NEW RELEASE OF DUACS PRODUCTS: 20 YEARS OF HIGH RESOLUTION SEA LEVEL TIME SERIES REPROCESSED

M.-I. Pujol, Y. Faugère and the DUACS Team
CLS
E. Bronner, N Picot
CNES

Ssalto/Duacs system processes data from all altimeter missions to provide a consistent and homogeneous catalogue of products for varied applications, both for near real time applications and offline studies in the framework of the SALP/CNES and MyOcean/SL TAC projects.

We present here a focus on the **recent reprocessed SSALTO/DUACS products.** They include important changes that also are implemented in the Near Real Time products.

Mesoscale better resolved

All the different changes implemented in the new version of the DT products lead to a more precise observation and reconstruction of the mesoscales structures.

Along-track products:

✓ The altimeter noise reduction on along-track products optimized: **only wavelength < 65km are filtered → strong impact at low/median latitudes** (Fig 3)

✓ Improved estimation of the along-track random noise error (Fig 4)

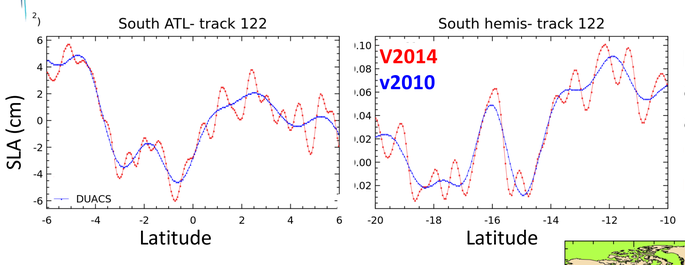
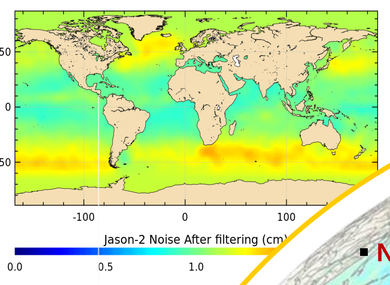


Fig 3: Along-track SLA profiles along Jason-2 track 122 (Atlantic area) over 2 sections.
➔ The new product better resolve mesoscale signal

Fig 4: Remaining along-track Jason-2 SLA 1hz HF content after a 65km spatial filtering (cms rms) ➔ Contains both the **residual instrumental white-noise** (link with SWH) and **other residual errors** which create a hump of spectral energy at small length scales (mainly on rain and bloom areas)



Gridded products:

✓ **SLA variance globally increased by 5%**

✓ **Additional signal at wavelength < 250km**; variability 2 to 4 times more important at wavelength ranging 100-80km.

✓ SLA maps error estimated between 1.5 cm² (very low variability areas) and more than 30 cm² (high var. areas).

✓ Improved consistency between SLA maps and independent along-track data (Fig 5): **maps error reduced by 5 to 10% in high variability areas.**

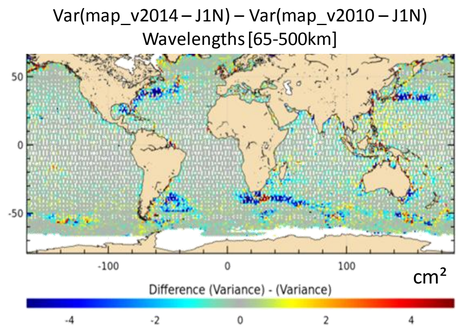


Fig 5: Variance reduction of the differences between map merged product and independent Jason-1N along-track measurements ➔ The v2014 version of the products leads to an improved consistency between gridded products and independent measurements. The errors are reduced by near 5 to 10% (high variability areas) compared to the v2010.

Change of the reference period

The historical 7-year [1993, 1999] period historically used to reference the Ssalto/Duacs SLA products as been changed for the **new 20-year [1993,2012] period**. As a consequence the interannual signals have more relevant intensities and spatial signatures.

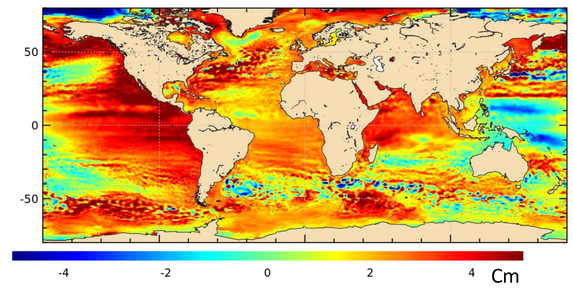
Main Impacts of this change on the products:

✓ Different signature of the SLA at regional scale (Fig 1) and impact on spatial variability (Fig 2; see also EKE in Fig 10)

✓ No change of the Absolute products (i.e. ADT)

More information in AVISO website, Newsletter #9 (may 2013)

Fig 1: Corrective term to convert a 20-year referenced product to a 7-year reference (will be available on AVISO).



STRONG IMPACT ON SLA USERS: the reference change impacts at regional scales

New absolute calibration of the SLA

SLA will be arbitrary calibrated so that the mean SLA is null over 1993.

Main Impacts of this change on the products:

✓ **A near 0.7 cm global bias will be observed** between the old DT products and the newest reprocessed products

✓ The bias between DT and NRT products will be changed

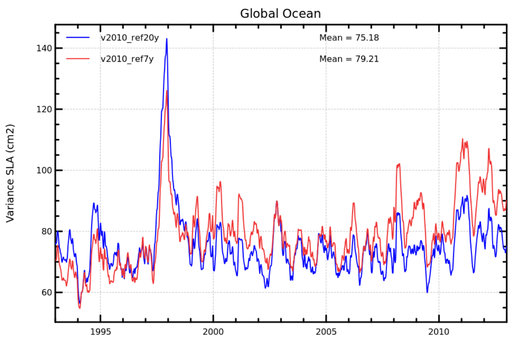


Fig 2: Evolution of the SLA spatial variability when SLA is referenced to the 7-year (red) or 20-year (bleu) period
The reference change impacts the SLA spatial variability with a significant reduction of the variability after 1999 when referenced to the 20-y period

Main important changes

- **New 20-year reference period**
- **New calibration convention: mean SLA is null over 1993**
- Use of **up-to-date standards** (GDR-D or equivalent):
  - GDR-D products for Jason1/Jason2
  - GDR-D orbit for Envisat
  - GSFC orbits for Topex and GFO (except during maneuver periods)
  - Reaper orbits foe ERS-1&2
  - GOT4v8 tide solution for all missions
  - New SSB solution from Tran 2012 for Jason-1&2, Envisat and Cryosat-2
  - Reaper ionospheric solution for ERS1
  - Dry troposphere from ERA-Interim for TP, ERS1&2; From ECMWF Gaussian grids for Envisat.
  - DAC solution computed from ERA-Interim for TP, ERS1&2; From ECMWF Gaussian grids for Envisat.
- **Improved inter-calibration**:
  - Bias from TP/Jason1 and Jason1/Jason2 were revised in order to correct geographical discrepancies affecting MSL observed with DUACS multi-mission MSLA.
  - Biais observed in the current DT products for the non repetitive mission were reduced
- SLA is computed with **MSS CNES-CLS-2011** referenced to the 20-year period. For repetitive orbits, cross-tracks gradients are improved using the **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/triplet mission (TP/Jason1&2; TPN/Jason-1N and ERS/Envisat) was also exploited.
- **Optimization of the optimal interpolation parameterization.**
- Computation of SLA maps with a **daily resolution**; spatial **Cartesian 1/4°** resolution for global and 1/8° for regional.
- **More precise noise along-track filtering**
- Use of the **new Mean Dynamic topography CNES-CLS-13** using the recent GOCE DIR-R4 mean field and improved processing method
- **Improved algorithms for geostrophic velocities computation.**
- **Changes of the nomenclatures and AVISO ftp directories**
- **Change of the NetCDF format to fit the CF convention**

Geostrophic currents improved

✓ The use of the 9-point stencil width method (Arbic et al, 2012) allows to reduce the impact of the anisotropy introduced by the Cartesian ¼° grid resolution.

✓ Stencil width, combined with new mapping parameters and grid resolution lead to **more intense currents** (EKE increased by 27%; Fig 10), now **closer to the drifter observations (Tab).**

✓ The SLA computation in the equatorial band is improved in order to **smooth the transition at ±5°N** (Fig 9) and improve the consistency between altimeter products and drifters observations.

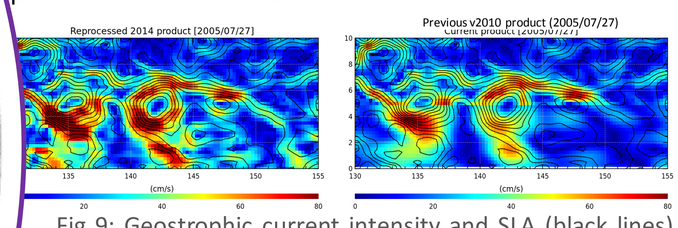


Fig 9: Geostrophic current intensity and SLA (black lines) on day 2005/07/27. ➔ the discontinuity at ±5°N is reduced in v2014 products

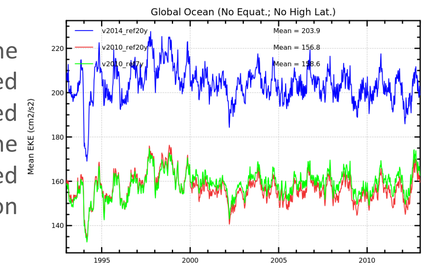


Fig 10: Evolution of the mean EKE deduced from the reprocessed product (bleu) and the previous version referenced on the 20-y period (red) or on the 7-y period (green)

➔ The EKE is more important in the reprocessed products, traducing the impact of the stencil width method (+10%); the change of the correlation scales (+6%); and the change of the grid spatial resolution (+20%)

	Zonal	Meridian
Outside the equatorial band	**0.86** (0.85)	**0.71** (0.64)
Inside the equatorial band	**0.85** (0.82)	**0.84** (0.81)

Tab: Taylor skill score of the comparison of the geostrophic current deduced from altimetry or measured by drifters. Results obtained with DUACS **2014** (2010) products.
➔ Geostrophic current are globally closer to the drifter current characteristics with v2014 products.

Coastal areas and high latitudes

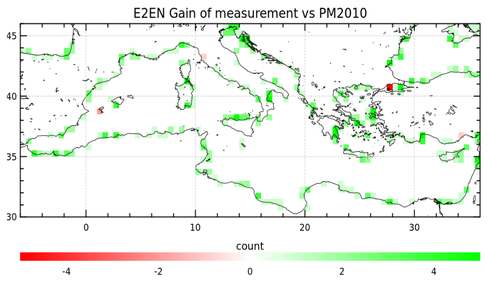
✓ **Along track defined closest to the coast** (Fig 6)

✓ **Maps better defined in coastal areas:**

- improved consistency with tide gauges observations (Fig 7)
- Improved consistency with drifters measurements in Eastern Boundary Upwelling Systems (see Capet et al, 2014)

✓ **Improved Editing in high latitudes areas** → both along-track and maps better fit the sea ice edge (Fig 8)

Fig 6: Difference between v2014 and v2010 mean profiles of the number of along-track point defined in 0.5°x0.5° boxes. Case of ERS1/2/Envisat Mean Profile.
➔The reprocessed mean profiles are defined closer to the coast (green boxes). It is also the case for Topex/Jason and Geosat Follow on mean profiles. This leads to an increased number of available measurements in these areas.



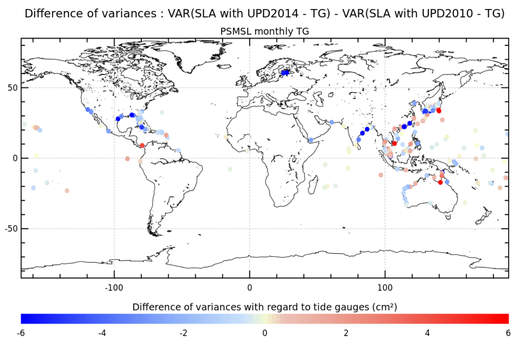


Fig 7: Variance reduction of the differences between map merged product and independent Tide Gauge measurements
➔ The reprocessed version of the products leads to an improved altimeter map product in the coastal areas. Local degradation is observed in the Indonesian area.

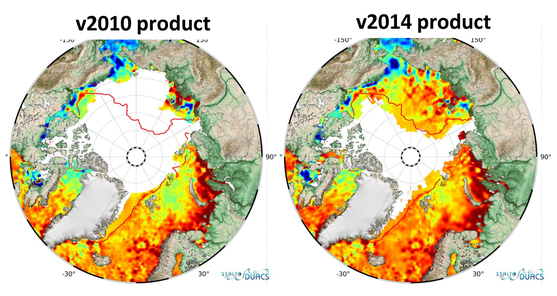


Fig 8: SLA map and ice edge (red line) on day 2007/10/17.
➔ The high latitude spatial coverage is improved in the reprocessed version of the DT products .

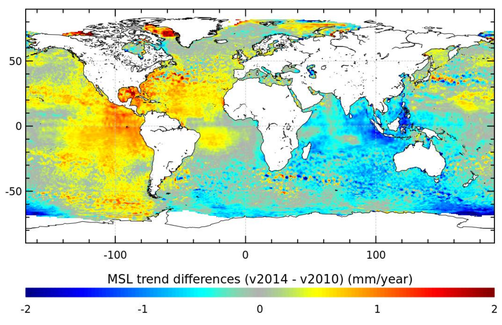
More precise climate signal

Using improved altimeter standards and inter-calibration processing significantly impact the restitution of the MSL trends:

✓Anomalies observed in 1994 on the previous dataset is corrected.

✓The regional MSL trend is improved with a more consistent trend between Eastern and Western basin: the ±1mm/year dipole error is reduced (Fig 11).

Fig 11: Regional MSL trend differences between the previous gridded product and the reprocessed version (period [1993,2012])
➔ Geographically correlated signature of the improved orbits solution used in the reprocessed products.



In Summary

In April 2014 different changes have been included in the NRT products and in a complete reprocessing of DT Products:

- ✓ **Change of the reference period and absolute reference of the measurement**
- ✓ **Improved standards and processing**
- ✓ **New nomenclature and format**

➔**PLEASE SEND US YOUR FEEDBACKS!**
aviso@altimetry.fr

Product access on the AVISO website
www.aviso.altimetry.fr