

# DUACS SEA LEVEL PRODUCTS: (SOON) 6 MISSIONS IN THE SYSTEM

Jason 3  
2016

OSTM/Jason 2  
2008

Jason 1  
2001

Faugère Y, M.-I. Pujol, F Briol, A Delepouille, G. Taburet, C Dufau,  
C Ubelmann, G Dibarboure, JD Desjonqueres, N. Picot

TOPEX/Poseidon  
1992



## Objectives of the presentation

### 1. Present a status of the altimetric constellation used in the CMEMS

⇒ *Focus on the Jason-3 integration, Sentinel-3 status*

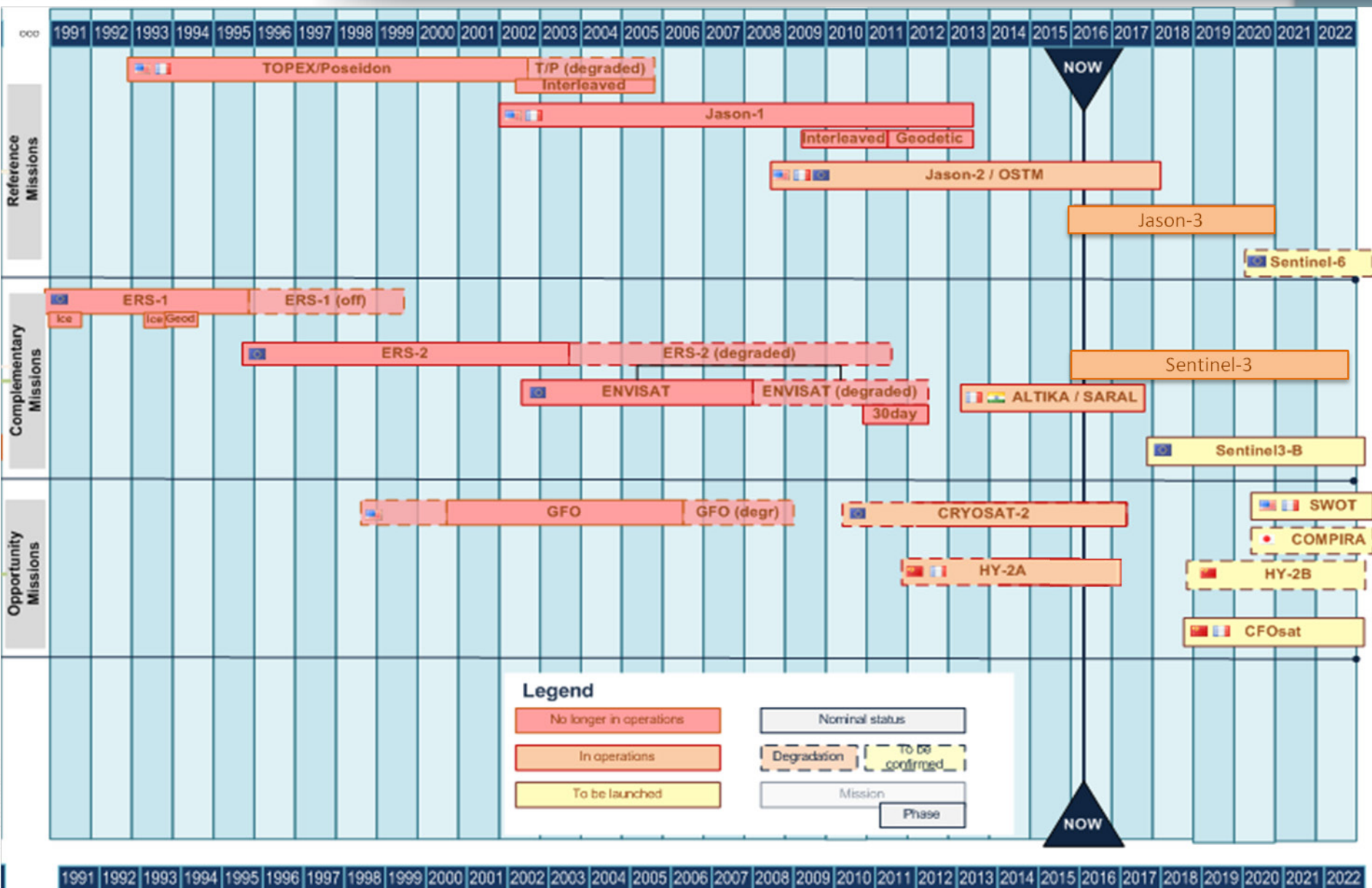
### 2. Give some perspectives: how to use these new satellites

⇒ *evolutions foreseen, R&D actions for the coming years*

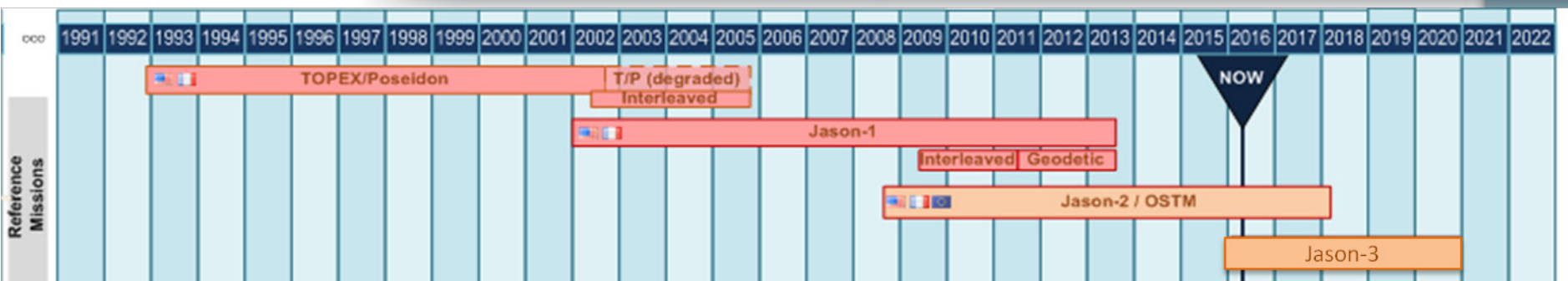




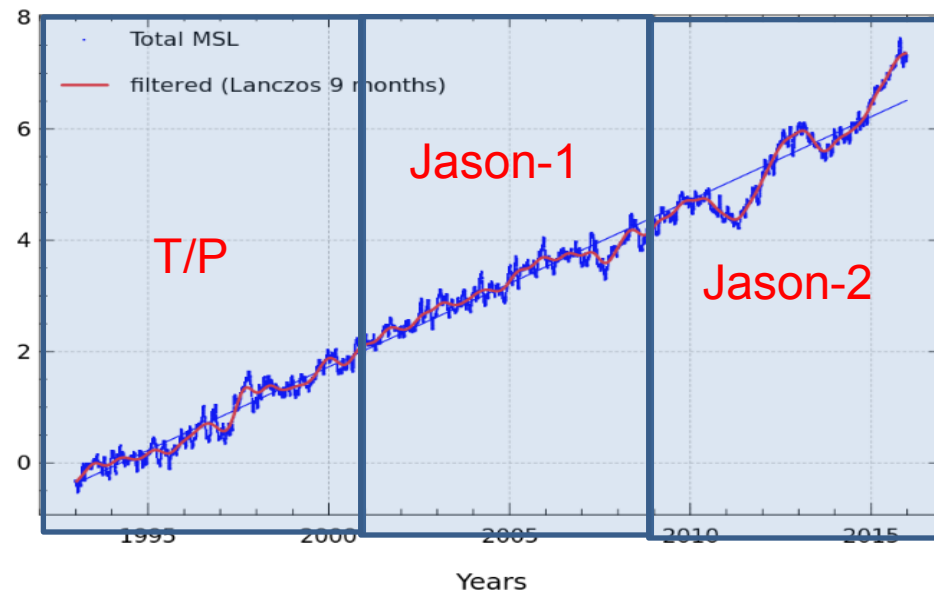
# Constellation used in CMEMS



## Constellation used in CMEMS



- The reference mission has a crucial role: the quality of the large scale signals completely depends on this mission
- A seamless transition is required, even in real time in order to avoid any trouble on operational application (eg forecasting centers).
- **This transition is a major step for CMEMS**

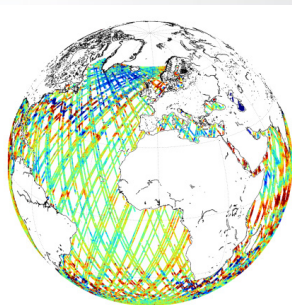
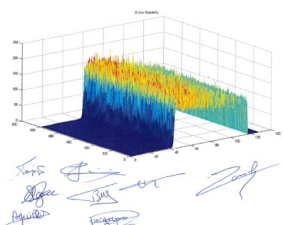


Next:  
Jason-3

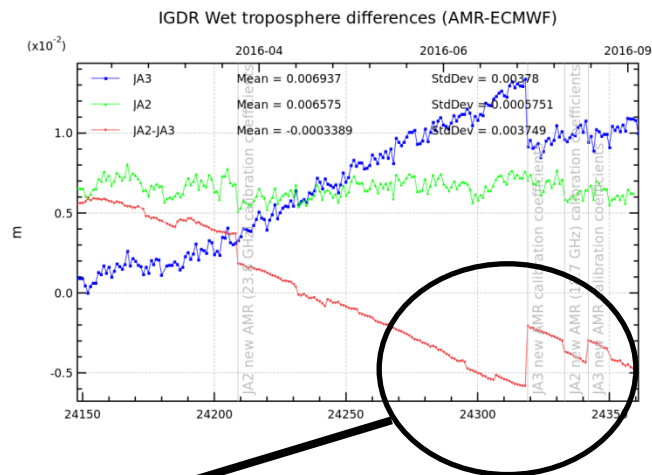
*Temporal evolution of globally averaged daily MSL without annual and semi-annual signals (blue), 3 reference missions have been used to build this time series*



# Jason-3 in DUACS



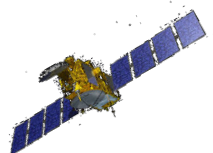
June 21st 2016  
CNES/NASA/EUMETSAT/NOAA NRT workshop : Data flows publicly open



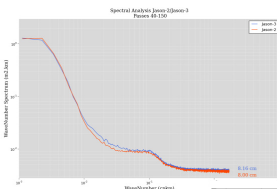
20/01/2016  
first waveform received

12/02/2016  
Jason-3 is on its final orbit → begin cycle 0

17/01/2016  
launch



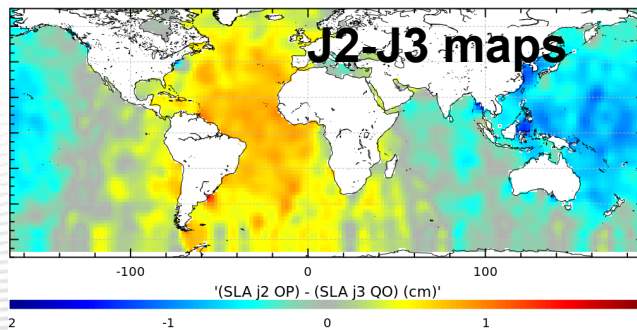
27/01/2016  
first comparison with Jason-2



Radiometer calibrations during summer time

April 2016  
SL-TAC starts integration test

J2-J3 maps



September 13<sup>th</sup> 2016  
Jason-3 in CMEMS SL Products

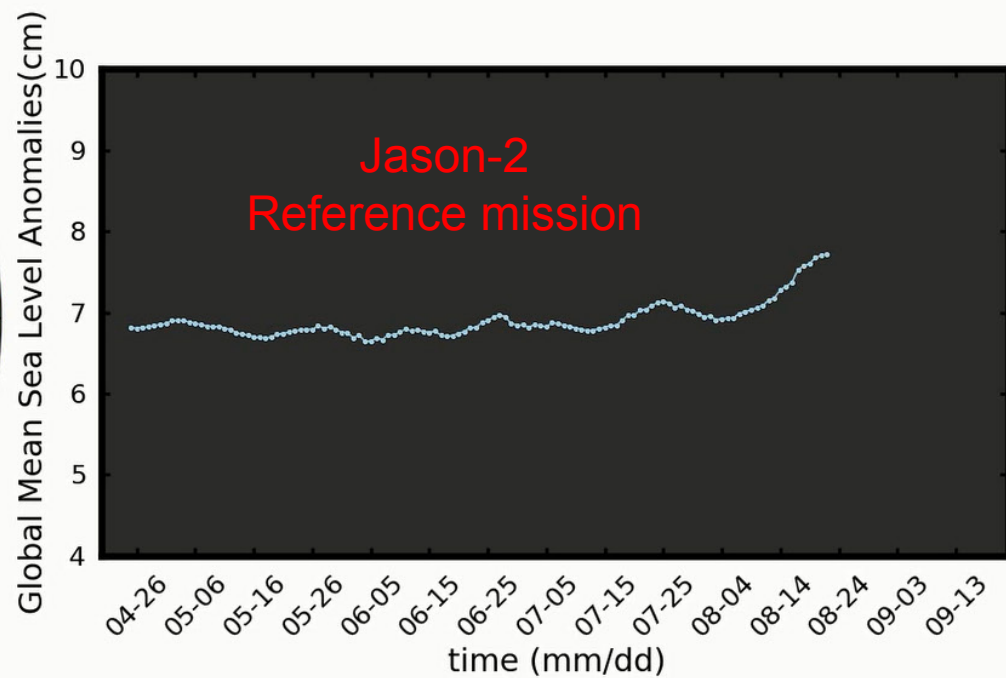
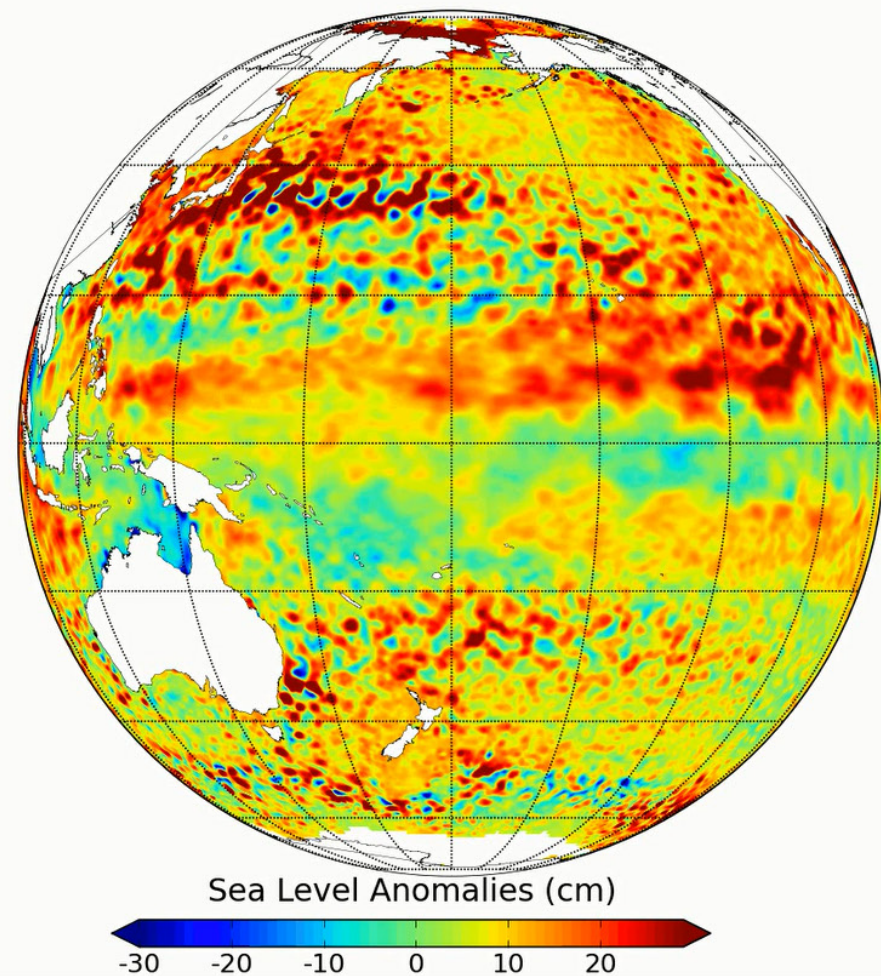
Jason-2 orbit shift  
October 2<sup>nd</sup> 2016

January

April

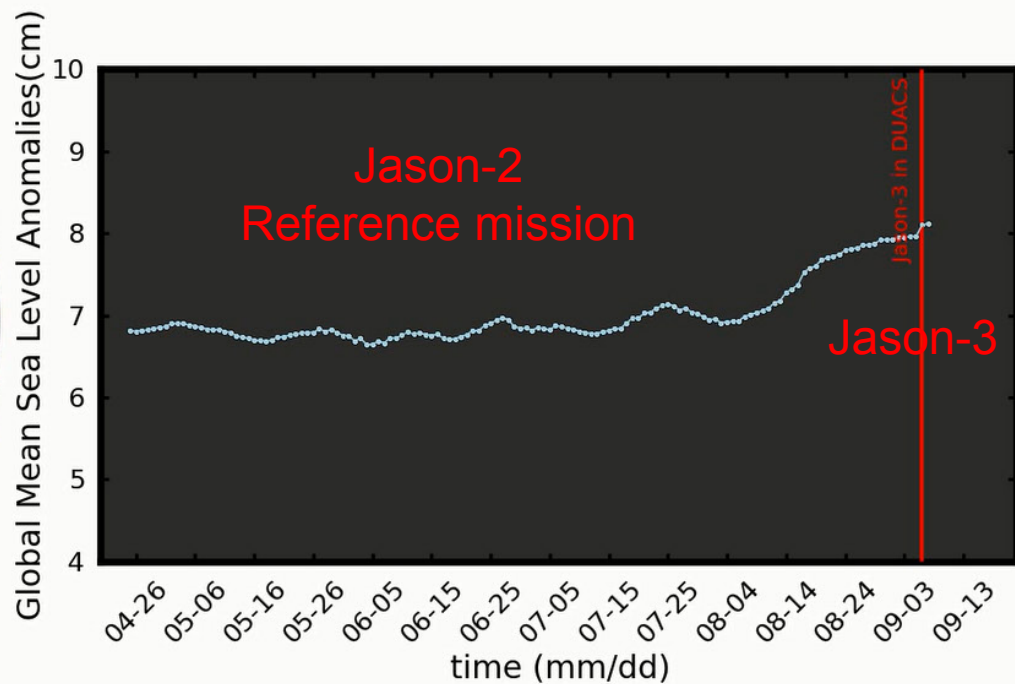
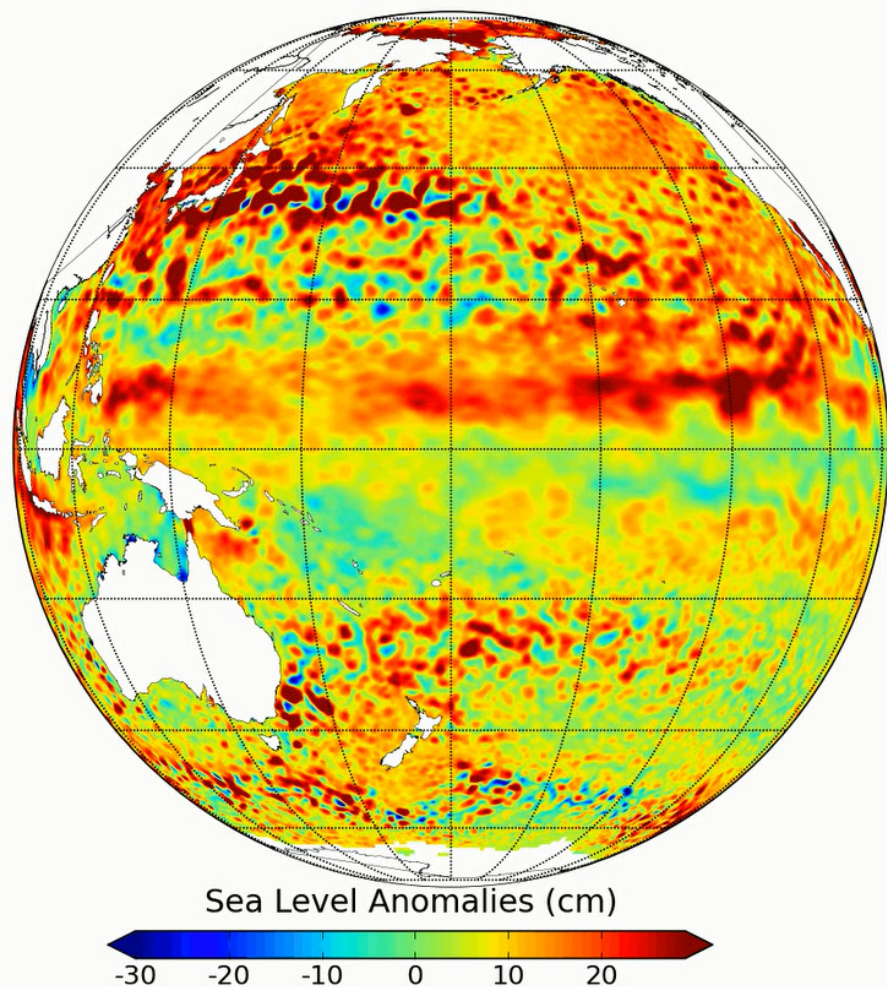
July

October



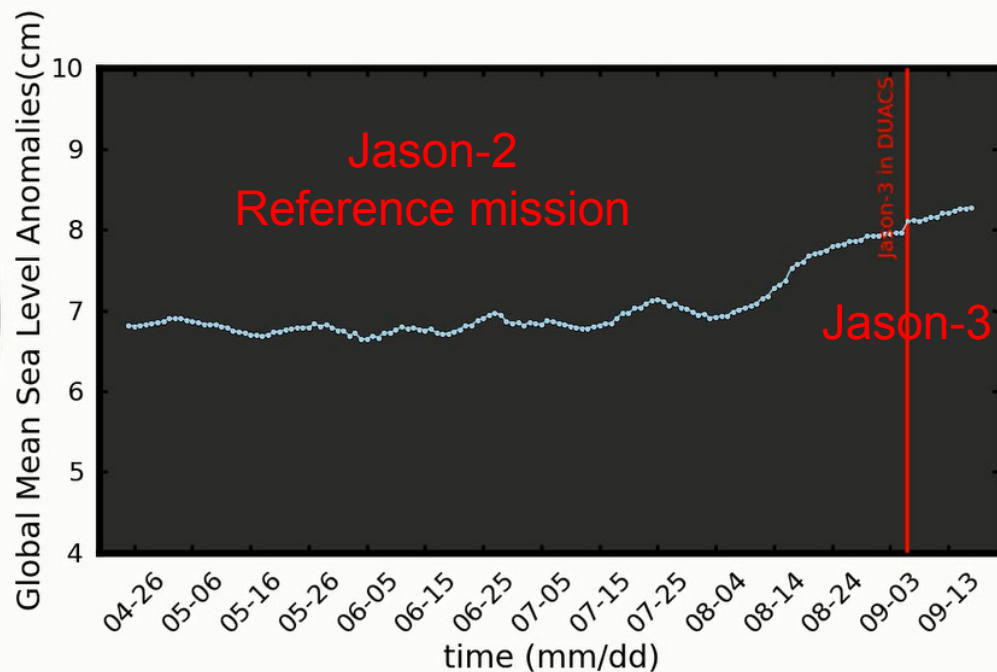
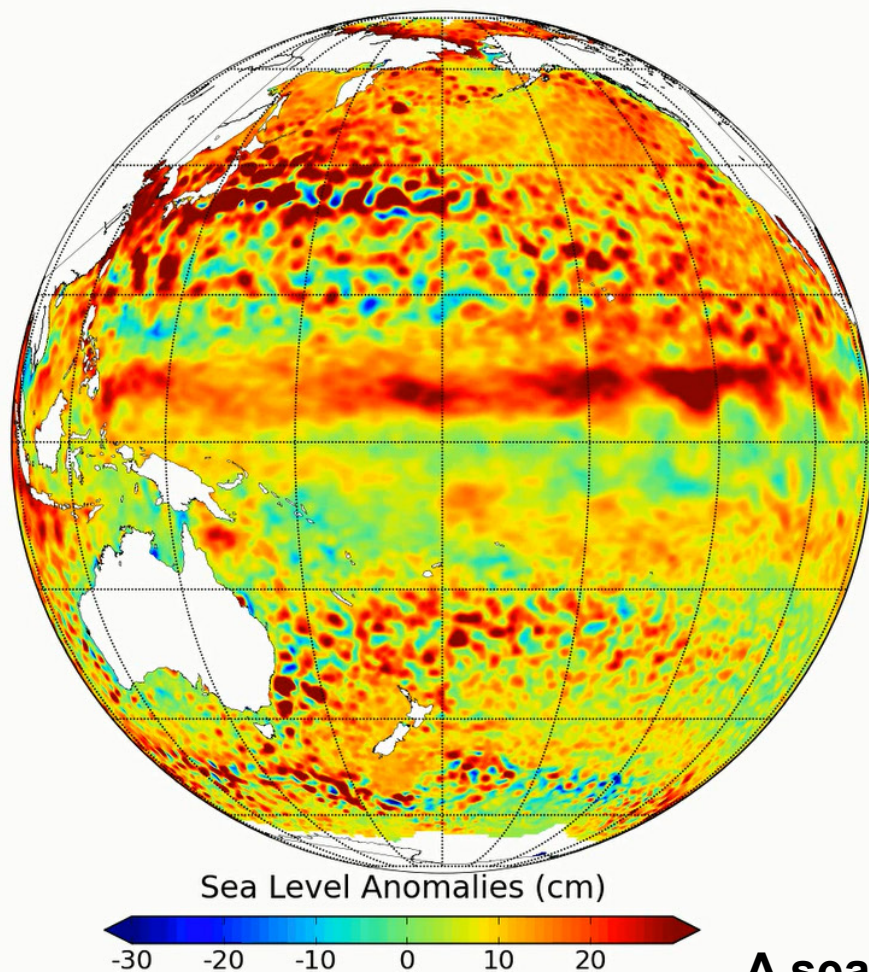


## September 13<sup>th</sup> 2016 Jason-3 in CMEMS SL real time Products



September 13<sup>th</sup> 2016

Jason-3 in CMEMS SL real time Products



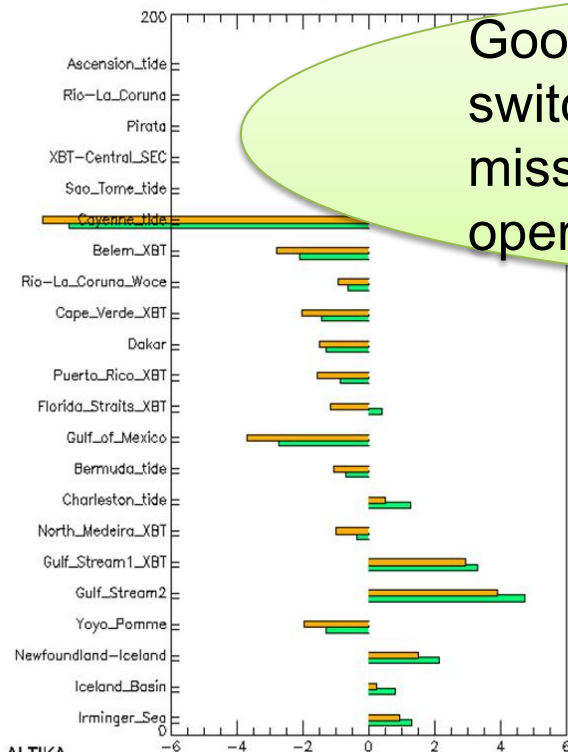
**A seamless transition is required, even in real time in order to avoid any trouble on operational application (eg forecasting centers).**



## Impact of using Jason-3 instead of Jason-2 in model misfit = (obs-model)

### Environment Canada

#### Average AVR(MISFIT)



ALTIKA

GD\_j2 Global = -0.525720

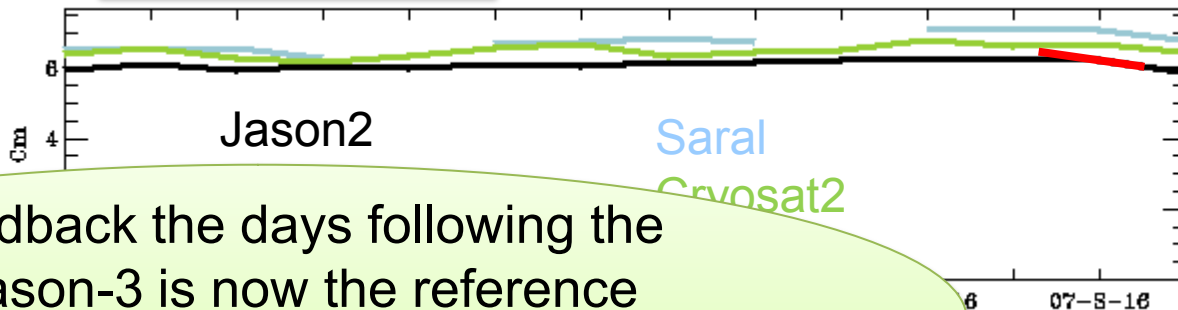
GD\_j3 Global = -0.339730

20160831

<http://www.cls.fr>

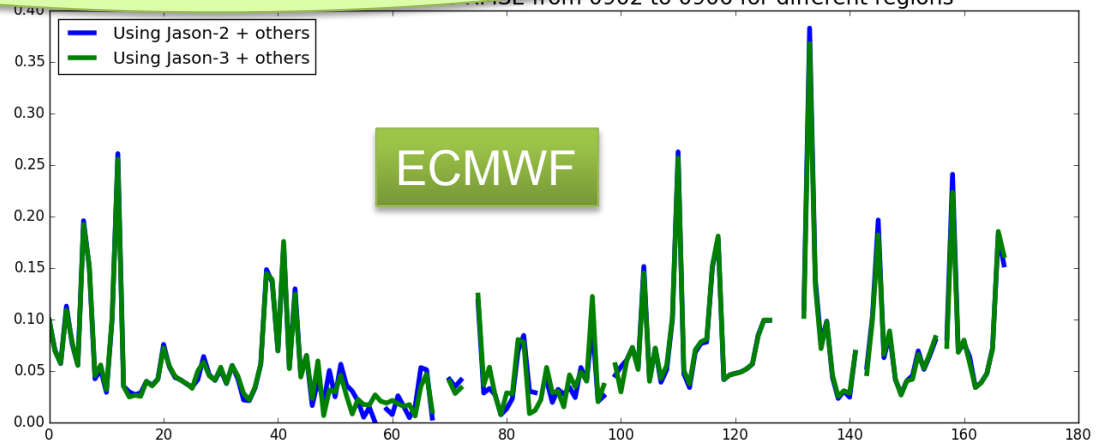
### Mercator

#### RMS Misfit



Good feedback the days following the switch: Jason-3 is now the reference mission for numerous oceanography operational center

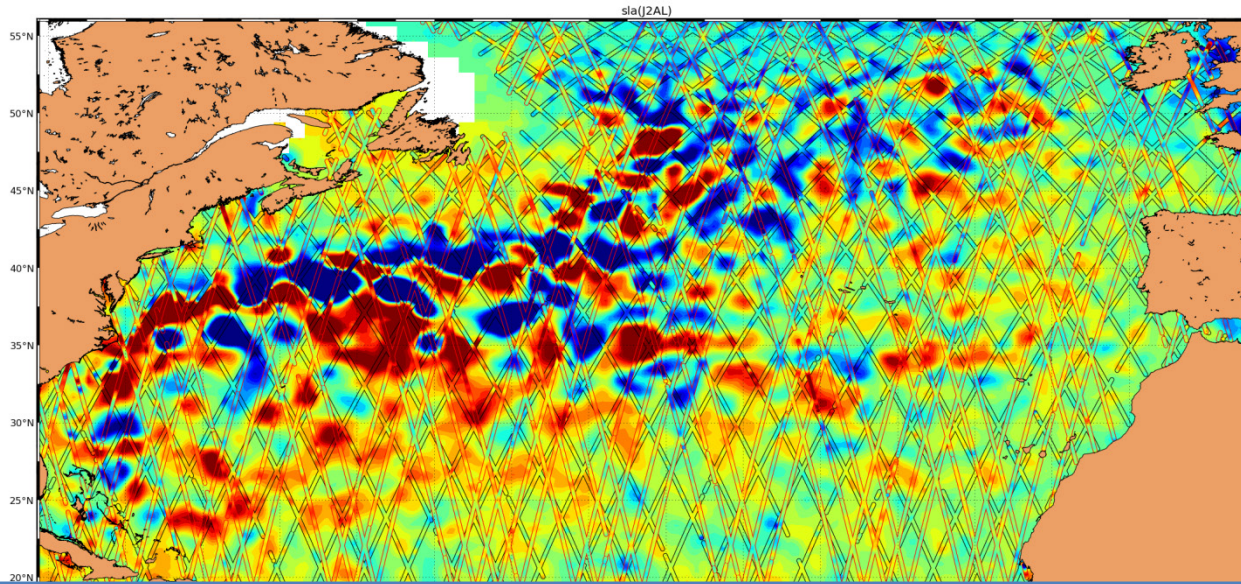
RMS from 0902 to 0906 for different regions



### ECMWF

Courtesy JM Lelouch et al, Hao et al

*Sentinel 3 soon*



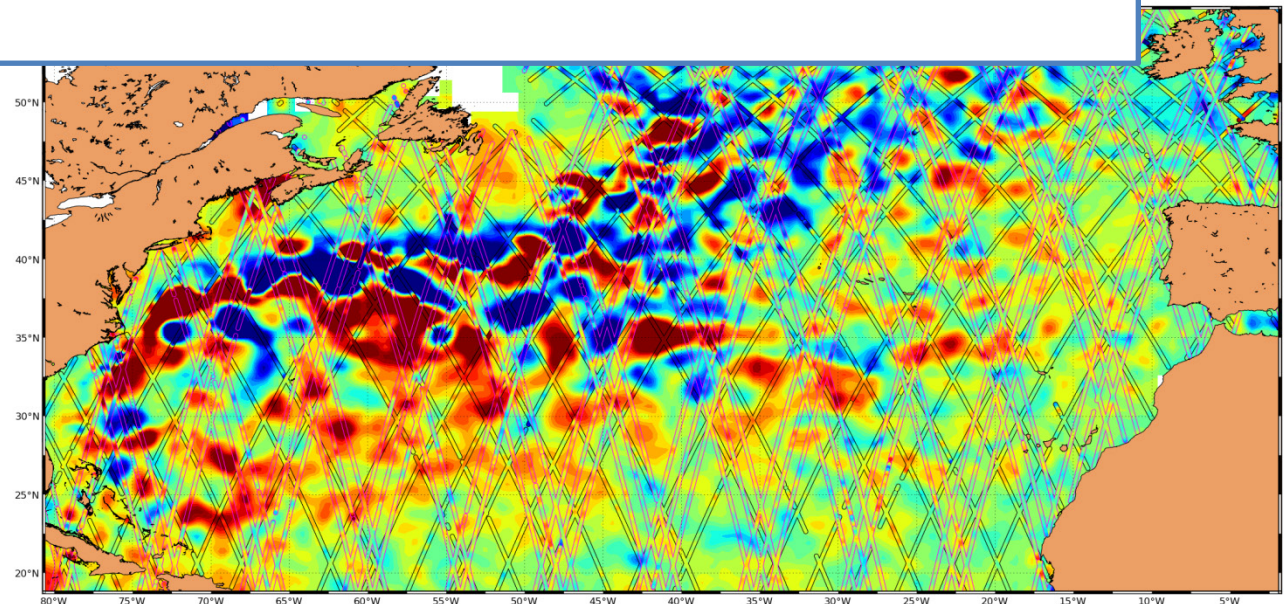
Page 10  
20 cm

**Jason-2 +  
Altika  
SLA map on  
15/03/2016**

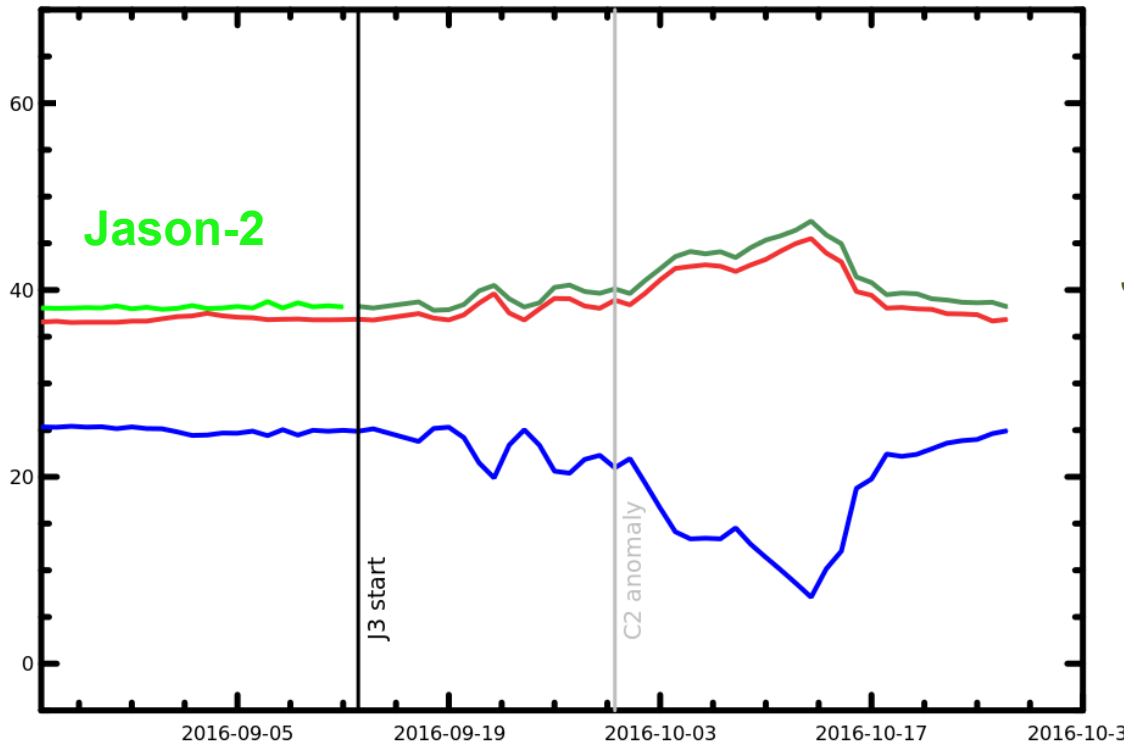
-20 cm

**Our QC results confirm the excellent CalVal metrics. After more in-depth quality assessment (STC products expected soon), Sentinel-3 together with Jason-3 will soon ensure the continuity of CMEMS Sea Level products**

**Jason-3 +  
Sentinel-3A  
SLA map on  
15/03/2016**







**Mean Contribution of each satellite since this summer (%)**

**Jason-3**  
**Altika**

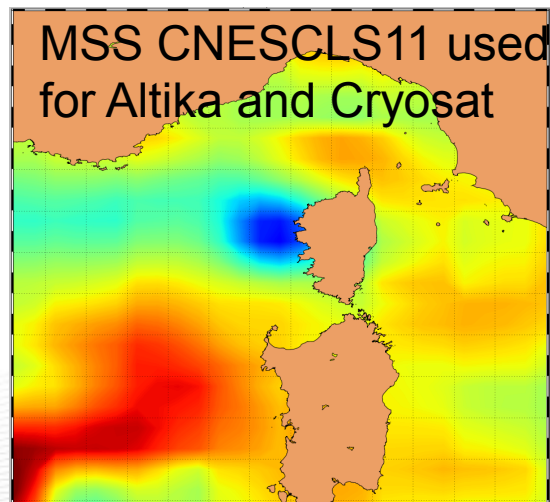
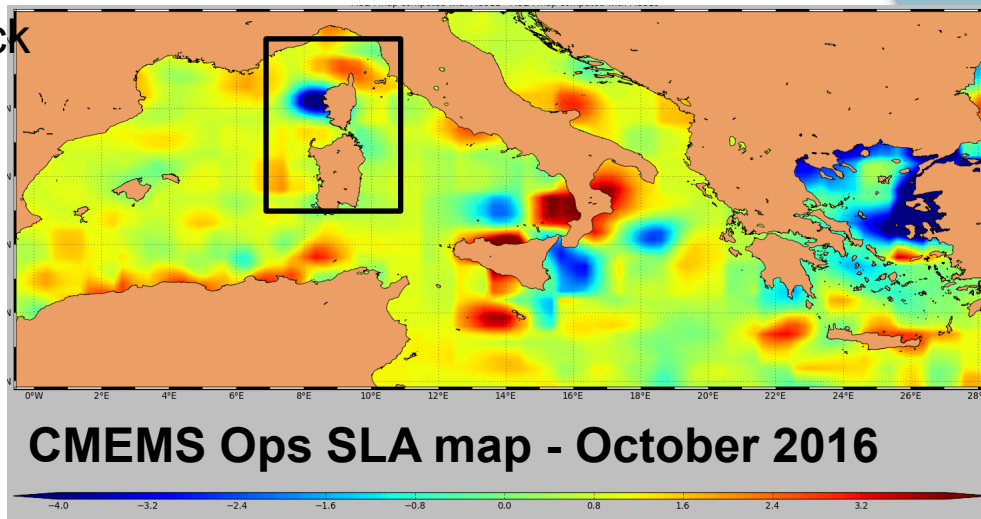
**Cryosat-2**

- ✓ 3 missions in the real time system
- ✓ Hy2A used in the Offline processing
- ✓ Jason-2 back NRT in the system 22 November
- ✓ Sentinel-3 in the NRT system soon

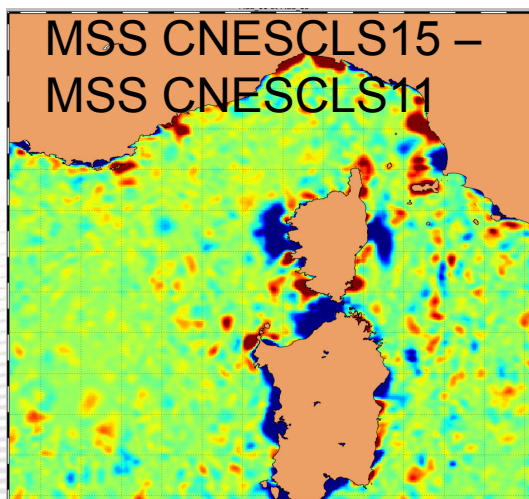
**5 missions in the NRT system early 2017 (6 offline)**

- Al, C2, S3 (and H2) have uncharted track in the current MSS used in CMEMS
- Example of an MSS induced error in October (Med sea)
- we will implement this month **the new MSSCNESCLS 2015** to mitigate this errors.

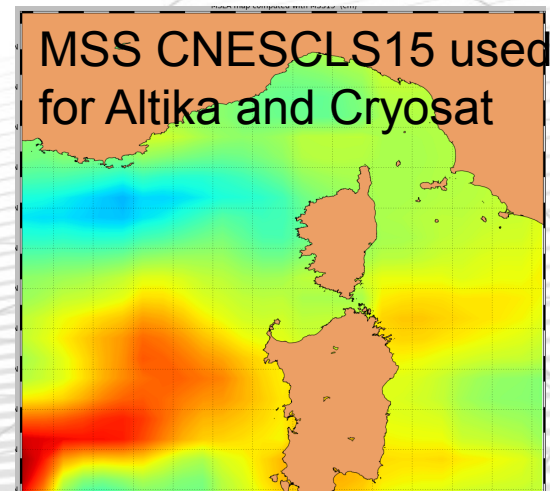
**See dedicated MSS presentations  
Schaeffer/MSS session  
Pujol/ Error session**



8 cm 22 cm



-10cm 10cm



8 cm 22 cm *demain*

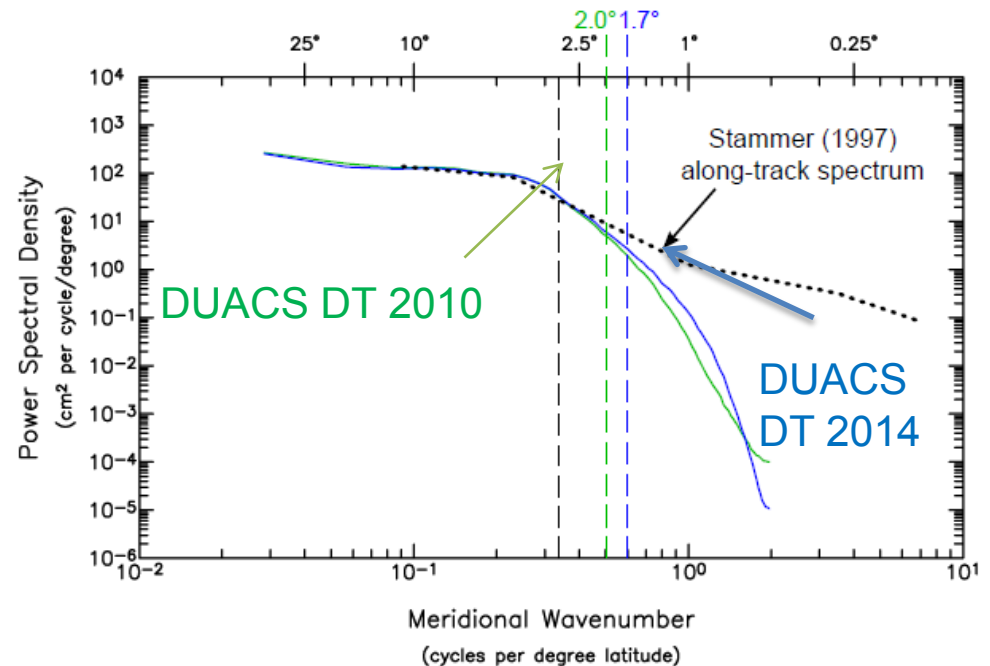


- Together with this input data, there is a need of new processing method to exploit the full content of the constellation

=> 1Hz measurements are no longer sufficient to retrieve the smaller scales.  
Exploiting the full 20Hz record is becoming the new baseline of L3 processors

See dedicated talk from M Ablain in the “Error session”)

=> Current mapping method, based on a simple Optimal interpolation scheme has to be revisited in order to try to resolve **scales of the order of 100 km and 7 days** (~4x better than now).



**SLA Spectrum from DUACS gridded products (Chelton et al, 2014)**

- Dynamic interpolation (Ubelmann 2016) uses a non-linear propagator (1-layer QG model) to mitigate poor temporal SSH coverage

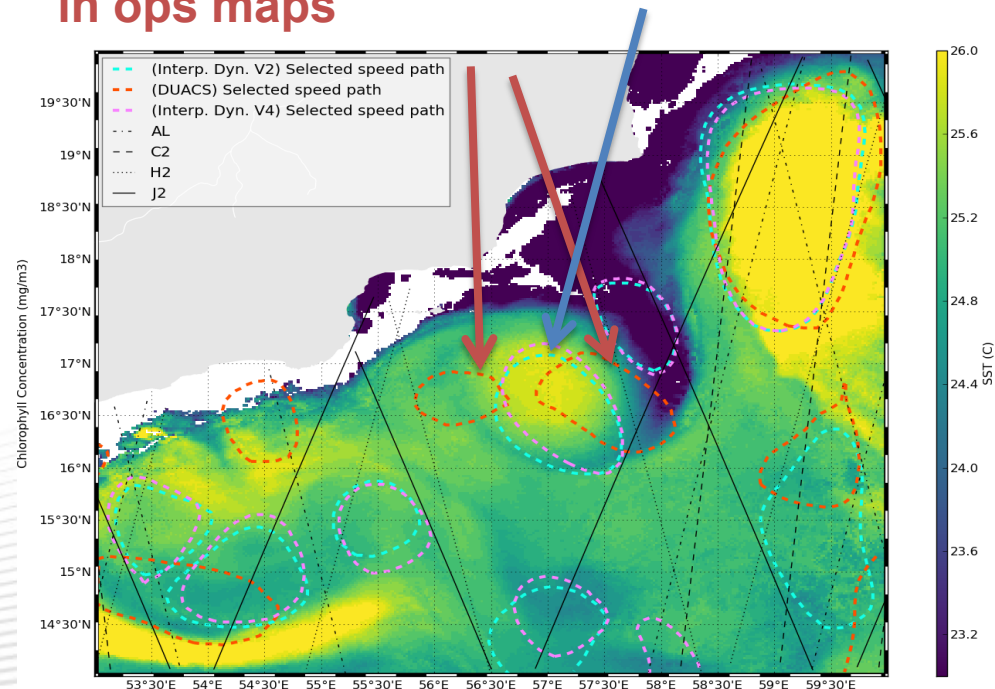
Ubelmann C., B. Cornuelle and L-L Fu : *Dynamic Mapping of Along-Track Ocean Altimetry: Method and Performance from Observing System Simulation Experiments*. J. Atmos. Oceanic Technol., 2016

See poster SC2\_015

- **Very promising results:** first tests in the Gulf Stream over 1 year allows us to reduce the error by ~20% compared to the standard operational maps
- Eddy trajectories consistently tracked, less affected by gaps in observation

2 eddies identified in ops maps

1 eddy mapped by Dyn Interpolation Consistent with SST



Experiment in the Indian ocean in August 2015



## *Perspectives: new eddy atlas on Aviso*

- Useful oceanographic informations are derived from SLA gridded maps
- Among them, we can identify and track the eddies at global level:

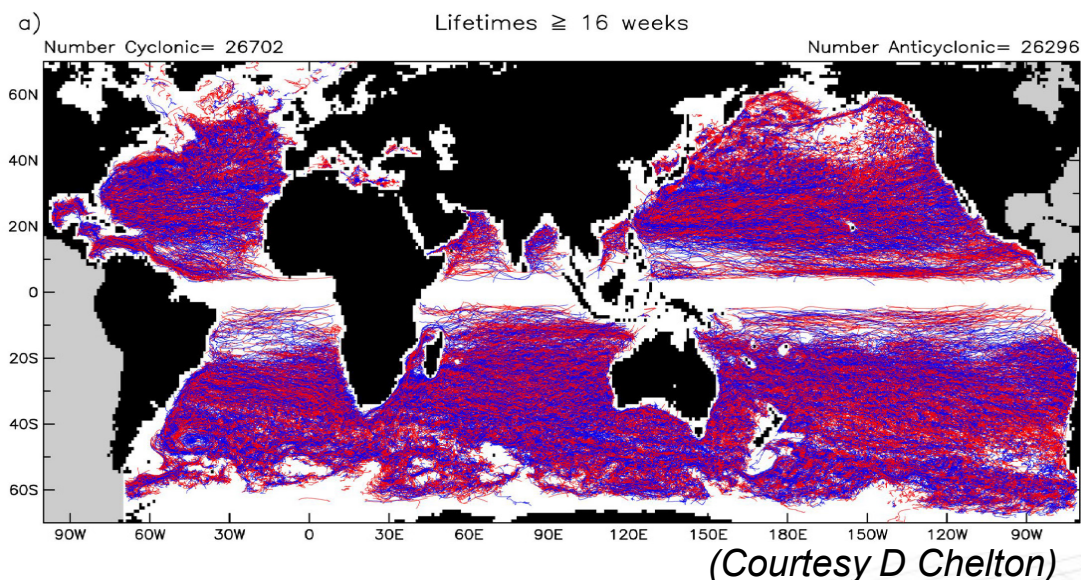


Illustration of the new atlas from Dudley Chelton released in July 2016. It is derived from DT2014 maps [January 1993 - April 2015]

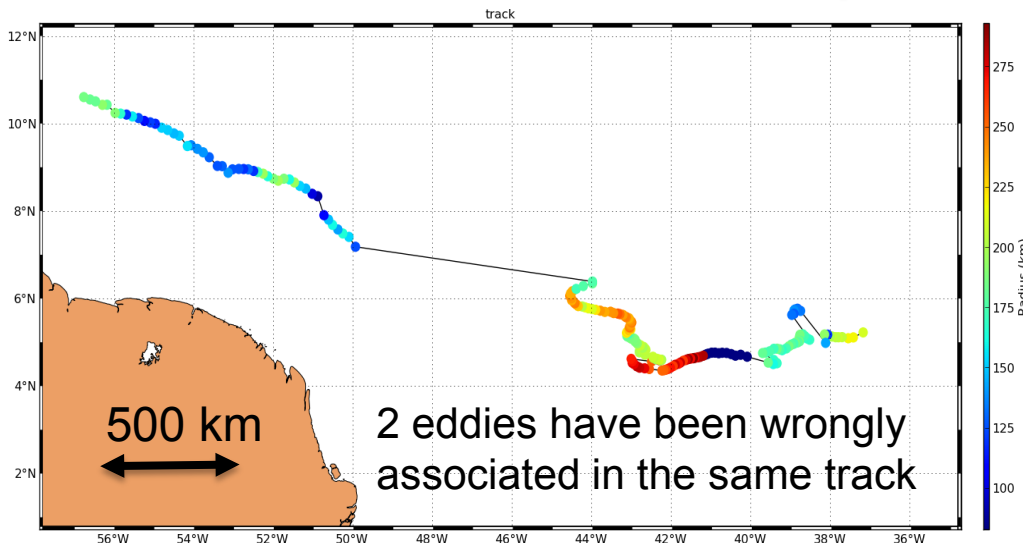
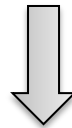
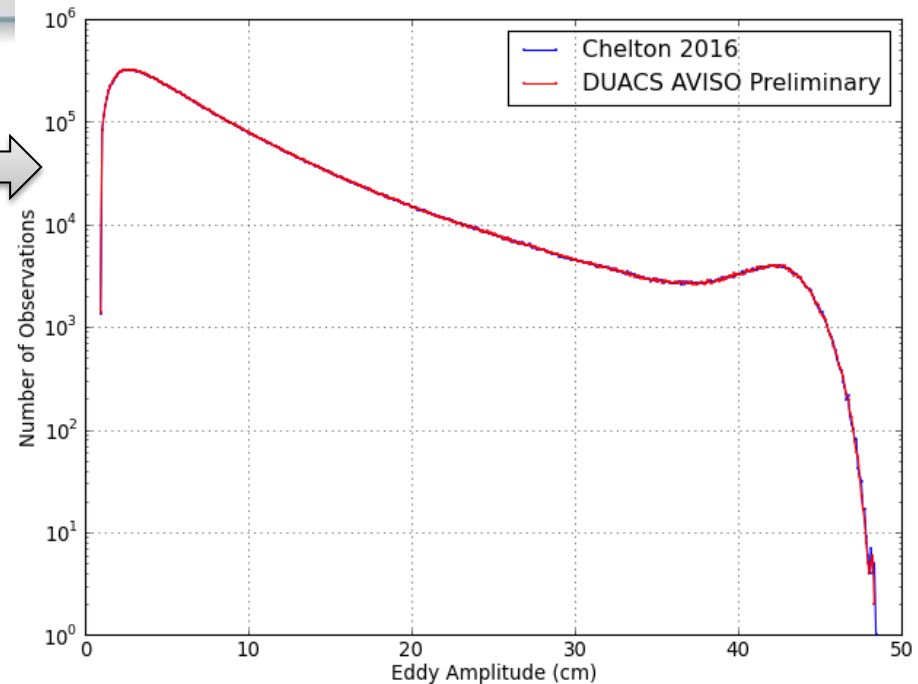
Available at:  
<http://wombat.coas.oregonstate.edu/eddies/>

757 downloads as of 31 October 2016 !!

- **Collaborative work between CNES/CLS/Univ of Oregon** started this year to transfer the future operations (updates) of the Atlas and make them available on Aviso.
- It will be based on the same algorithm, with some minor updates

## *Perspectives: new eddy atlas on Aviso*

- Very consistent results obtained, small differences due to 2D filtering algorithm used to pre-process the data
- In some cases wrong eddy associations has been observed in both datasets => tracking algorithm can be tuned to correct from this effect (maximum distance allowed between two observations)



• Released of the updated dataset with 23 years of eddy trajectory foreseen end 2016

• Then regular updates in 2017 (goal is provide close to real time updates)



- Jason-3 is now the reference mission for the NRT system : **a major step for CMEMS**: Smooth transition in a tight planning context (Jason-2 shift) good feedback from forecasting centers. **Sentinel-3 soon in the System**: tests on-going, promising results
- AI, C2, S3 have uncharted track in the current MSS used in CMEMS => we will implement next month **the new MSSCNESCLS 2015 to mitigate this errors.**
- We will have a **6 missions constellation** available to map the ocean topography. And more precise altimeters (SAR), so we will able **to better fulfill downstream user needs**:
  - Improve current products: **improve the resolution** thanks to CNES R&D activities to => One of the target is to reach the **100km/7 days for maps**
  - new products: **New eddy Atlas on Aviso** for the end of the year.

