Reply to reviewer comment 2

We thank the reviewer for his/her very helpful remarks, in particular regarding the physical processes at stake and the new information brought compared to mean picture.

> (1) There are in the literature a bunch of eddy detection algorithms, some of them based on lagrangian tracking (Mason et al., 2014; Conti et al., 2016; amomng others). . How data from DYNED compare with them?

Present study relies on the AMEDA algorithm, which is a mixed geometric-dynamical approach, presented by Le Vu et al (2018). It uses the velocity field to find the eddy centers in extrema of the local normalized angular momentum – similarly to Conti et al (2016) – and then looks for surrounding closed SSH contours to find the eddy contours – similarly to Chelton et al (2011) or Mason et al (2014) -.

The main improvement of the AMEDA algorithm is an effective detection of merging and splitting events (see also answer to point 5), which allowed to successively track eddy network and connectivity due to Agulhas rings drift between the 2 sides of the South Atlantic ocean by Laxenaire et al (2018). In the Mediterranean sea, this algorithm was also used to track Ierapetra eddies over several years (Ioannou et al, 2017) and Algerian eddies (Garreau et al, 2018). It was also applied in the Arabian sea (de Marez et al, 2019)

> (2) The manuscript lacks of dynamical information in order to better understand the eddy formation (frontal instability?; flow topography interaction?, etc.) The inclusion of information about MKE and EKE (or MEKE) will clarify this issue.

The scope of the article is to develop a methodology aiming to recognize statistical patterns in eddy dynamics, and is not focused on their formation. However since a significant number of eddies drifting to the Eratosthenes region are formed near the coast, we can assume that some of them are formed by instabilities of the along-shore current. Such eddy detachments form the coast were already spotted by Hamad et al (2006). But our study shows that some eddies converging towards Eratosthenes are formed westwards in the Herodotus region. A possible formation process there could be instabilities of the meandering Middle-Mediterranean Jet. Physical processes leading to eddies formation should constitute a next study, as they are important to understand water masses transported by eddies.

For discussion purpose, a mean EKE map is shown in Fig. R3. It illustrates the fact that focusing on eddy intensity overrepresents intense eddies with strong variability (Ierapetra eddies) but masks important eddy dynamics and recurrent eddy patterns. Similarity with Fig.1 in Amitai et al (2010) is striking.

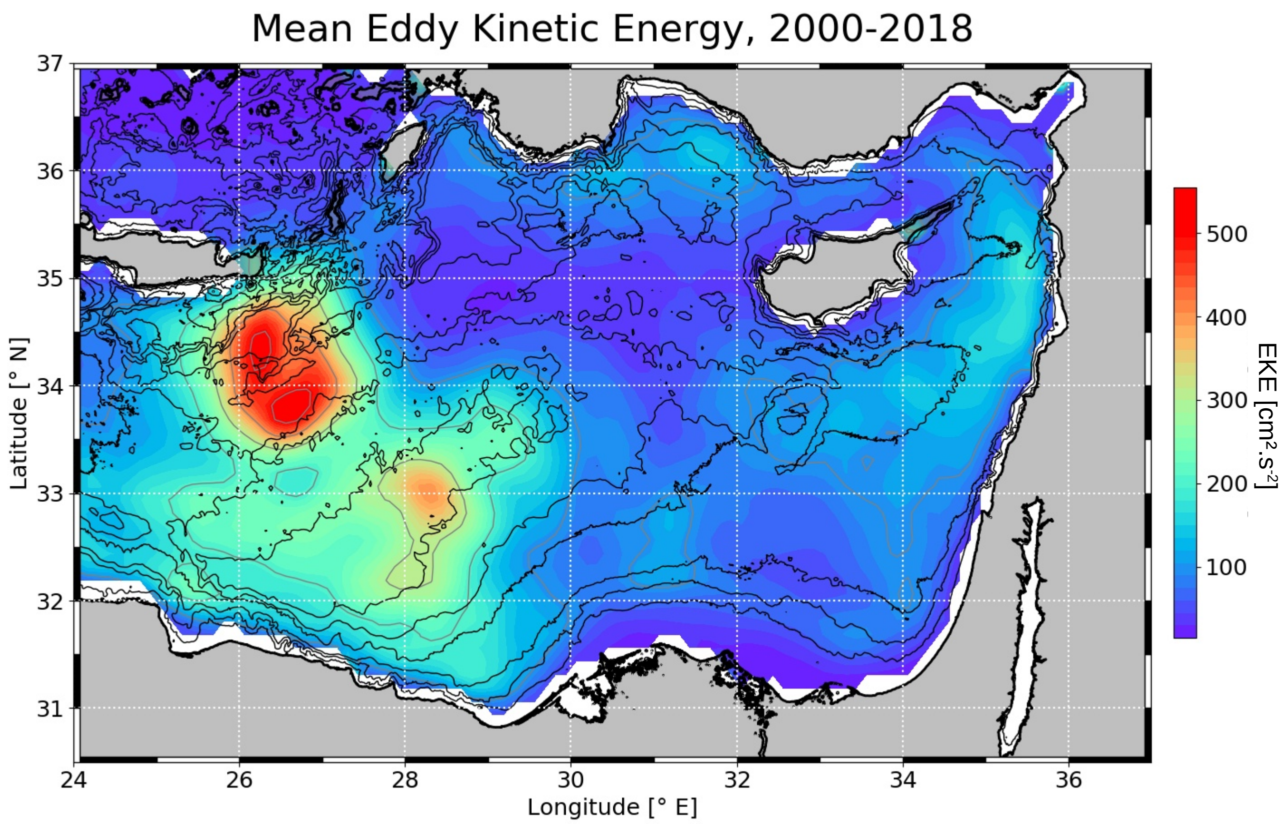

Figure R3 : Mean eddy kinetic energy, computed using the geostrophic speed derived from Sea Level Anomaly in AVISO products. Ierapetra eddy is a very prominent feature, but the Mersa-Matruh structure also appears, whereas the Eratosthenes region is blurred.

(3) Authors in the discussion argue that convergence of AE in the southern levantine basin towards the Eratosthenes is clear but some issues are still missing regarding the role of the long living structure in attracting eddies. Does the authors think that advecting viertual particles (from the geostrophic velocities) on advecting eddies (inside and outside its maximum radius) will provide some information about this guess?.

This issue is partly addressed in the discussion of the manuscript, whether it is the bigger Eratosthenes anticyclone that is pulling smaller ones to the seamount, or anticyclones formed in the attraction basin that are drifting to what seems to be a convergence point (similarly to particles). Or in other words : do the observed convergence occurs from eddy-eddy interaction or from eddy advection ?

It is very hard to answer this issue, however it can be seen on the Eratosthenes anticyclone histogram (Fig 7.a) that every time the bigger anticyclone constituting the attractor dies, it is quickly replaced by another one. The Eratosthenes seamount then seems to be a preferred stranding point for anticyclones. On the other hand 19 *order 1* eddies are detected in this region, most of them merging with *order 0* eddies in the Eratosthenes region. A importing flux of roughly 1 anticyclone/year can be approximated, highlighting the importance of eddy-eddy interactions.

To answered the question asked : advecting virtual particles could indeed be an idea to assess this issue.

(4) Something that would enforce the work from an oceanographic point of view is to clarify the different polarities (i.e. +1 AC -1 CE) found in the different areas identified.

For each studied region within our area of interest, we attributed an averaged dynamical activity inferred from the MDT (see Fig.4 in the manuscript or Table R1). However, it appears that (anti)cyclones are not always found in averaged (anti)cyclonic regions. As reported in Table R1, Haïfa region, although being clearly cyclonic on average on the MDT, hosts the formation of 24 anticyclones over 19 years.

Actually the average occurrence of an eddy of a given polarity can directly be read looking at Fig.4 of the manuscript : it shows for each pixel the time percentage spent inside the maximal speed contour of an eddy. Almost permanent anticyclones such as Mersa-Matruh or Eratosthenes are highlighted by a strong presence, whereas areas with intense but fluctuating eddies are less marked, such as Ierapetra or the Beyrut region. Only reading Fig. 5 we can inferred the probability to fall inside an anticyclone over the top of Eratosthenes seamount (33.6^{o}N ; 32.6^{o}E) 50% of the time, and almost 0% for cyclones.

The DYNED method used to compute the reference background (see reply to the first reviewer) is precisely intended to retrieve the eddy physical anomalies and take into account the various occurrences of cyclones and anticyclones.

(5) A better explanation about the tracking algorithm is also desired.

Some precisions were added to the manuscript to give details about the tracking method. Briefly, AMEDA minimizes a cost function taking into account spatial proximity but also similarity in size and Rossby number over a given correlation time to gather different eddy observations in tracks. Merging and splitting events are detected as the outcome of eddy interactions, defined as a period when 2 eddies share a closed SSH contour with averaged velocity higher than the ones for the eddies taken separately (see section 5.b in Le Vu et al , 2018)