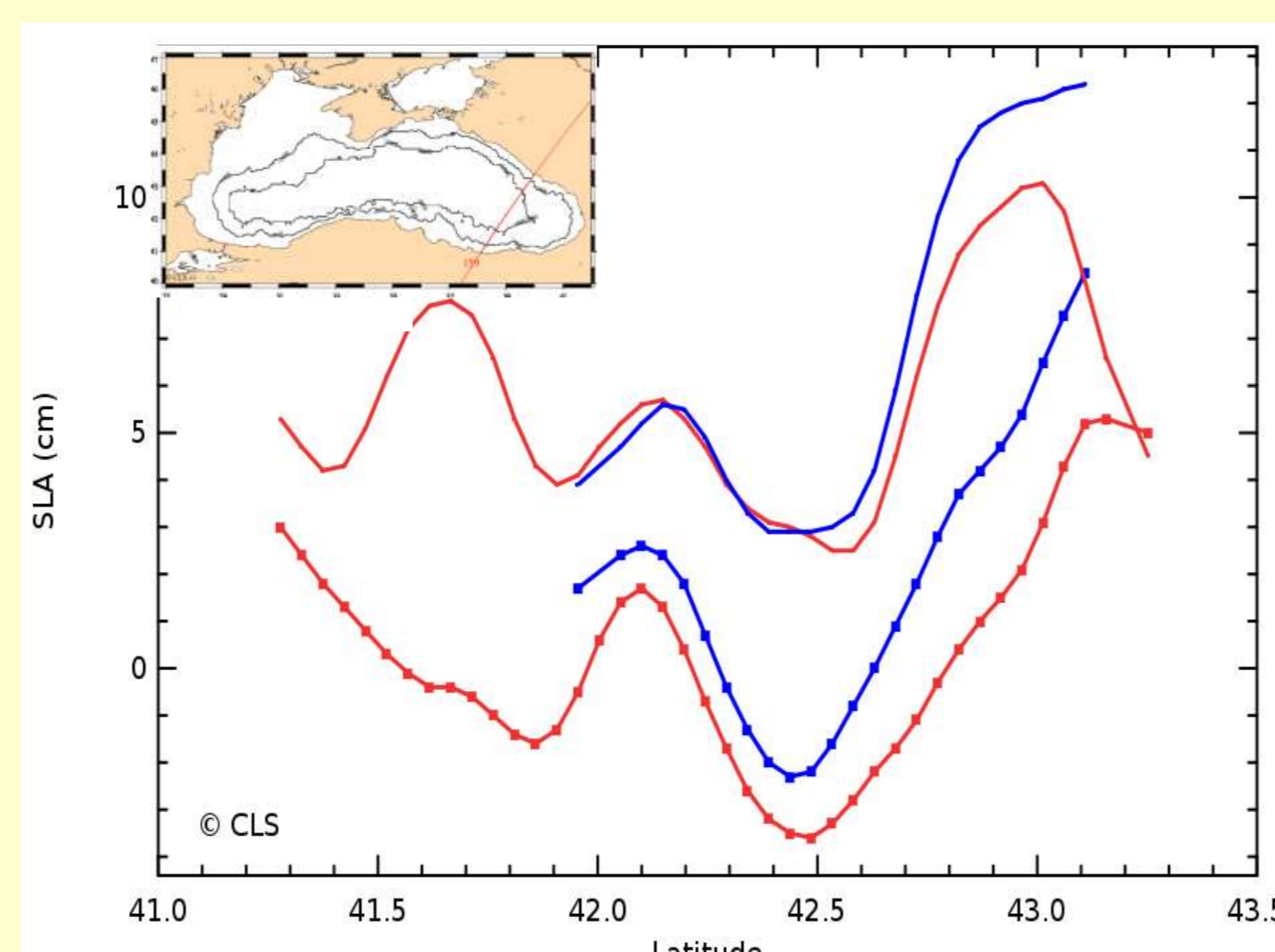Daily resolution production is on going.

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Fig 6: Example of improved data coverage in the Black Sea. Case of Jason1 tandem track 159 ; cycles 265 (dot line) and 266 (smooth line). Blue : old DT data set; red : reprocessed data set.
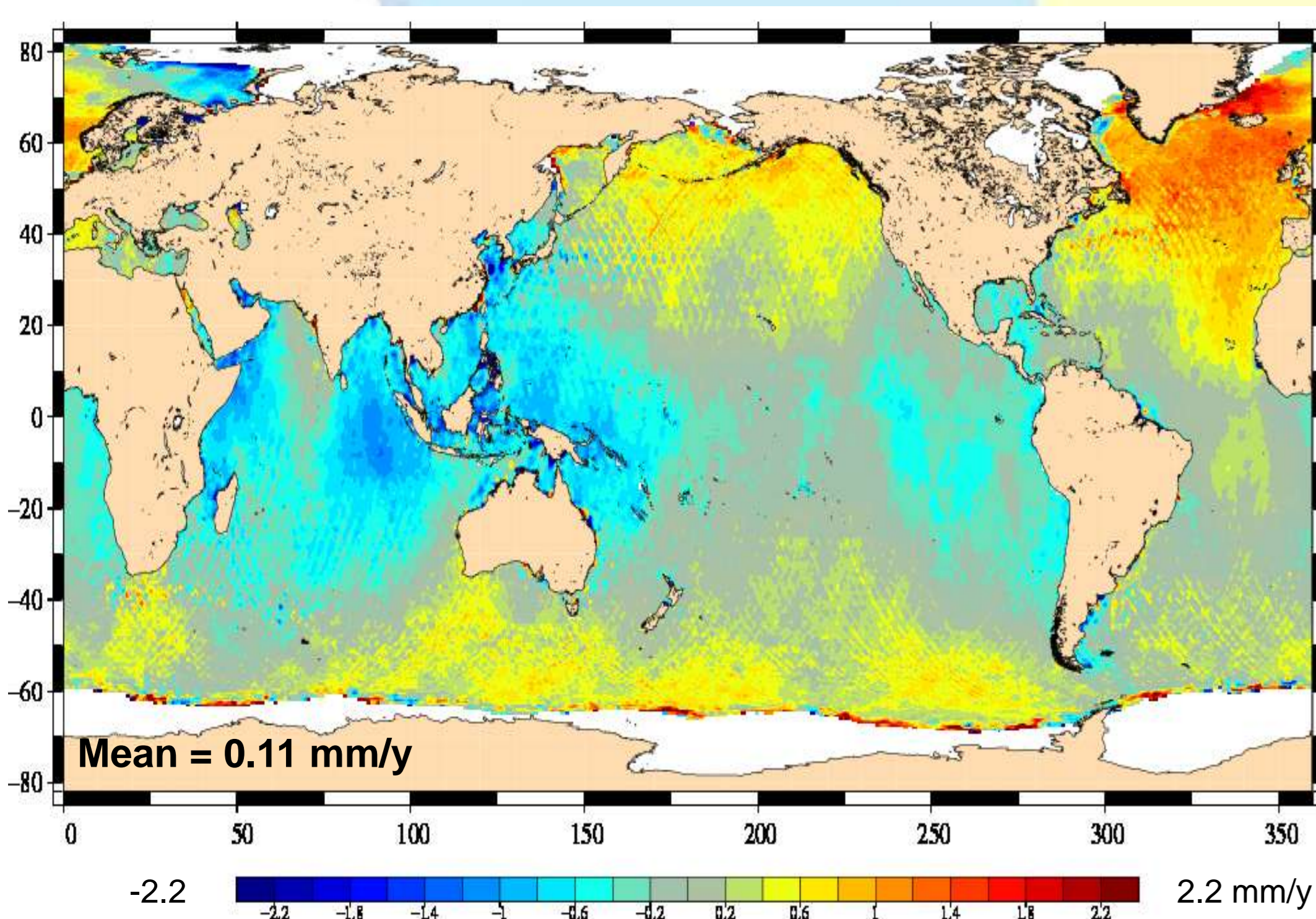

Mean = 0.11 mm/y

-2.2   2.2 mm/y

Fig 4: MSL trend differences between reprocessed and old DT data set (« ref » version)

Comparison to independent data sets:

Validation of the reprocessed data with comparison to independent data is on going. Combination of altimeter products with Argo (for steric component), ECCO model (for bottom pressure) and GRACE (for ocean mass) allows an estimation of remaining errors on which part is due to errors on altimeter products. Comparison with old DT data set underlined a reduction of these errors by near 1 mm rms. It is a small improvement, but clearly significant given that it is observed almost everywhere. (with courtesy of J. Willis, JPL) .

Comparison with tide-gauge data allow us to better estimate quality of reprocessed product in high latitude areas. First comparisons in Arctic ocean underlined quite good correspondence in Kara Sea (Fig. 7). However, in some other areas, correlation between both the data set is lower, underlining possible improvements of altimeter data processing in these areas (with courtesy of D. Volkov, UCLA) .
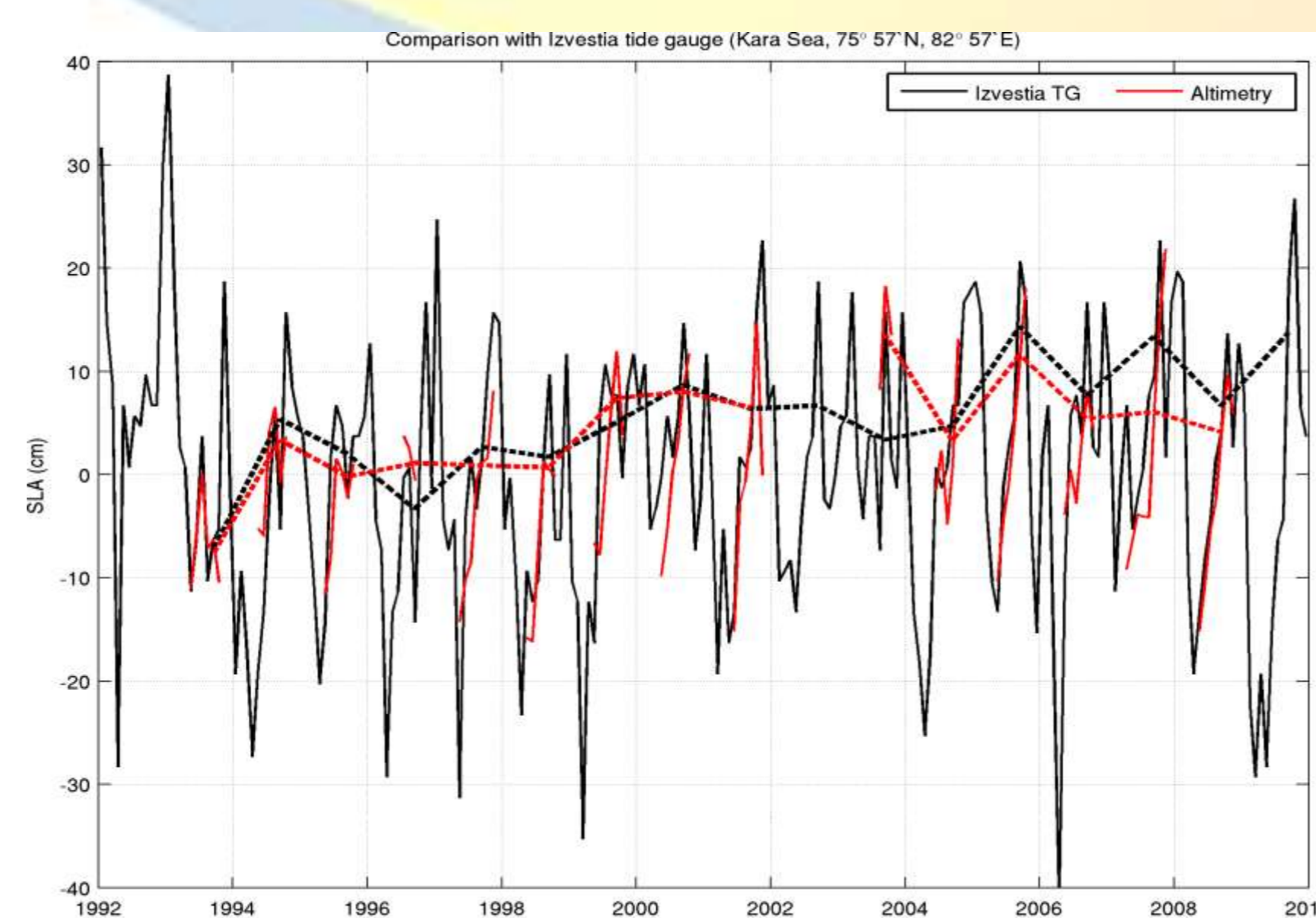
Validation of the reprocessed data set will be continued. Study of the physical signals observed and comparison with independent in situ data (tide gauge, T/S profiles and drifter boy velocities) is still on going and should better quantify the improvements induced by this new data set.

Fig 7: Comparison of SLA variations view by reprocessed altimeter product (red) and tide gage (black) in the Kara Sea . (with courtesy of D. Volkov, UCLA)

Processing Upgrades 2010/2011

Continuous improvements on DUACS system are scheduled for end2010/2011 :

- Improve the data latency with an "on the fly" RT (OGDR-based) data production.
- Prepare the DUACS system to the future Envisat drifting orbit.
- Improve the accuracy and resilience of the system, taking advantage of ERS2 in reduced coverage, of the future missions (Cryosat2, AltiKa, HY2) and also past missions such as and Topex/Poseidon in its drifting orbit period and ERS1 with 3-day repetitivity.
- Implement, in its experimental phase, a new orbit reduction scheme (used for multi-mission cross-calibration), that is based on multiple reference missions rather than single reference mission, in order to minimize the impact of an anomaly on the reference mission.
- Develop higher resolution along-track products and improved regional gridded products.
- Maintain the efforts for production and validation processing to deliver you the best quality products.

[1] CalVal reports for the different altimeters: www.aviso.oceanobs.com/fr/calval/systematic-calval
[2] Faugère Y., M. Abalin, E. Bronner, N. Picot, Recent and coming improvements of the performance of open ocean altimetry products, Poster communication at OceanSciences symposium, 22-26 Feb. 2010, Portland
[3] Rio, M-H, P. Schaeffer, G. Moreaux, J-M Lemoine, E. Bronner (2009) : A new Mean Dynamic Topography computed over the global ocean from GRACE data, altimetry and in-situ measurements . Poster communication at OceanObs09 symposium, 21-25 September 2009, Venice.
[4] M. Ablain, P. Prandi, A. Cazenave, N.Picot, Error estimation of the global and regional mean sea level trends from altimetry data, Communication at OceanSciences symposium, 22-26 Feb. 2010, Portland

More information on the AVISO website
www.aviso.oceanobs.com
www.cls.fr/duacs (mirror)