Regional assessment of altimetry products in the NW Med: Comparisons to *in-situ* data and model outputs.

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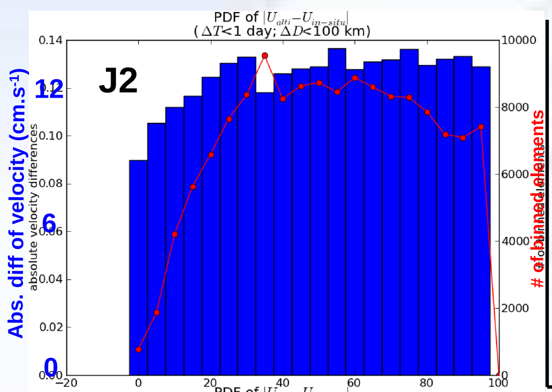
INTRO

In this preliminary study, we investigate the characteristics of a standard regional NRT product & an experimental L3 coastal sea-level product from PISTACH data, and assess their combined use with in-situ data (drifters) and a regional model.

The results suggest that:

- *J2 NRT data shows some consistent behaviour with drifter data, despite biases*
- *RED3 retracking : better coastal coverage (>5%)*
- *NORMED model has an excess of energy at the mesoscales, possibly arising from the lack of energy dissipation towards the finer scales*

2 Colocating NRT regional sea level product with drifter trajectories from IMEDIA 2012 cruise.



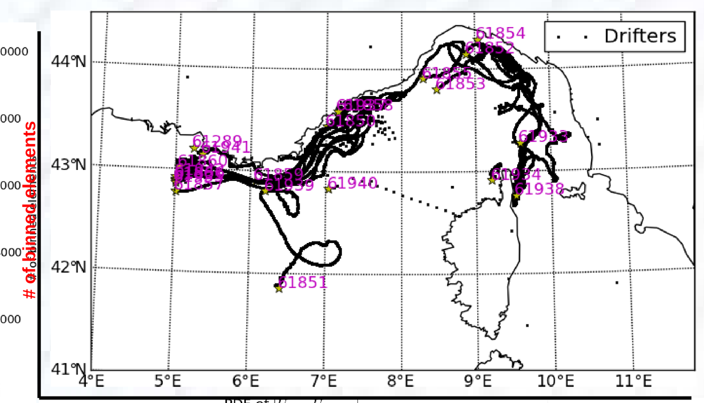
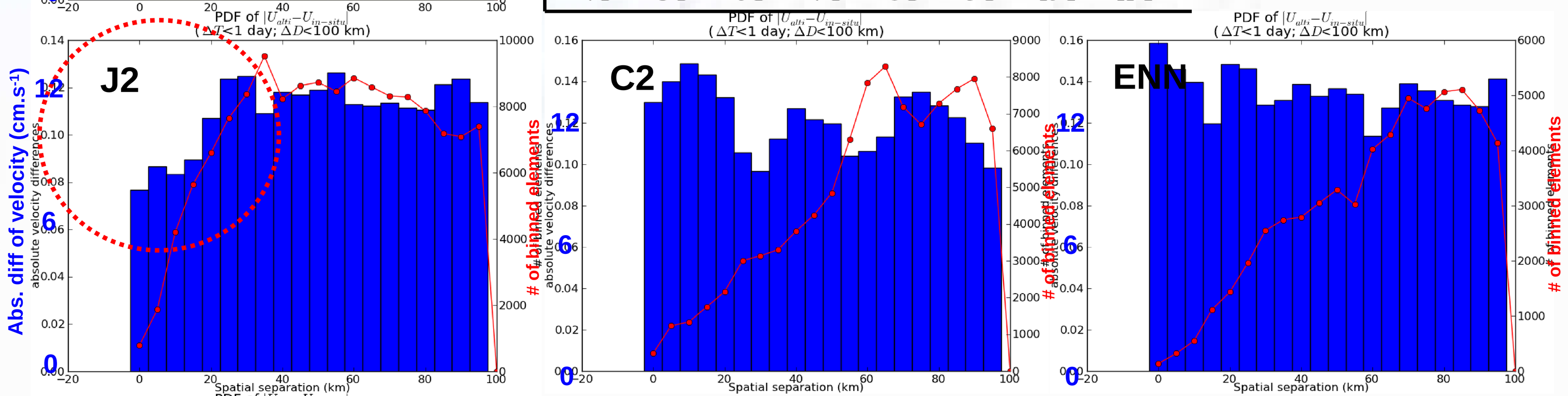
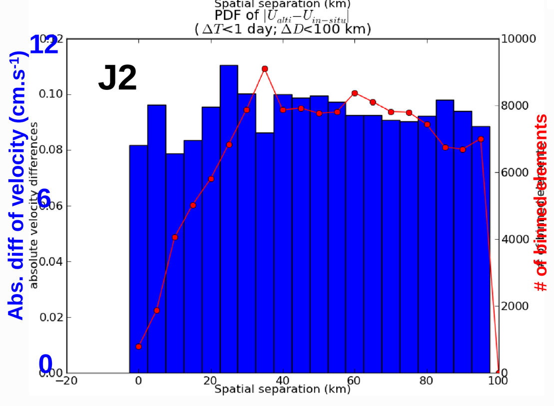


Figure 1. Trajectories of drifters deployed during IMEDIA 2012 cruise (8,14 & 21 March 2012). The data was processed by the Coriolis Data Center (www.coriolis.eu.org).





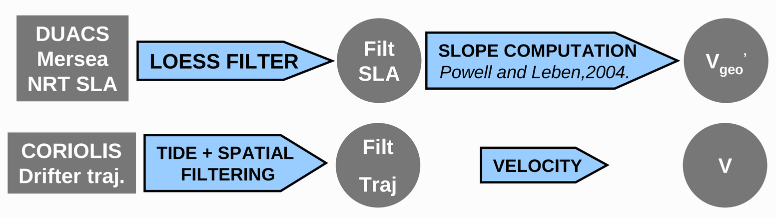


Figure 2. Histrograms of distribution of velocity differences (cm.s⁻¹) between altimetry derived geostrophy velocity anomalies and drifter velocities along spatial separation, for different spatial filtering (28, 54, 108 km - left column) and different missions (Jason 2,Cryosat 2,Envisat new orbit – central row). Above is an illustration of altimetry data and drifter trajectory processing.

Velocity differences between altimetry data and drifter trajectories have been computed (see fig. 2):

- As expected, differences tend to be lower spatial separations smaller than 20 km.
- Differences vary with spatial filtering scale, with smallest differences for 54 km filtering.
- Such behaviour not reproduced by Cryosat-2 and Envisat (new orbit) data.
- Important bias (6-7 cm.s⁻¹) and irregular sampling (slope mostly – cf. figure 1).

➔Best results using Jason-2 regional NRT data filtered at 54 km
➔Currently, C2 and ENN NRT products may not be used during scientific cruises
➔Remaining biases may result from missing Ekman drift, mean component (MDT)

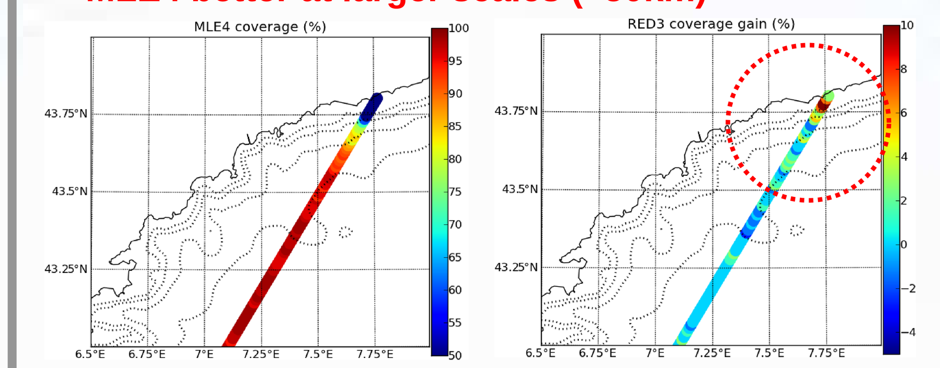
1 Comparison of RED3 & MLE4 retrackings on L3 coastal SLA product from PISTACH data.

An experimental Delayed-Time L3 coastal sea level product has been computed in the NW Mediterranean from AVISO Jason 2 PISTACH data (www.aviso.oceanobs.com)

➔ see C.Dufau talk in Session 1 & Labroue et al. poster in Coastal altimetry session @ 20YPRA

- HF 5Hz subsampling of 20Hz data, 21 & 41 pts Lanczos filtering, outliers detectiopn, RED3 & MLE4 retrackings, 07/2008-07/2011 period.

➔Better coverage near coast (+5-10%)
➔Less norse on RED3 at fine scale (~10km), MLE4 better at larger scales (~50km)



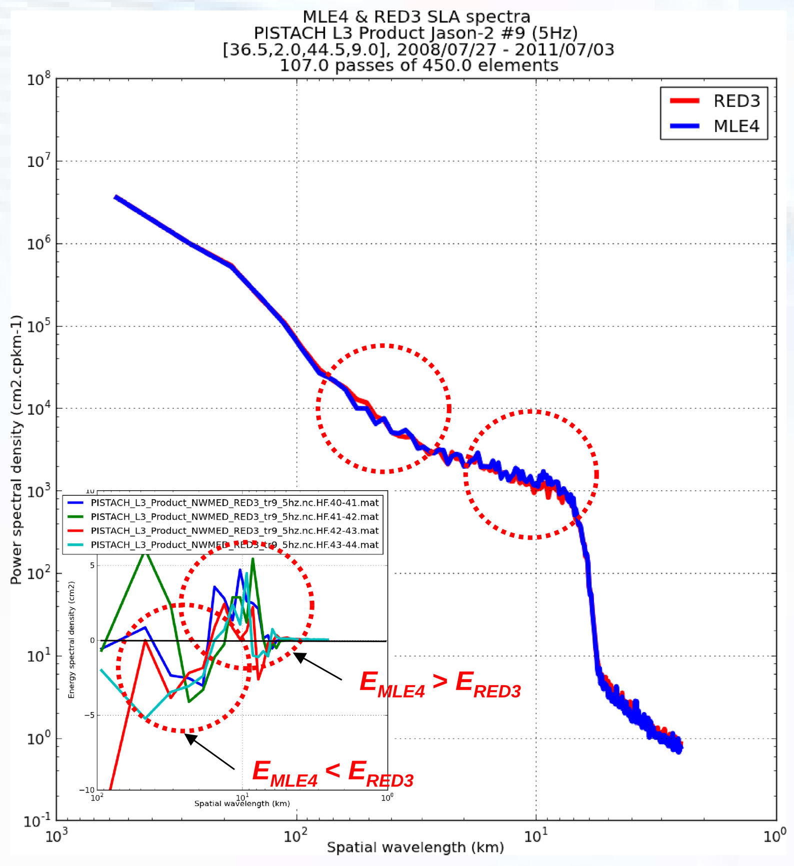


Figure 3. Left) Spatial coverage using the MLE4 retracking on J2 track #9 along French coasts. Right) Coverage gain (%) using MLE4 rather than RED3.

Figure 4. Spatial spectra computed from L3 coastal SLA products using MLE4 (blue) and RED3 (red) retrackings. Inside panel) Differences between MLE4-RED3 spectra.

3 Comparing L3 coastal SLA product from PISTACH data to the NORMED regional model

MARS3D : 3D numerical ocean model for Application at Regional Scale (Lazure and Dumas, 2008).

- free surface model, Boussinesq and hydrostatic assumptions, Arakawa-C grid

The NORMED configuration :

- NW Mediterranean sea (cf. figure 5)
- 1.2 km resolution, 30 σ-coords vertical levels
- Initial and open boundary conditions from OGCM (MOON network - http://www.moon-oceanforecasting.eu).
- Atmospheric forcing : MM5 model (3 to 9km)

Applications:

- operational purposes (PREVIMER; http://www.previmer.org/en)
- surface oceanic circulation (Andre et al. 2005; Andre et al. 2009)
- cross- shelf exchanges (Rubio et al., 2009)
- sediment dynamics (Dufois et al. 2008).

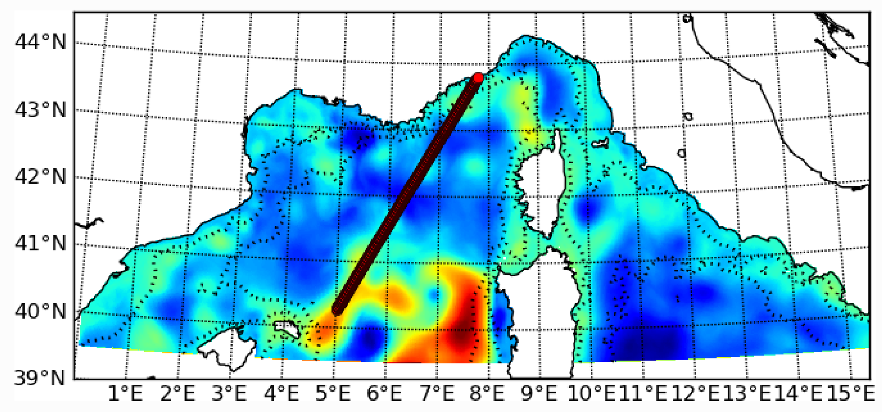


Figure 5. Snapshot of the MENOR configuration domain SSH (28th June 2009). Jason-2 Track #9 (5Hz sampling) is shown in black.

PROCESSING

MENOR vs. L3 coastal SLA :

- **➔June 2009 – June 2011**
- **Nearest 3-h model output extracted along J2 track 9**
- **2-year model mean surface removed**
- **Geostrophic current anomalies derived from model and altimetry SLA (cf. fig. 1) with 40 km spatial filtering.**

4 Geostrophic Current Anomalies from model and altimetry data

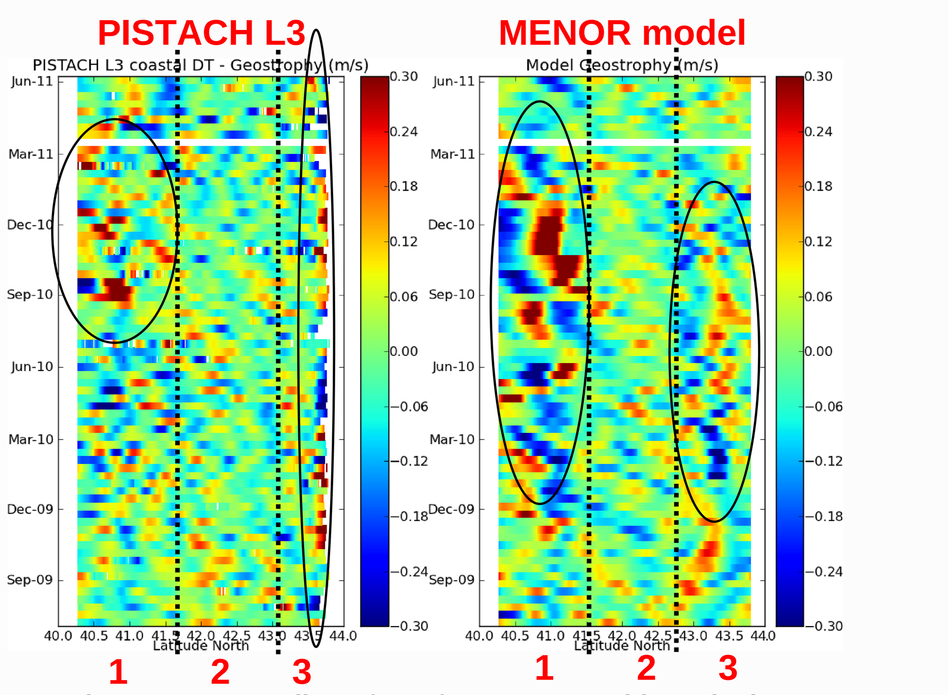


Figure 6. Hovmoller of Surface Geostrophic Velocity Anomalies (m.s⁻¹) computed from L3 Coastal SLA from PISTACH data (left) and from MENOR model (right)

From fig. 6 & 7 : 3 main zones of variability are visible along J2 track #9 on both altimetry data & model SLA :

- **Coastal & slope areas (3)**
- **Lower energy offshore zone (2)**
- **Balearic front zone (1)**

➔On model, stronger variability in zone (1) with more energetic eddies.
➔Slope current variability located further offshore in model (south of 43.5°N)
➔Strong eastward anomaly of the Northen Current in winter : processing artefact or local effect?

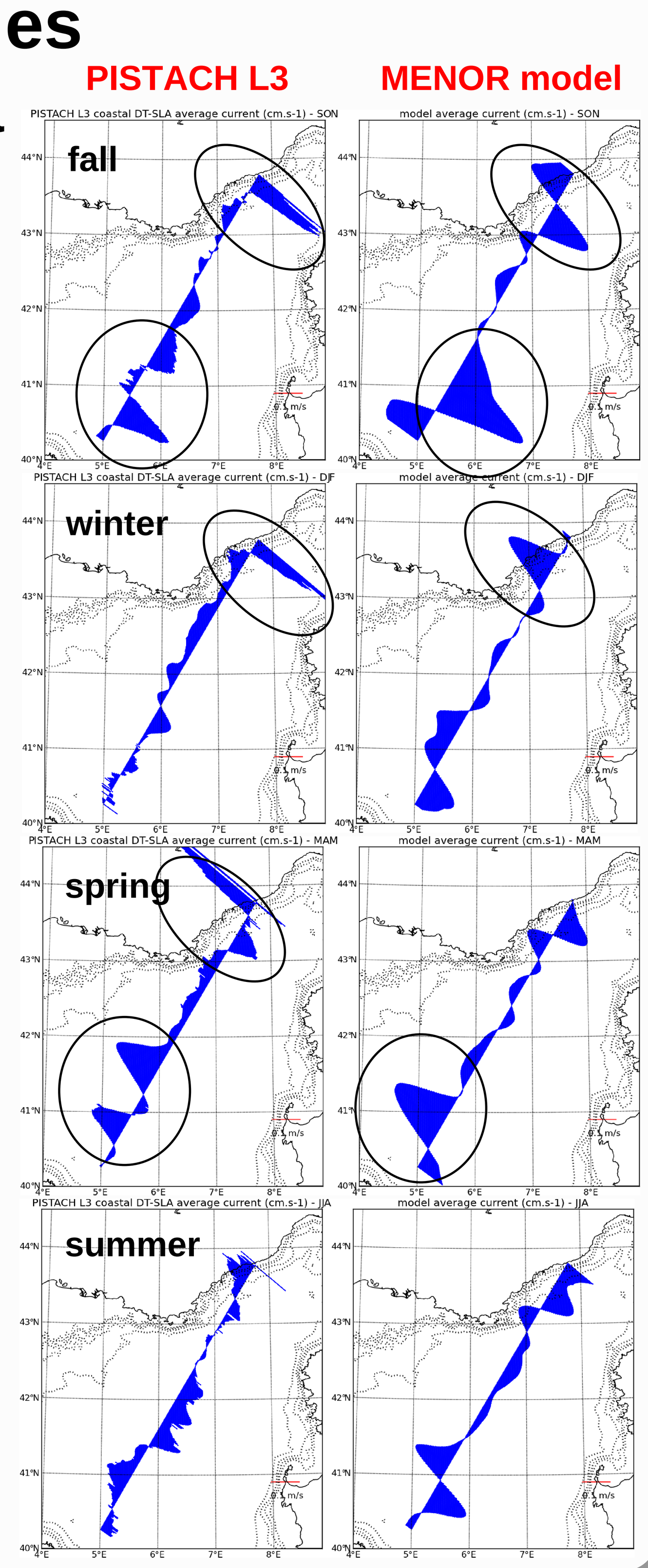


Figure 7. Seasonal anomalies of Surface Geostrophic Current (m.s⁻¹) computed from L3 Coastal SLA from PISTACH data (left) and from MENOR model (right)

5 Analysis of data & model spectral contents

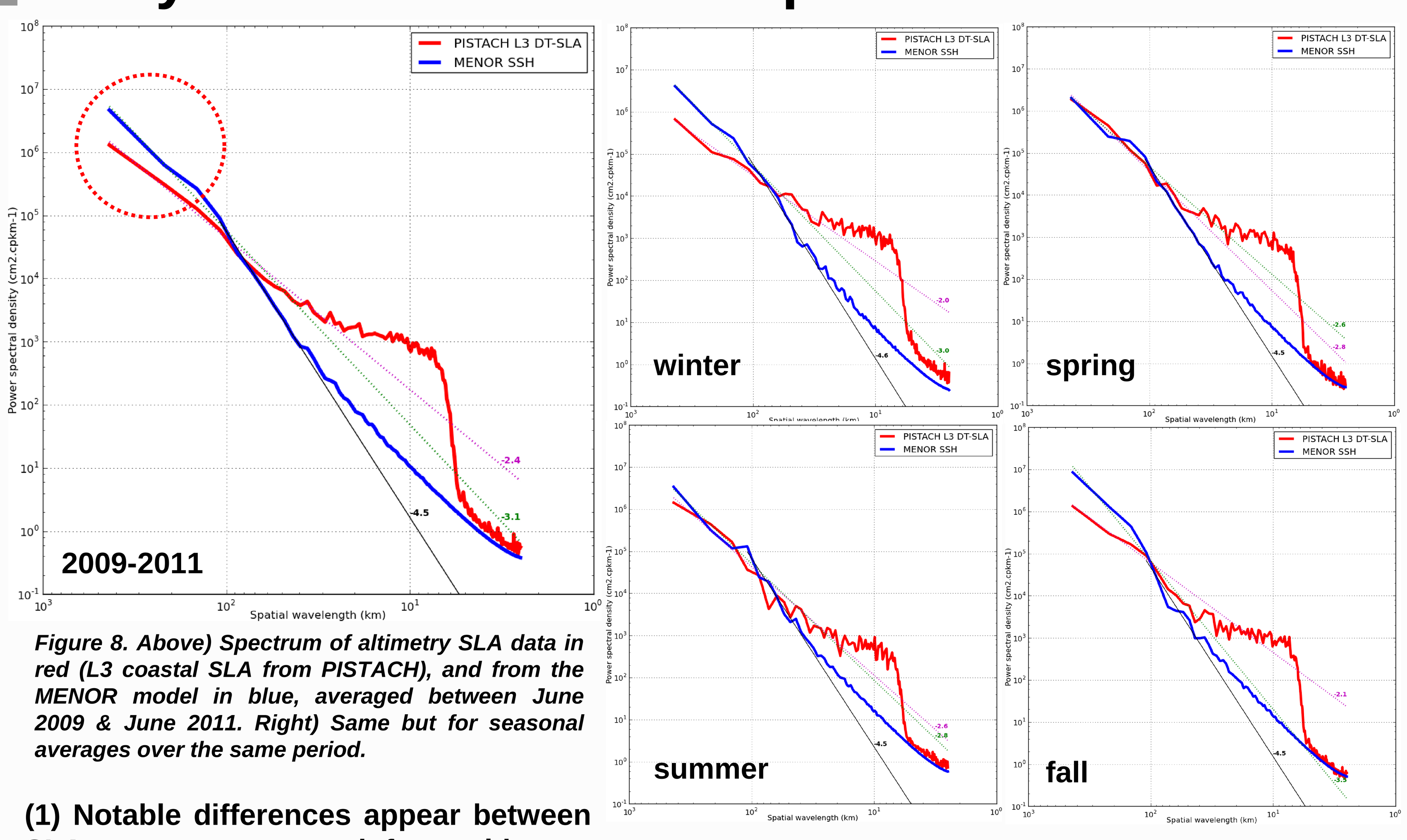


Figure 8. Above) Spectrum of altimetry SLA data in red (L3 coastal SLA from PISTACH), and from the MENOR model in blue, averaged between June 2009 & June 2011. Right) Same but for seasonal averages over the same period.

(1) Notable differences appear between SLA spectra computed from altimetry data and model :

- **Increased energy at mesoscale on model in winter and fall.**
- **Steep slope ($k^{-4.5}$) of the model at 60-100 km (~2πR_R) – close to QG theory (Charney et al, 1971)**

➔Inverse energy cascade in MENOR ?

(2) Seasonal variability of the spectrum is visible on altimetry SLA spectrum:

- **Higher energy at mesoscales in spring and summer.**
- **Flatter slope ($k^{-2.4}$) on altimetry spectrum, peaking in spring ($k^{-2.8}$)**

➔Dissipation of turbulent energy from a direct cascade (eg. Capet et al., 2008) ?