Comparing in situ current data with current anomalies derived from the PISTACH products: *the Florida Current case*

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(5) NOAA-AOML
(6) CNES

18/10/2011

Context of the study

- Context:
  - Using geostrophic current anomalies derived from the altimeter data to observe the coastal currents or meso-scale structures is very challenging.
  - PISTACH project:
    - Funded by the CNES
    - New processing methods and corrections dedicated to coastal applications, for the Jason-2 mission products.
    - Up to now: Jason-2 IGDR products + about 80 extra fields
    - PISTACH level-3 products: high frequency SLA on reference ground-tracks *(presentation and poster by S. Labroue)*
  - "Test zones" chosen after consulting the coastal altimetry community:
    - The Florida Strait
    - The Algulhas Current *(next year)*

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Objectives of the study

- Objectives:
  - **Validate** the L3 PISTACH demonstration products with independent data
  - **Estimate the added value** of these products in coastal zones, compared to classical SLA products.
  - **Establish the best "recipe"** for the combination of parameters and corrections to be used to monitor coastal currents

    ➔ In this study, only the retrackings were evaluated.

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Agenda

- Description of the study area: the Florida Strait
- Altimetry data post-processing
- In situ data post-processing
- Comparison of the current anomalies
- Conclusions and perspectives

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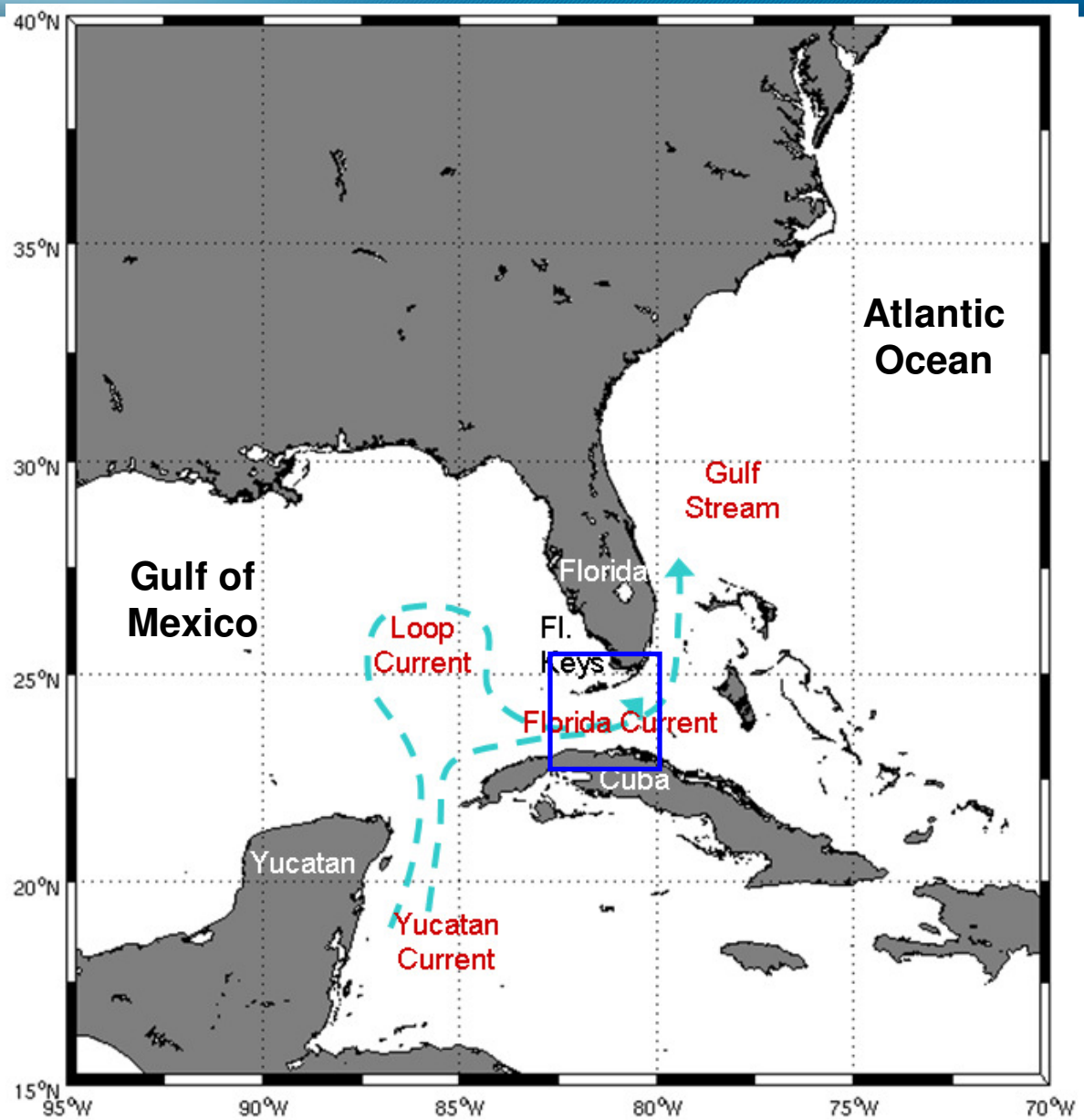
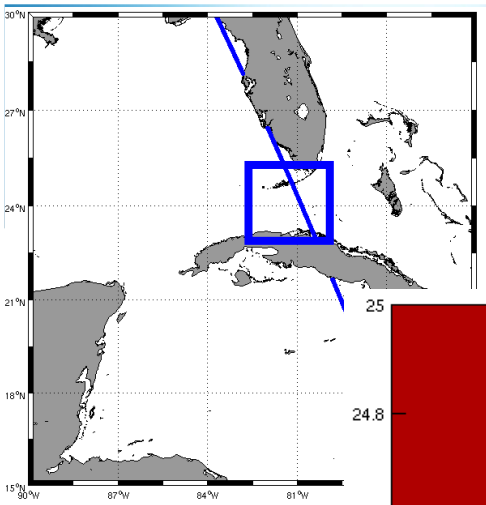
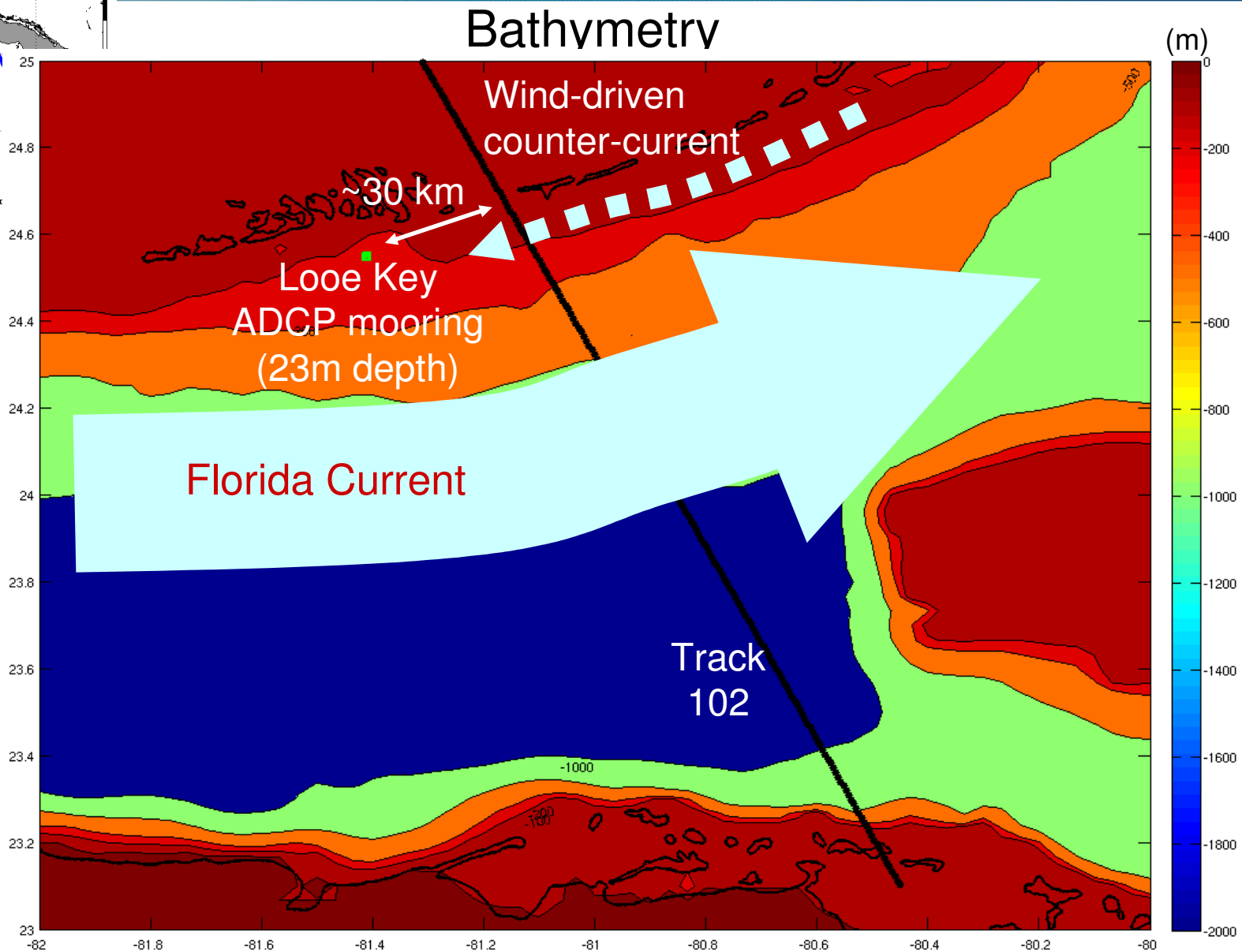
Study area: the Florida Strait



Study area: the Florida Strait





Altimetry data post-processing

- 4 altimetry SLA datasets
  - PISTACH retrackings: 5Hz products (1.4km), 7km low-pass filtered
    - MLE4
    - RED3 = MLE3 applied on a reduced number of gates
    - OCE3 = MLE4 applied to filtered waveforms
  - Jason-2 DUACS SLA: monomission 1Hz product
- Post-processing:
  - Along-track 30-point (=42km) low-pass filter
  - 20-point (=28km) filter to compute the geostrophic anomalies *(Powell & Leben, 2003)*
    - ✓ First Rossby radius of deformation: about 30km in the area

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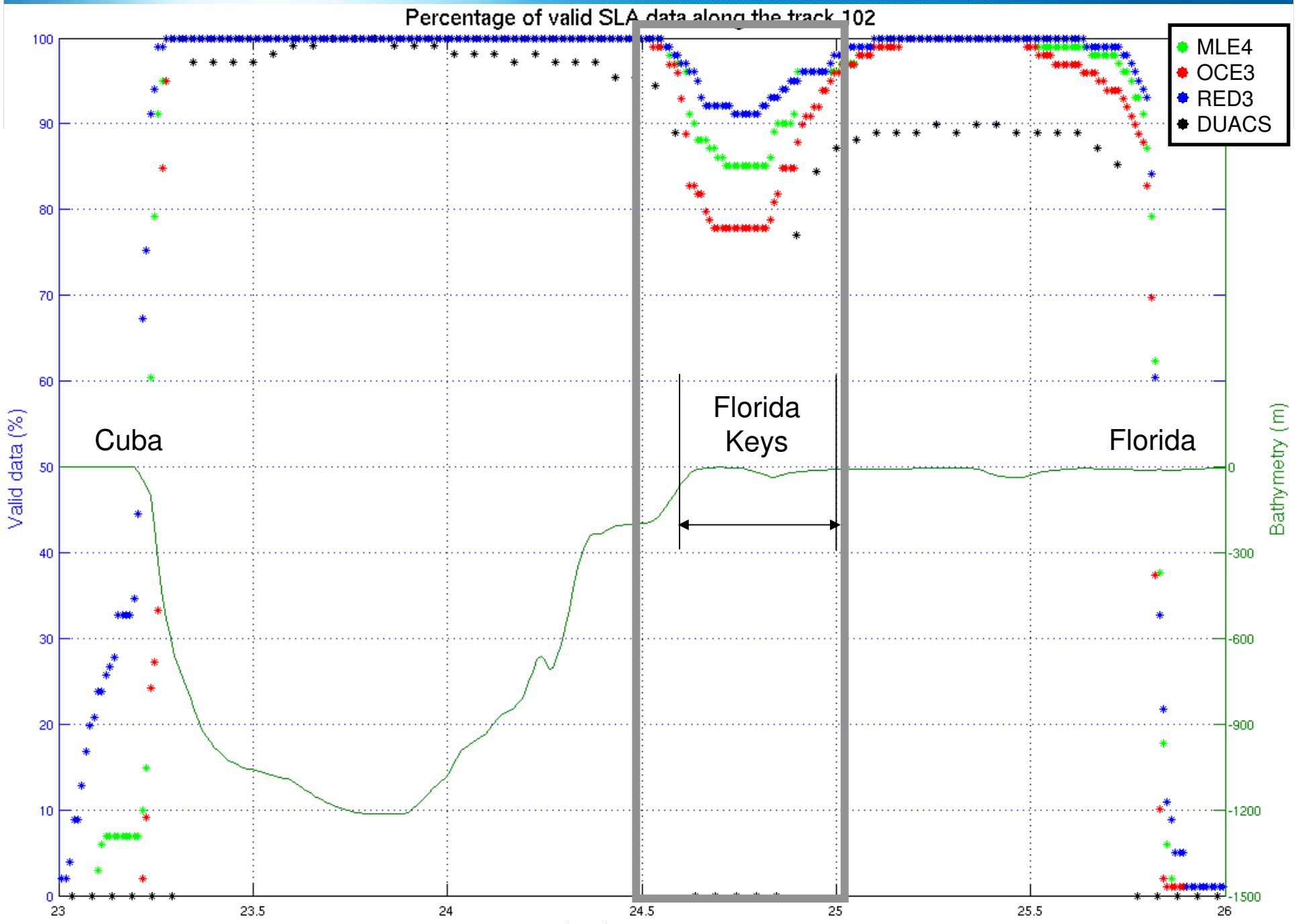
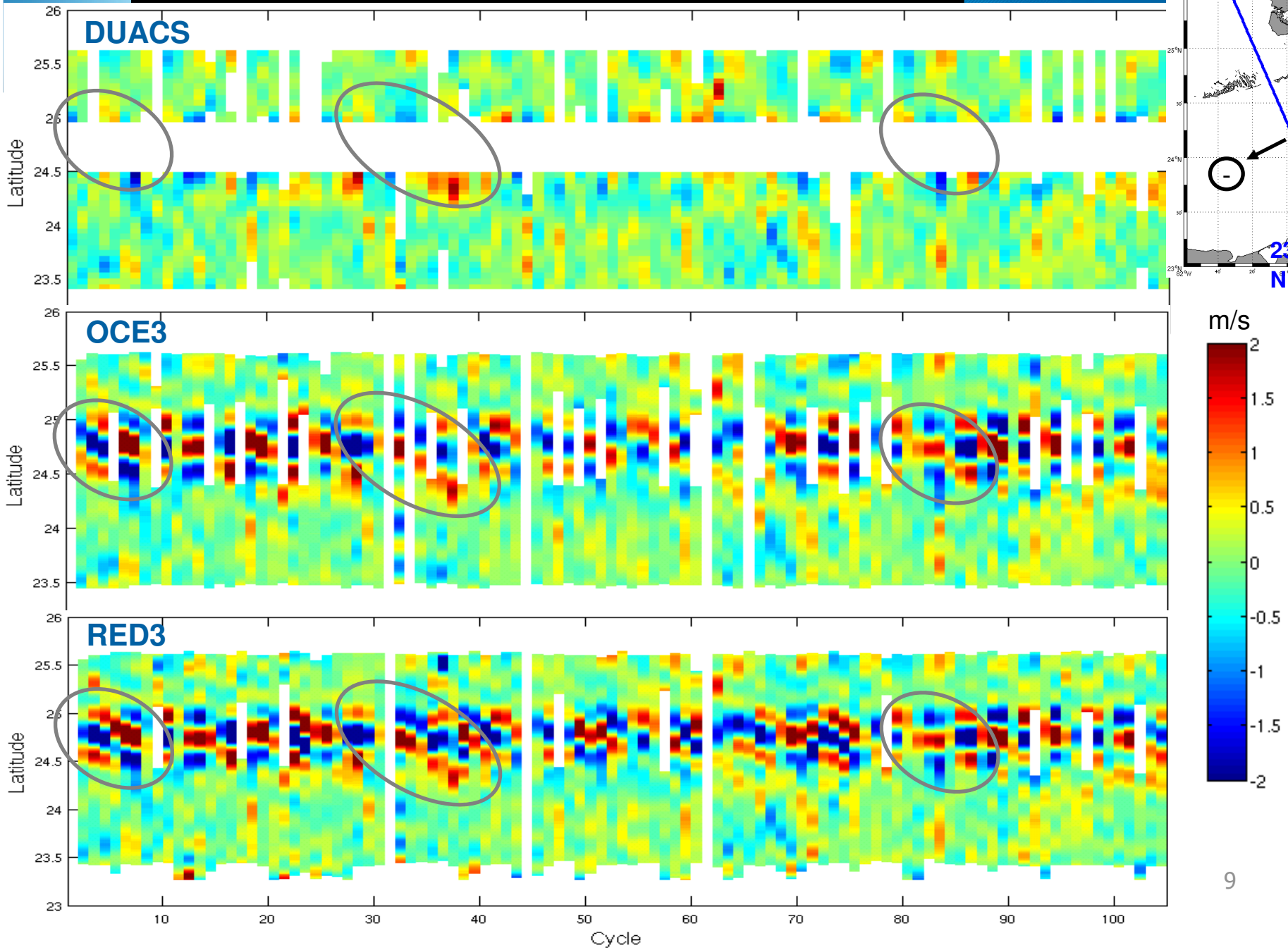
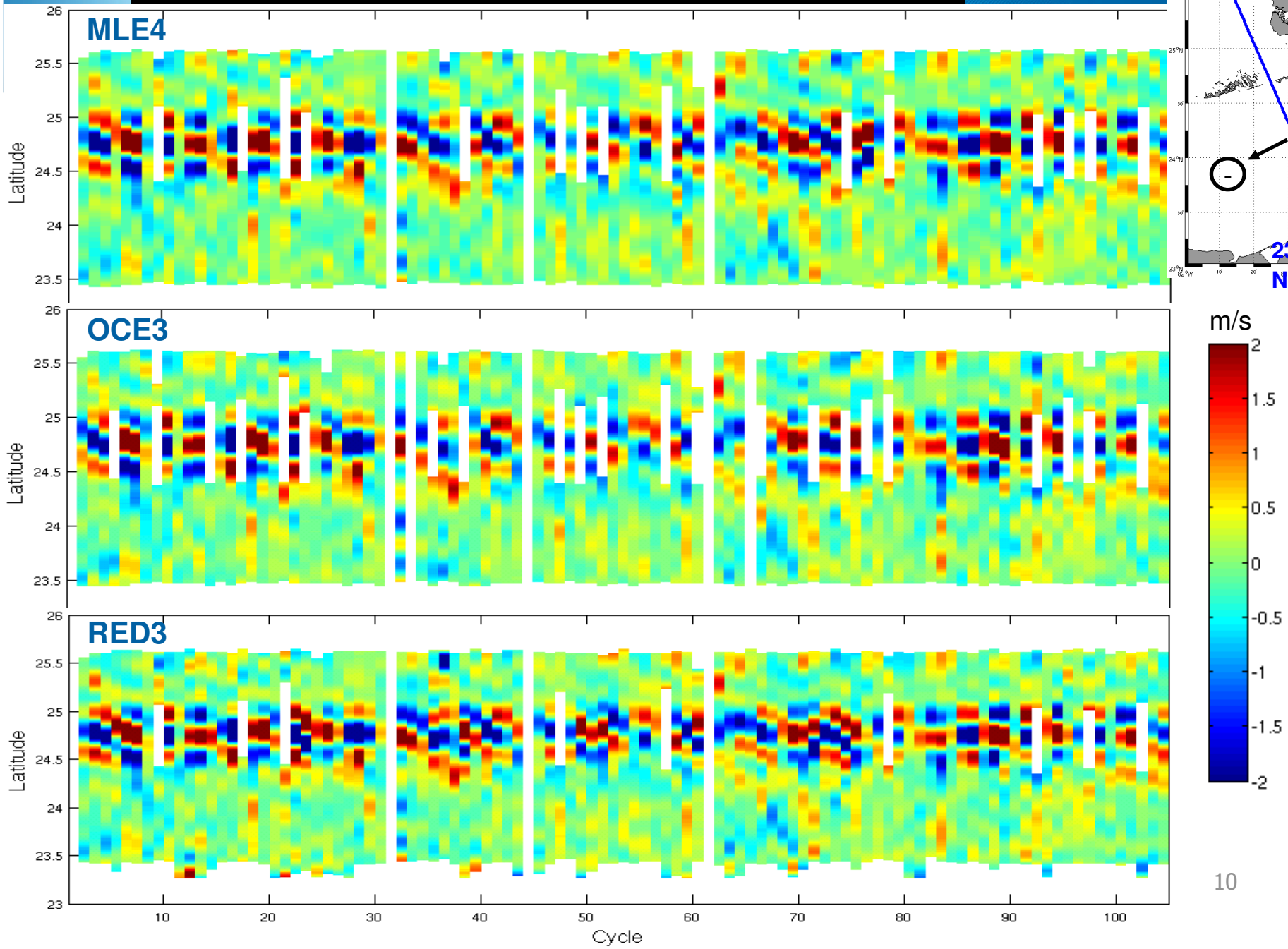
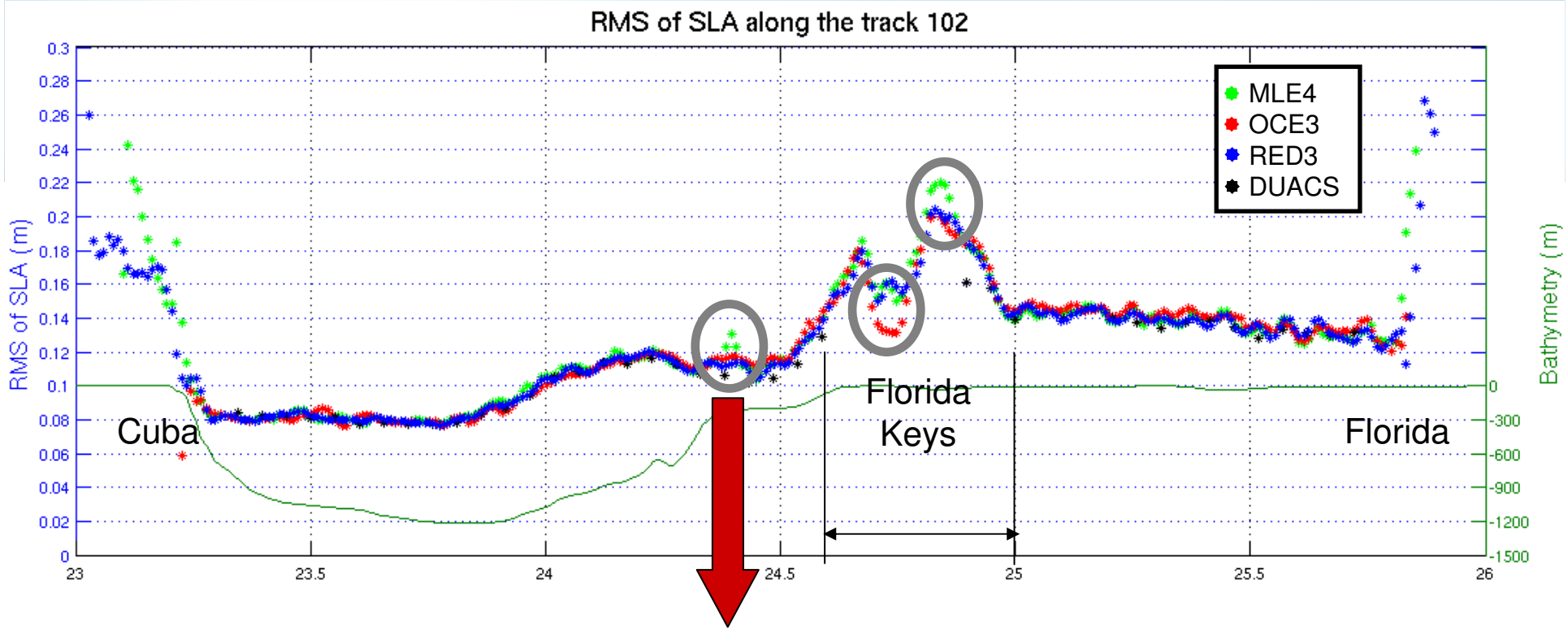

Percentage of valid SLA data along the track 102
MLE4
OCE3
RED3
DUACS
Cuba
Florida
Keys
Florida
Valid data (%)
Bathymetry (m)
100
90
80
70
60
50
40
30
20
10
0
0
-300
-600
-900
-1200
-1500
23
23.5
24
24.5
25
25.5
26

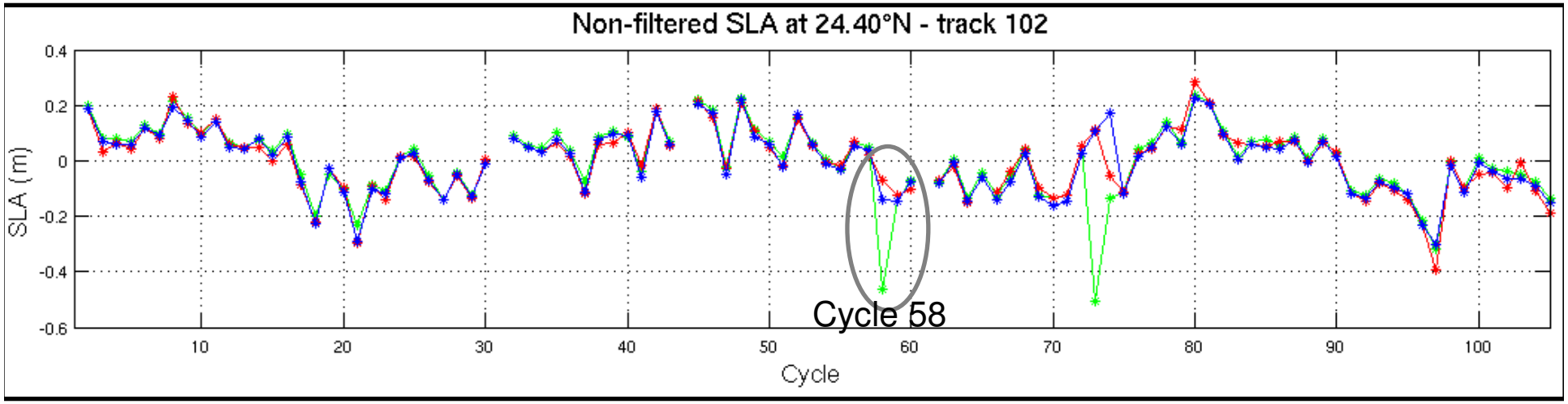
Geostrophic current anomalies – track 102



Geostrophic current anomalies – track 102







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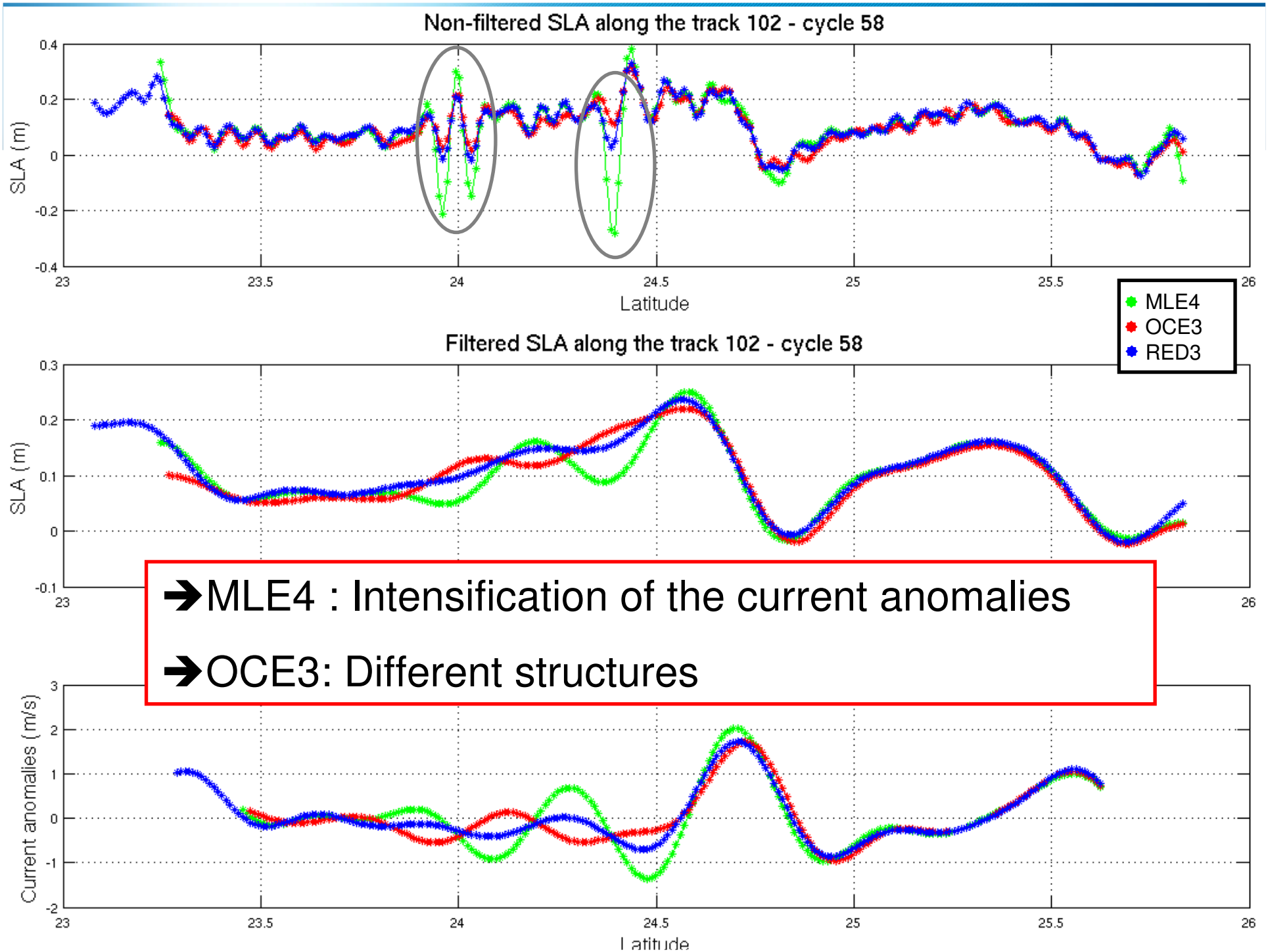
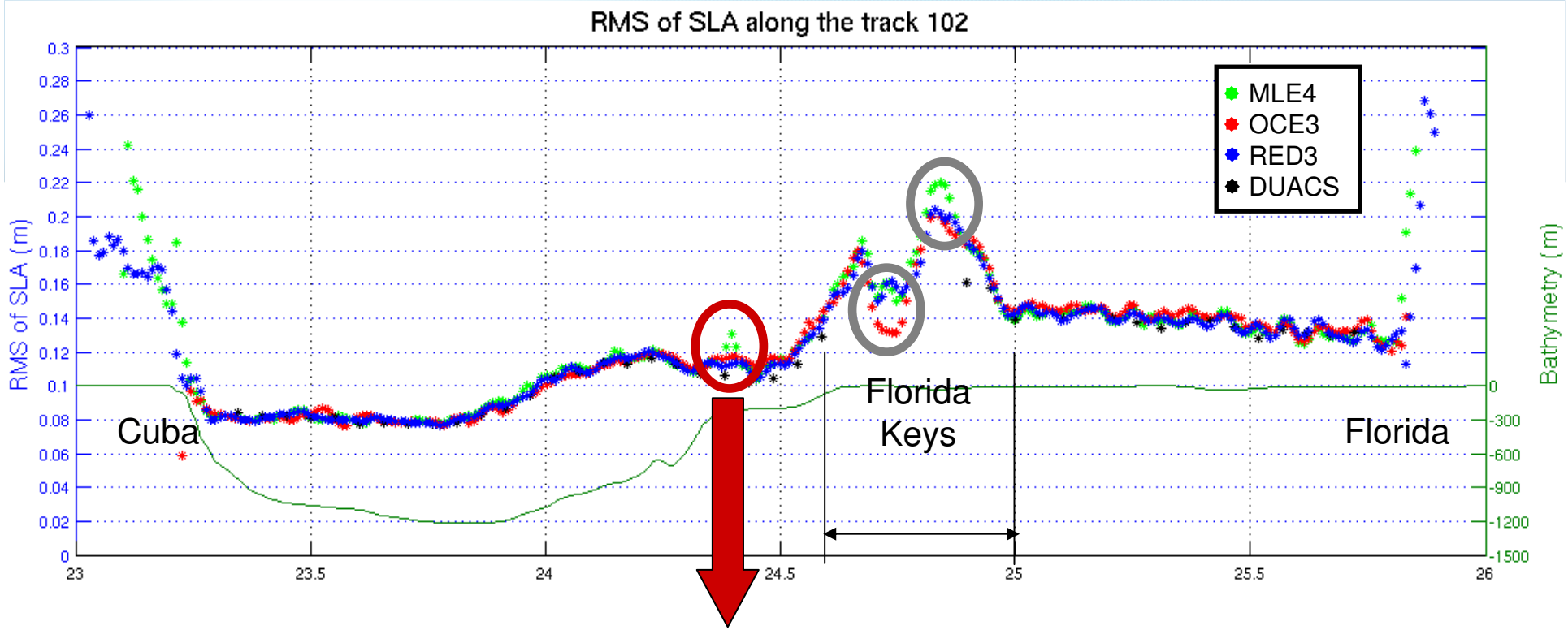
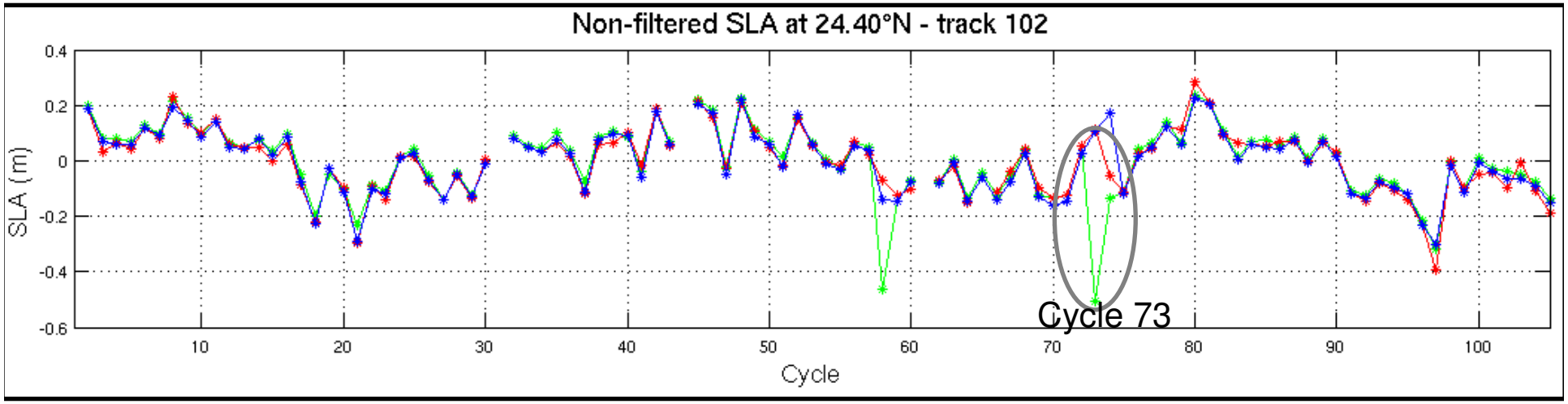


➔MLE4 : Intensification of the current anomalies

➔OCE3: Different structures





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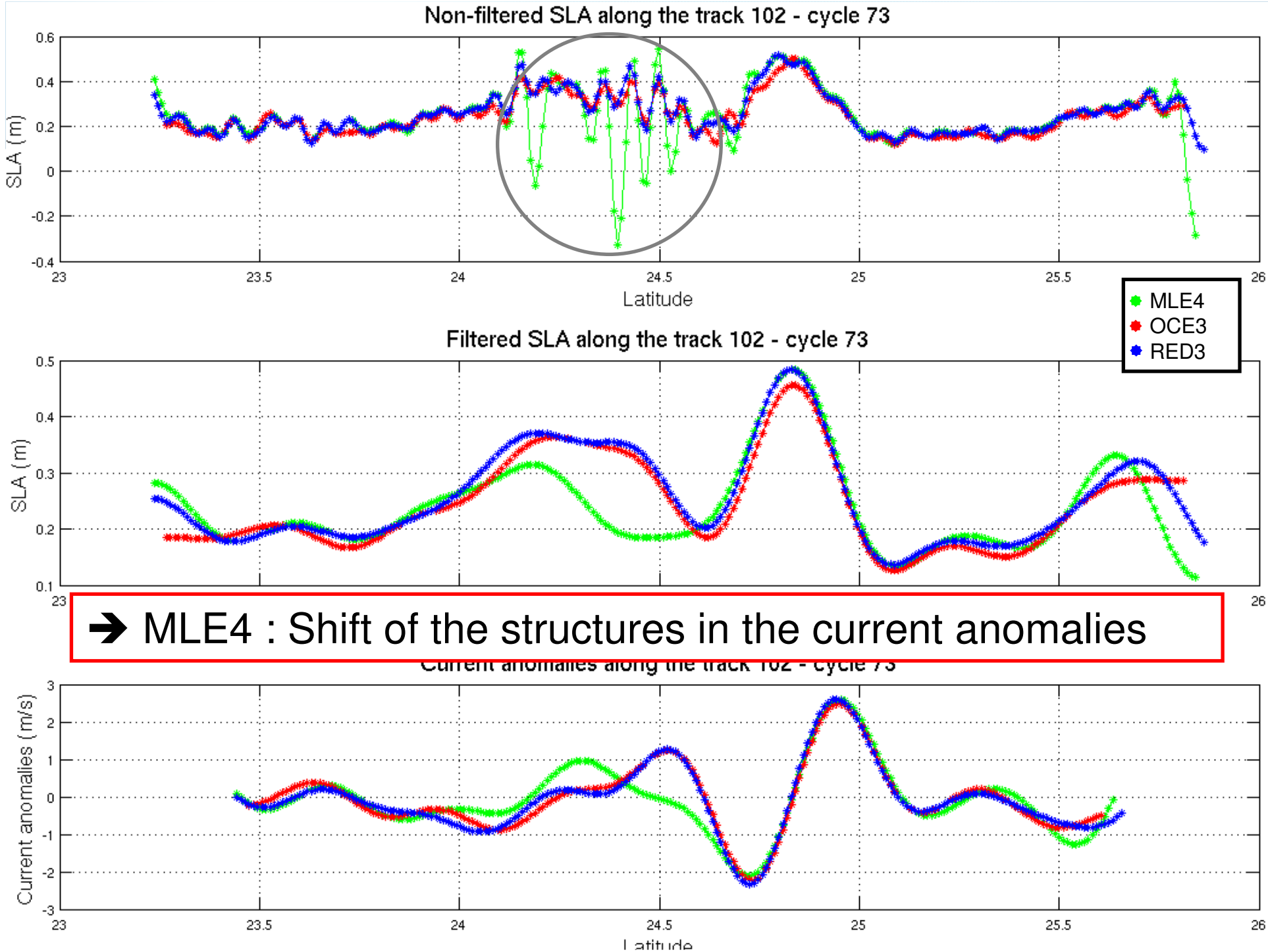
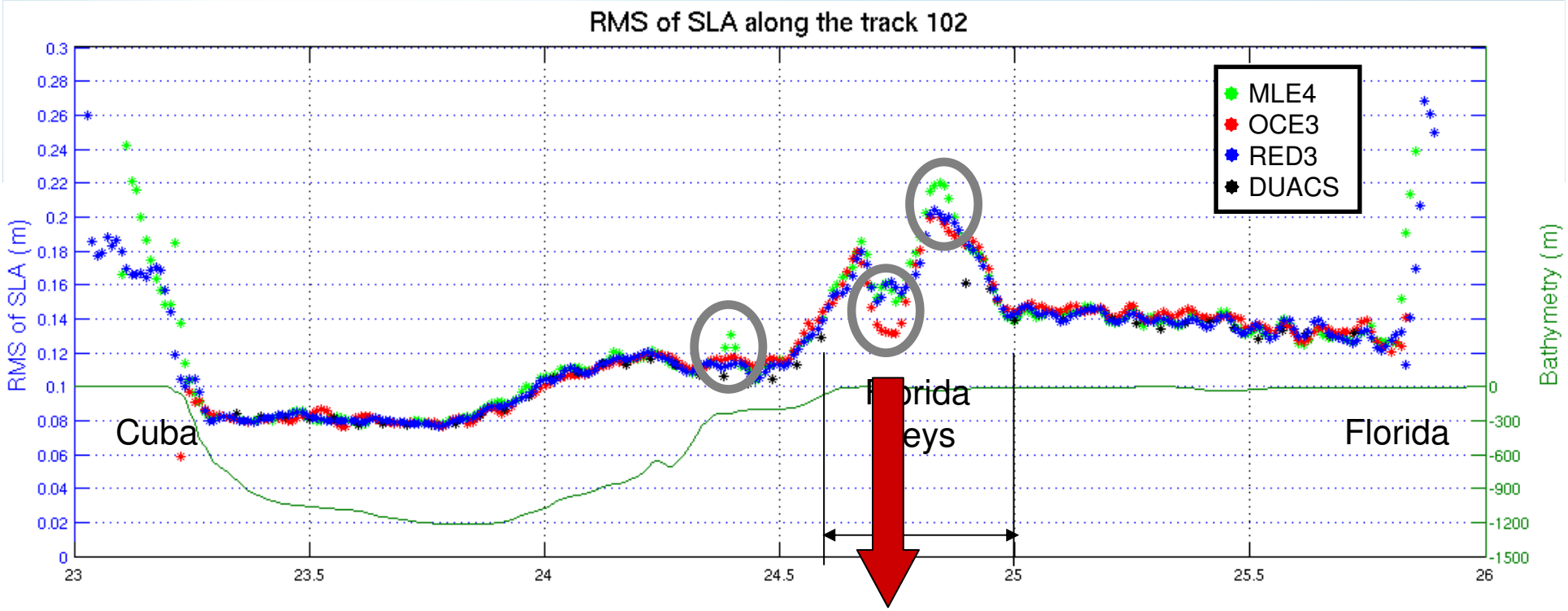
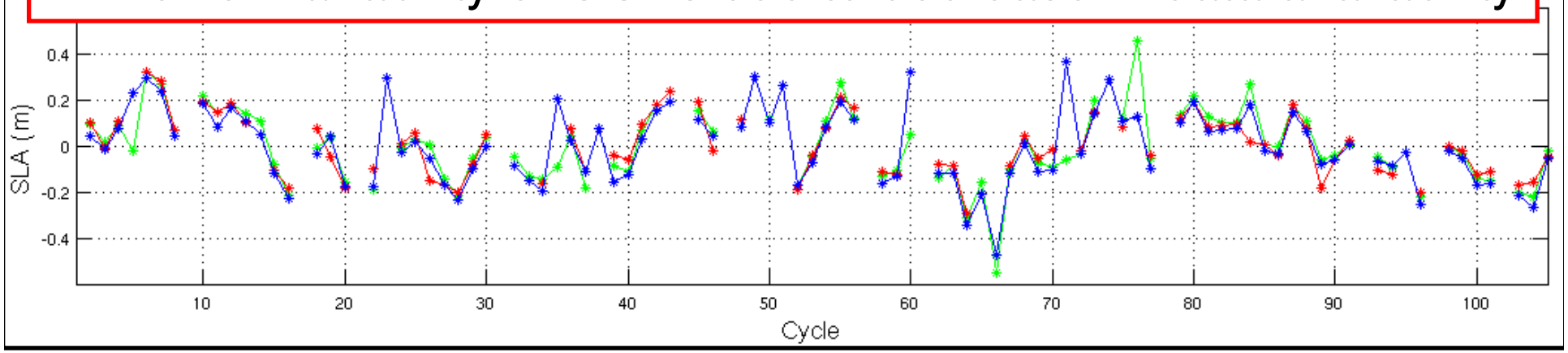


➔ MLE4 : Shift of the structures in the current anomalies



➔ Lower variability of OCE3 due to decrease in data availability



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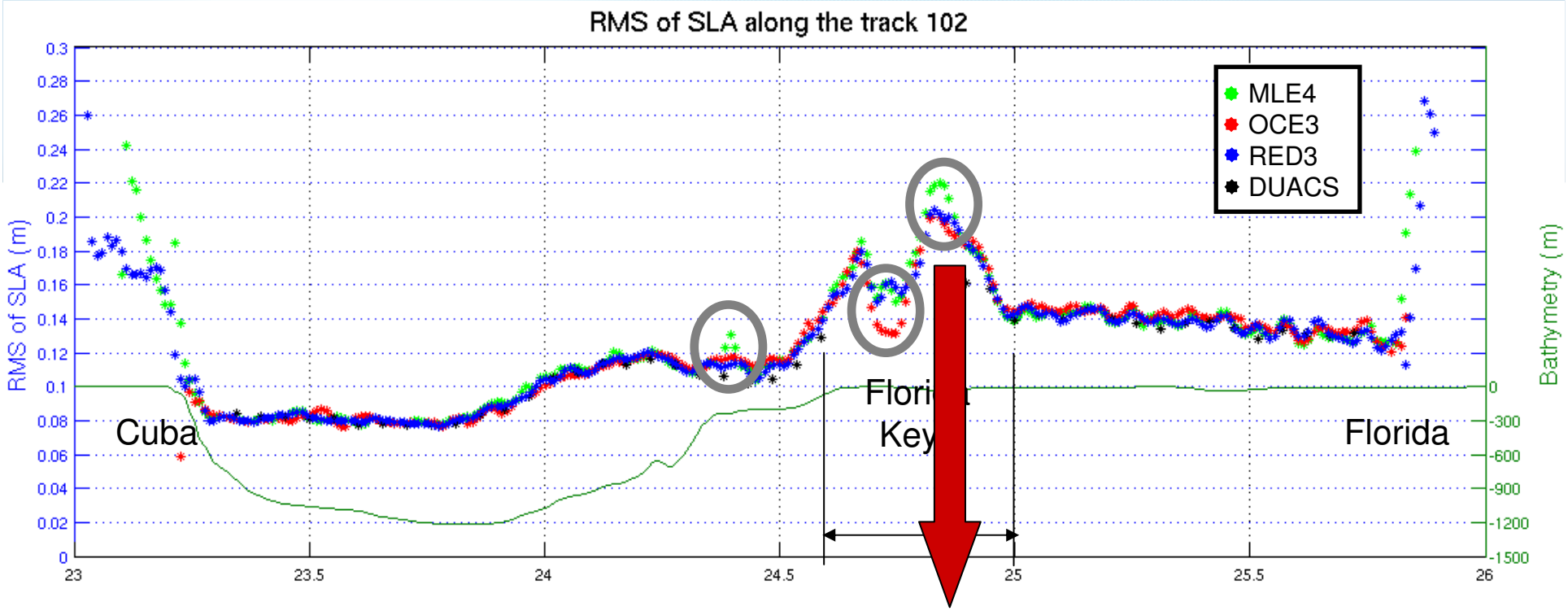

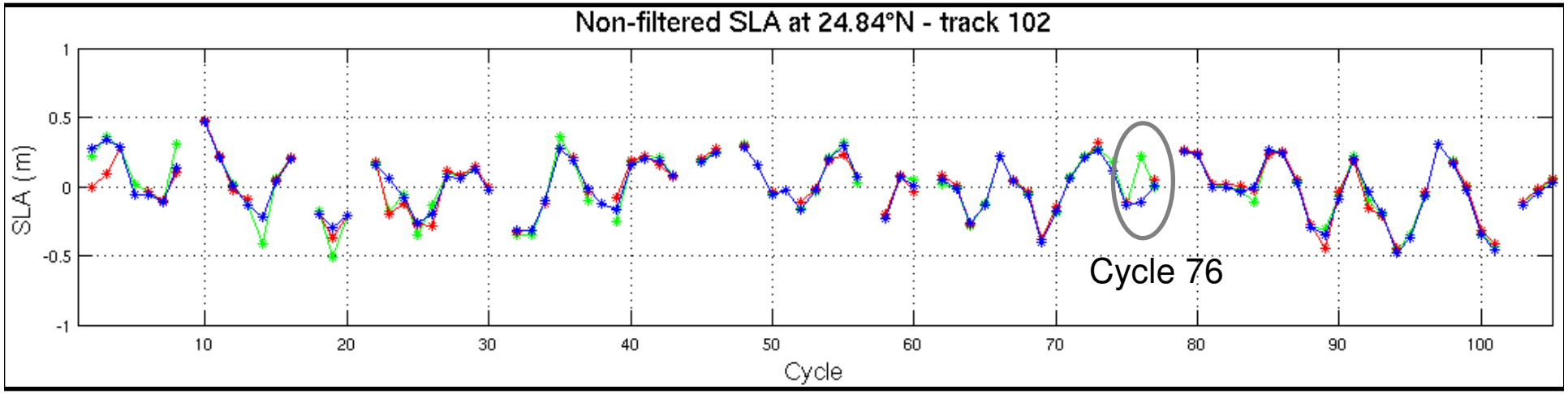

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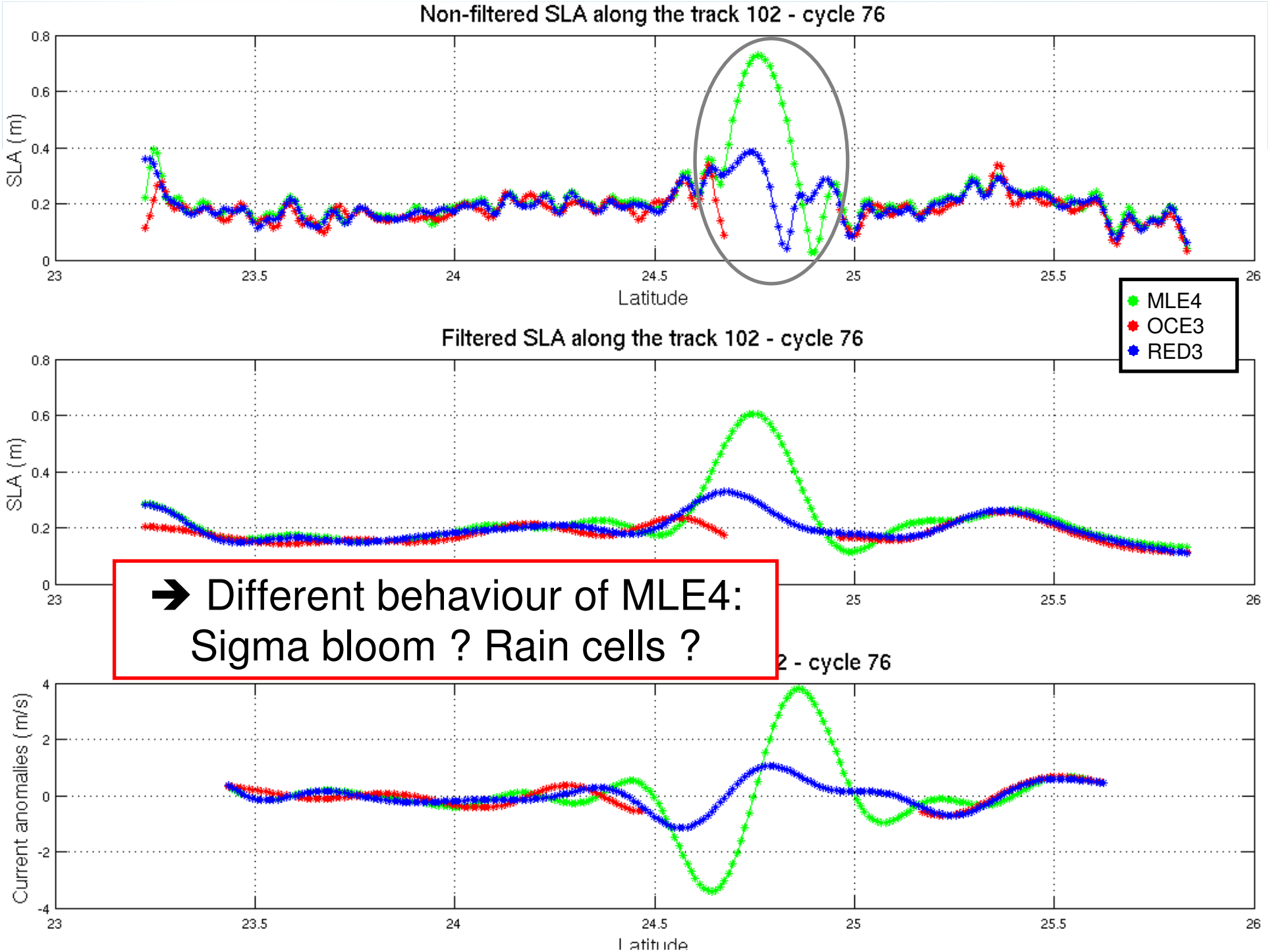

➔ Different behaviour of MLE4:
Sigma bloom ? Rain cells ?

Altimetry data post-processing

- Large gain of data for the PISTACH products, compared to DUACS
  - Especially in the 24.5°N-25°N area, near the Keys
- Coherent signals near the Keys
  - Variations visible on several consecutive cycles
  - Consistent with the DUACS data
- RED3 retracking:
  - Allows to retrieve more data near the coasts
  - Generally close to MLE4, but less noisy
- MLE4 retracking:
  - Sometimes more noisy than the others, with large SLA variations along the track
- OCE3 retracking:
  - Largest decrease in the data availability near the coasts
  - May see different structures

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Altimetry data post-processing

- Large gain of data for the PISTACH products, compared to DUACS
  - Especially in the 24.5°N-25°N area, near the Keys
- Coherent signals near the Keys
  - Variations visible on several consecutive cycles
  - Consistent with the DUACS data
- RED2 retracking:
  - Sometimes more noisy than the others, with large SLA variations along the track
- OCE3 retracking:
  - Largest decrease in the data availability near the coasts
  - May see different structures

Which one is the most realistic ?

➔ Comparison to independent in situ data

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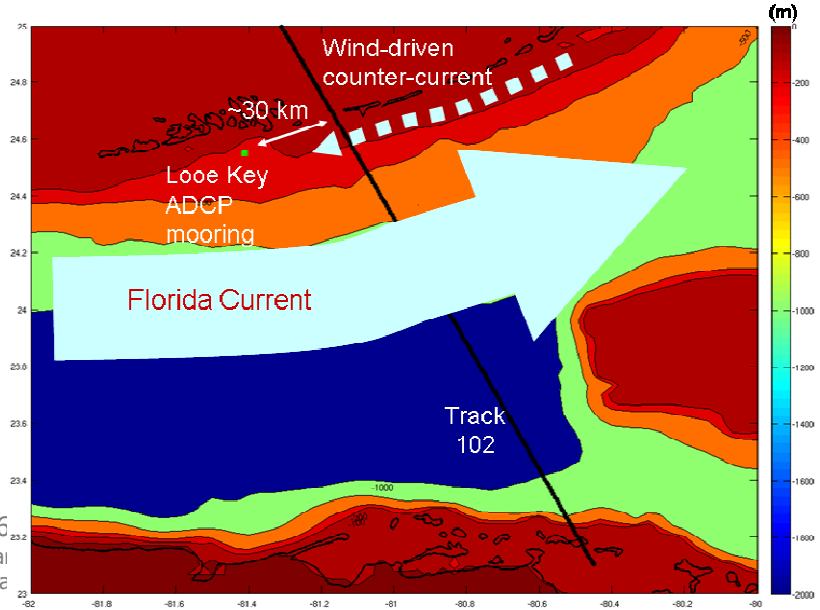
In situ data post-processing

- **Looe Key ADCP mooring** (81.40°W - 24.54°N)
- Dataset divided into two periods
  - January 2008 – February 2009
  - May 2009 – February 2010

  ➔ **14 months in common with Jason-2** (44 cycles)
- Depth: 23m depth (shallow waters)



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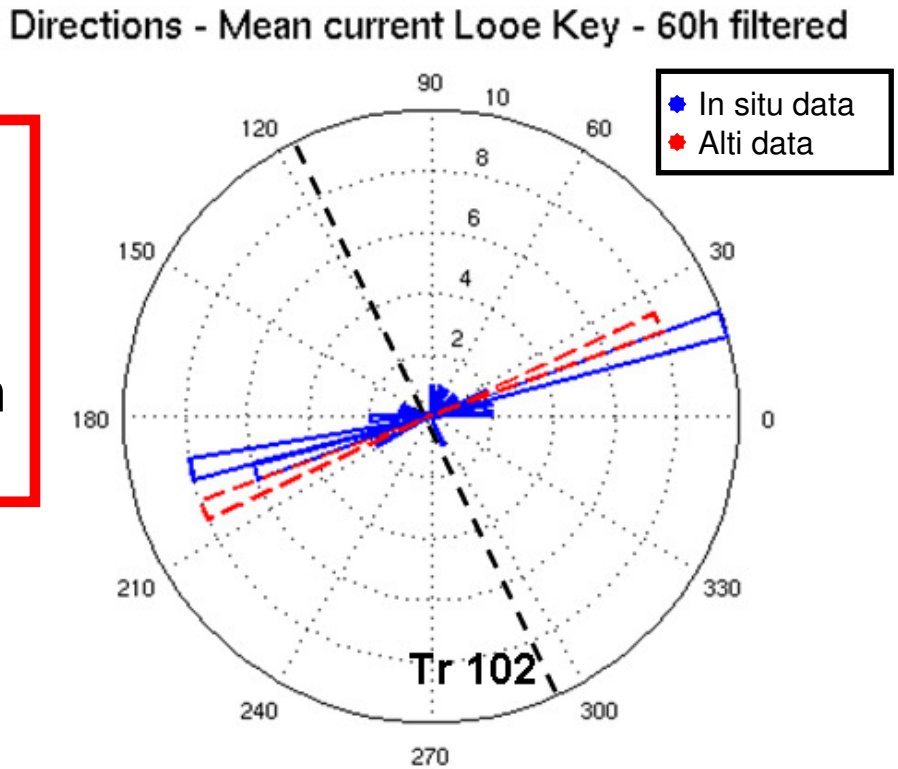
In situ data post-processing

- 60h low-pass filter
  (Inertial period in the area = 29h)
- Interpolation of the in situ data at the altimeter measurement dates
- Projection in the cross-track direction

In situ currents' main direction close to the altimetry cross-track direction

➔ Should be a good configuration for comparisons



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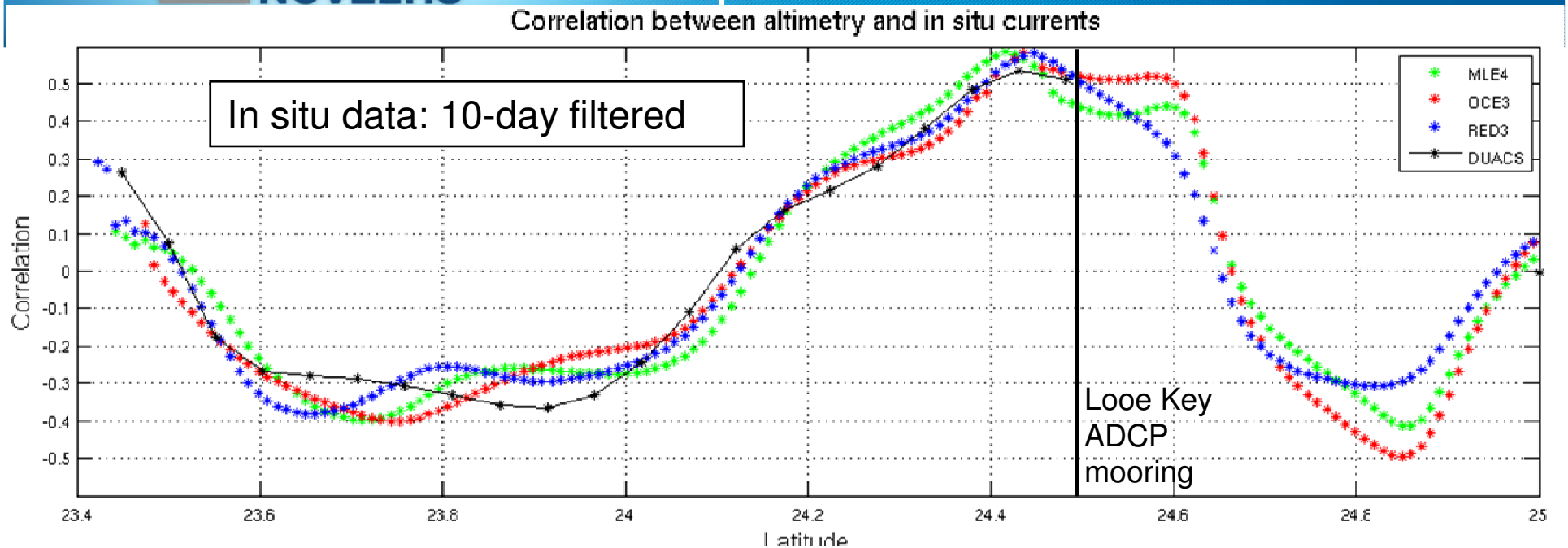
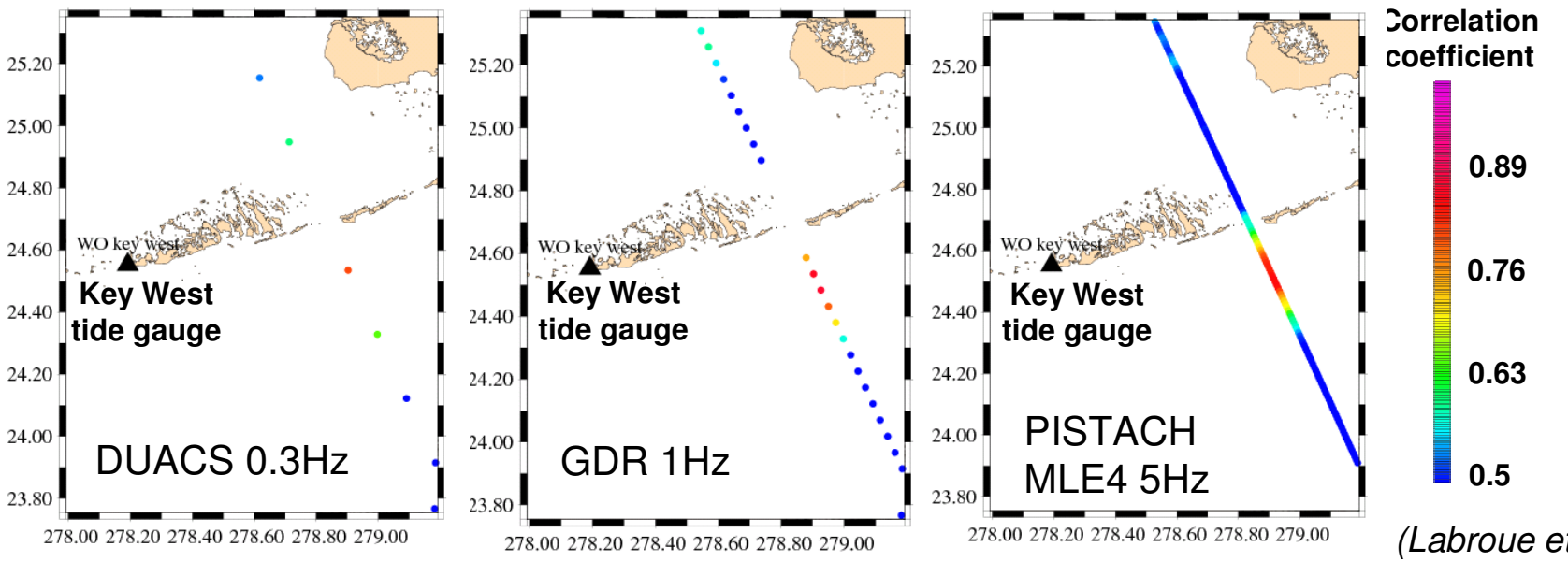
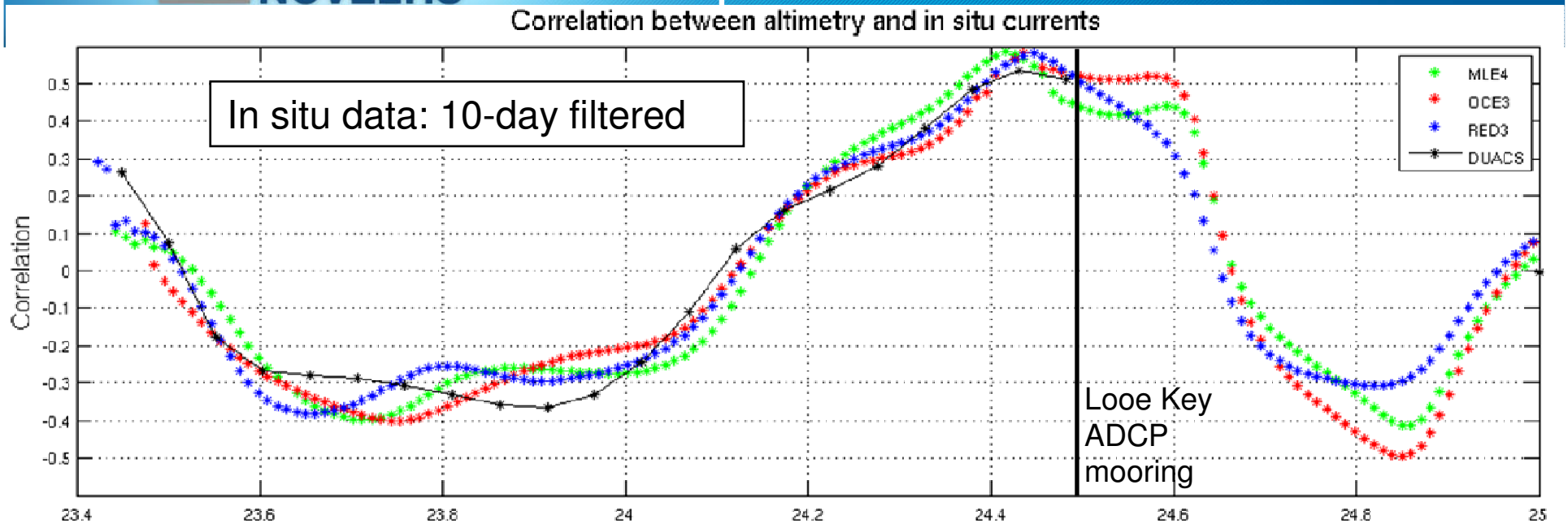
Comparison of the current anomalies

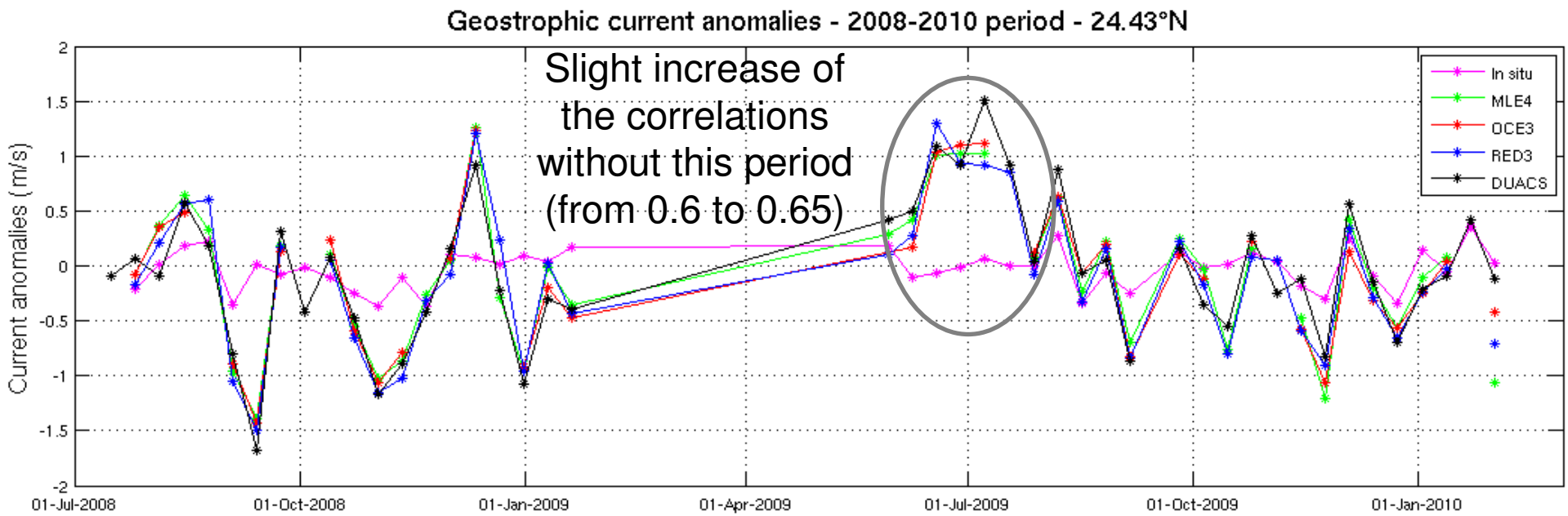


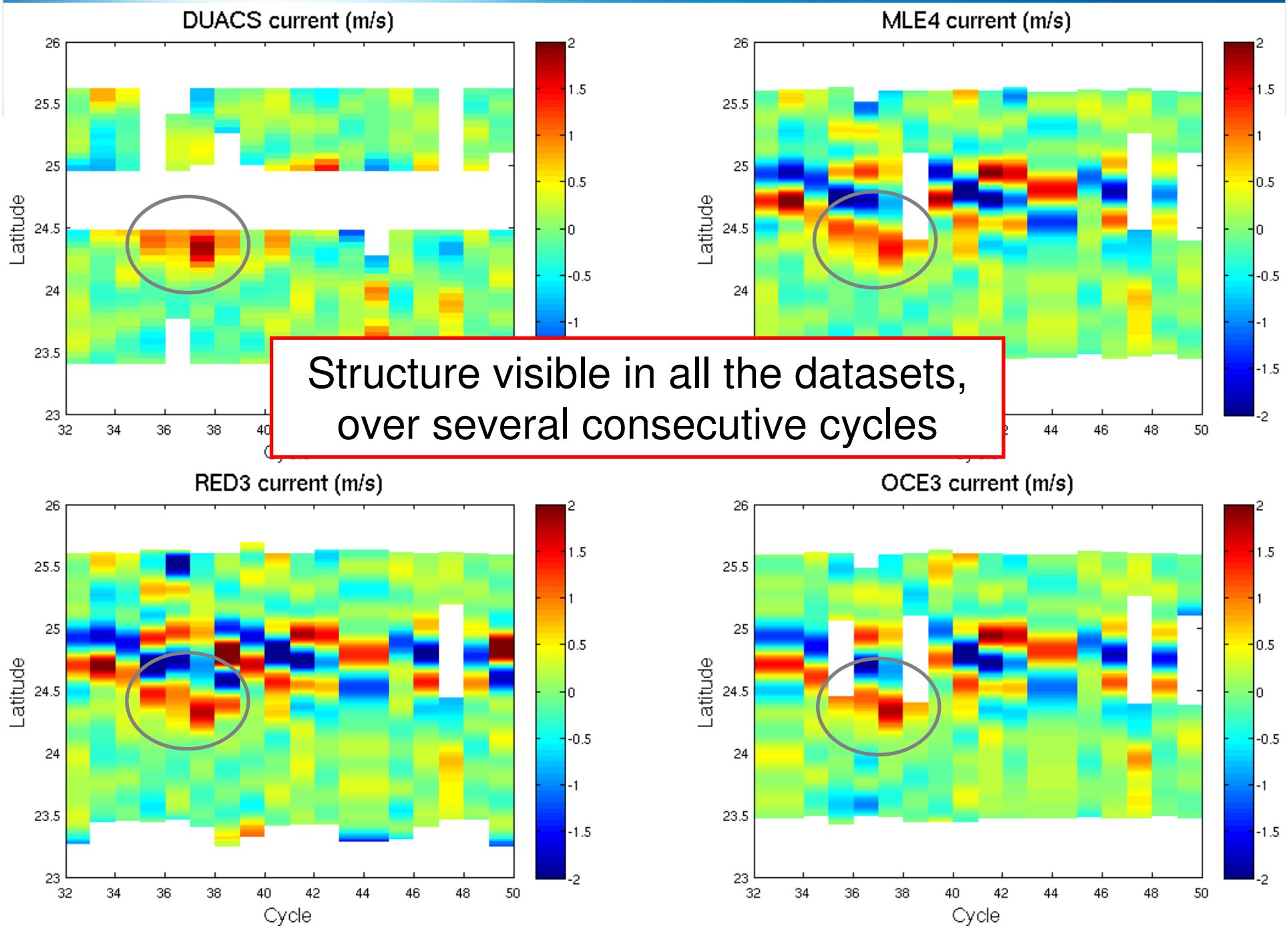


(Labroue et al)

Comparison of the current anomalies

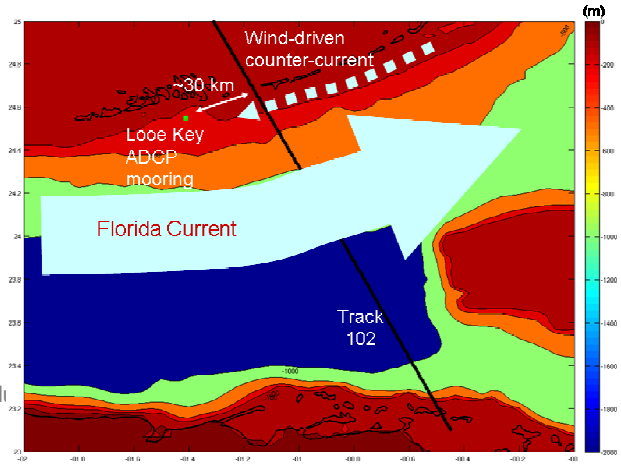





DUACS current (m/s)
MLE4 current (m/s)
RED3 current (m/s)
OCE3 current (m/s)
Latitude
Cycle
Structure visible in all the datasets, over several consecutive cycles

Comparison of the current anomalies

- Limits of the comparison:
  - Position of the ADCP mooring (bathymetry bend)
  - Distance between the altimeter track and the mooring (30 km)
  - Length of the time series (14 months - 44 cycles)
- Perspectives:
  - Use well-known structures to validate the altimetry data retrieved thanks to the PISTACH processing
  - Comparison to other types of data
    - Model simulations
    - Ocean colour
    - SST, SSS



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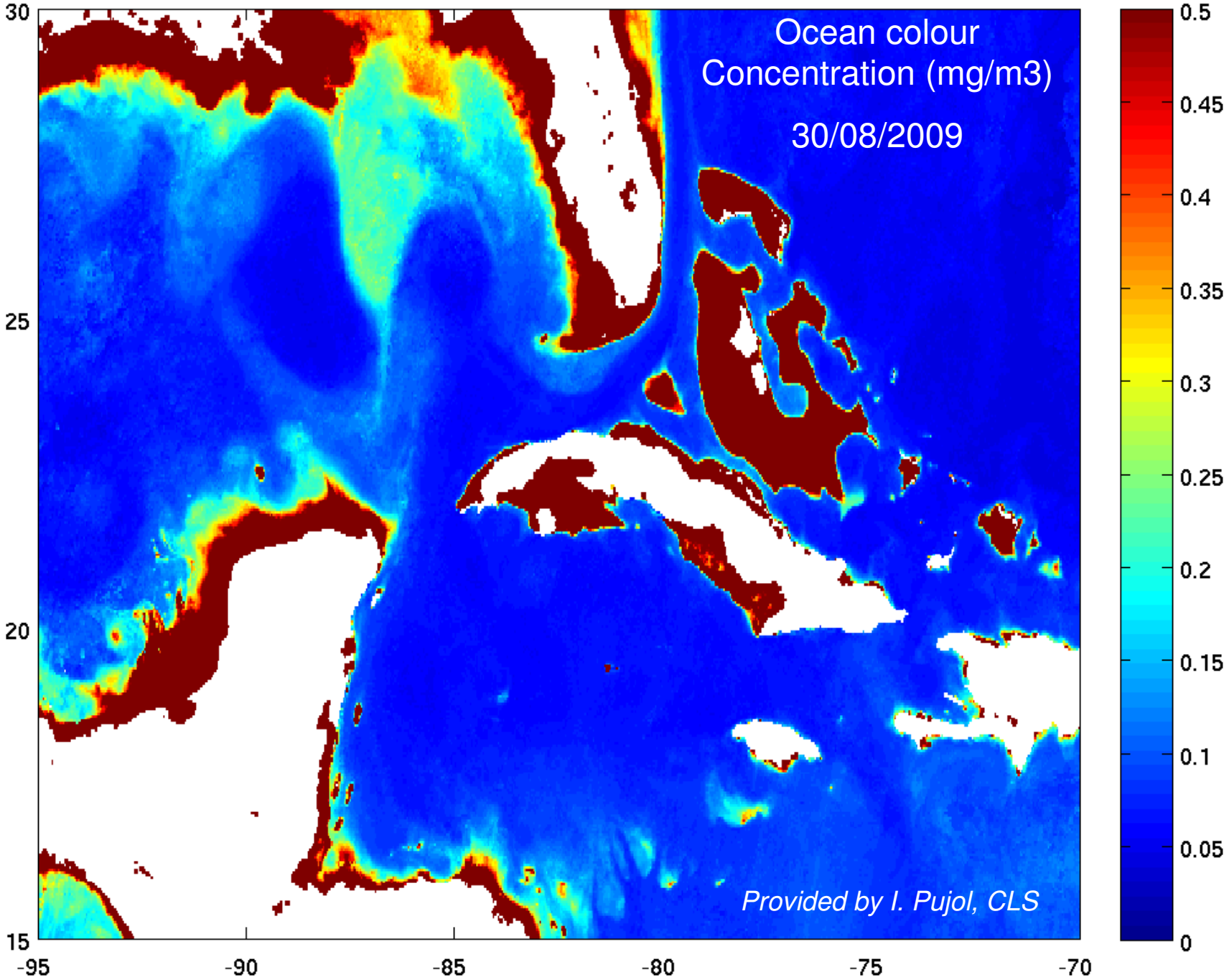
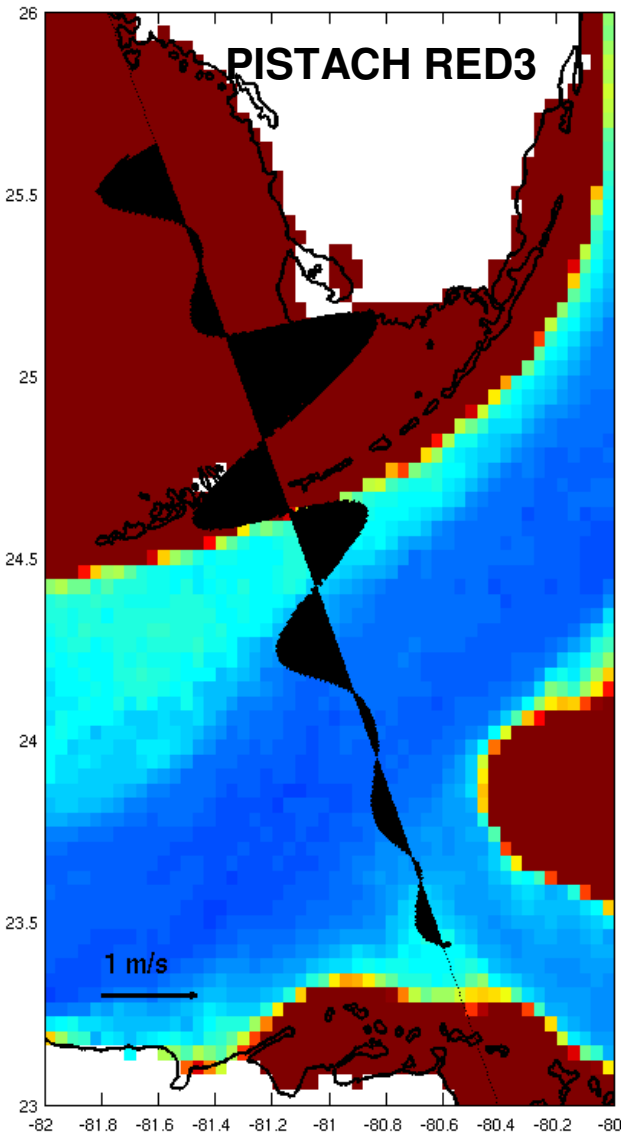
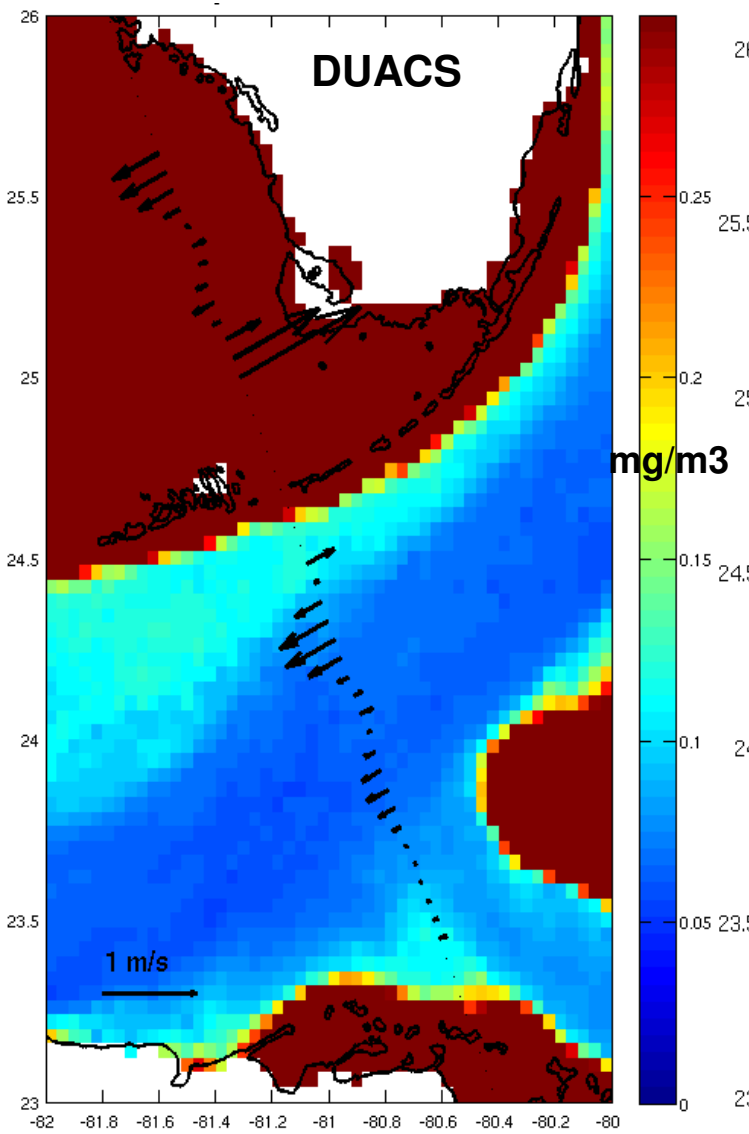
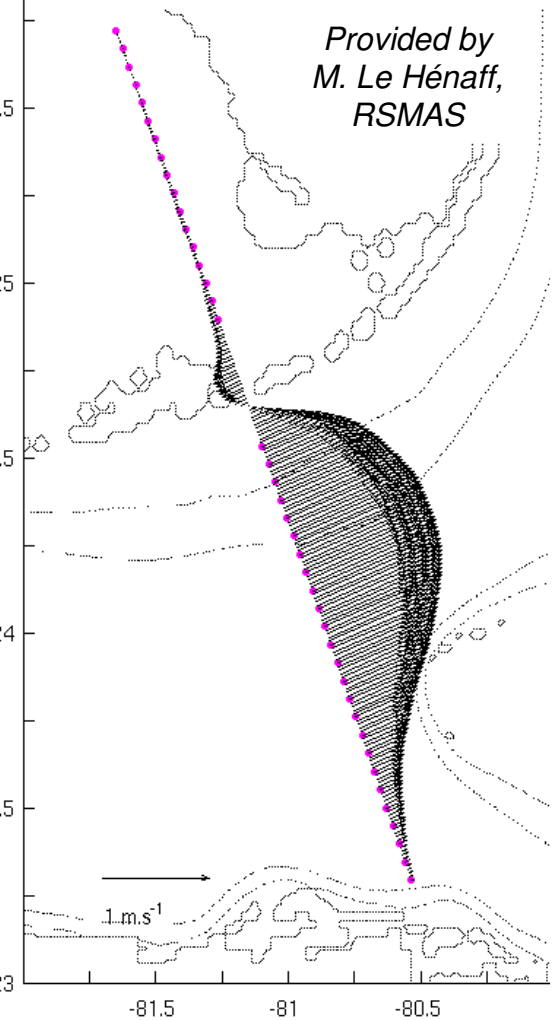

Ocean colour
Concentration (mg/m3)
30/08/2009
Provided by I. Pujol, CLS
30
25
20
15
-95
-90
-85
-80
-75
-70
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0

Comparison of the current anomalies





Mean geostrophic current – HYCOM model – 30/08/2009



Conclusions and perspectives

- Conclusions
  - Large gain in the data coverage in the Keys area with the L3 PISTACH products, compared to DUACS products
  - Coherent signals, including with the *in situ* tide gauge and ADCP data
  - Differences between the 3 retrackings appear (data coverage, noise, different behaviours…)

    ➔Need of more investigation to determine which "PISTACH recipe" is the most adapted (other regions with different ocean dynamics)

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Conclusions and perspectives

- Perspectives
  - Quantify the differences and realism of the various retrackings, focusing on particular events
    - SST, SSS and ocean colour data
    - Model simulations
  - Assess the influence of other parameters, such as ocean tide corrections, wet tropo, DAC…
  - Very encouraging results

    ➔ Use the coastal altimetry products for scientific studies !
  - Same kind of work to be done over the Algulhas Current (2012)

➔ On-going work…

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Many thanks to…

RMSAS: Villy Kourafalou and Matthieu Le Hénaff

LEGOS: Florence Birol and Rosemary Morrow

CLS: Claire Dufau and Sylvie Labroue

CSIRO: David Griffin

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