

Interactive comment on “Particle fluxes in the deep Eastern Mediterranean basins: the role of ocean vertical velocities” by L. Patara et al.

Anonymous Referee #1

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The authors related the deep sedimentary fluxes to the ocean vertical velocities in the Eastern Mediterranean basins. They used interesting field data and modeling approach to reach their conclusions. Local upwelling created by upward current vertical velocities would stimulate primary production and grazing that will generate fluxes events few weeks later. Sinking speed of the aggregates has been estimated around 200 m.d^{-1} . This fast sink rates is assumed to be caused by fecal pellets produced by gelatinous zooplankton.

The authors raised an interesting point that is how the physic can interact with the biological pump. The paper is well written and ideas and data are interesting however I do not think that the paper can be published without major revisions.

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General comments

First, the authors submitted the paper and few weeks later submitted an impressive set of corrections (method/statistical important issues plus revisions of figures, table, results and discussion) that make the revision process particularly difficult and changes hard to track. My following general and specific comments are based on the paper and new figures and table downloadable on the author personal website. For this reason I would suggest a resubmission of the paper in order facilitate the track of authors/reviewer/reader discussion.

Second, the authors mentioned the lake of correlation at the Bannock site between the vertical velocities and fluxes and mentioned others mechanisms like horizontal advection and vertical mixing in order to explain this lake of correlation (page 20 paragraph 1). The authors highlight the fact that the Ionan Sea is subject to strong mesoscale features (fig 2). Fig 2 shows horizontal current velocities up to 30 cm.d^{-1} . These strong horizontal currents probably affect the distribution of upwelled nutrients, then the primary producers distribution and finally the fluxes resulting from aggregation, food web pathway, and others mechanisms. The authors also argue that there is a time lag about 10 days (mooring 1) between the upward current velocities and the fluxes events. How the authors reconciled these 2 different mechanisms? How vertical and horizontal current interact in order to produce local fluxes measured in sediment traps? How sediment traps, used in the study, were affected by the horizontal current field? All these questions are critical and need to be addressed in the revised version of the manuscript. There are obvious temporal and spatial issues in the present study that need to be clarified. Efforts have been done concerning the "temporal" issue by testing time lags between fluxes and CVV however the spatial issue remains unaddressed.

Third and somehow related to point 2, significant correlation between fluxes and CVV were found at mooring 1 at 2800 m for total particle fluxes (TPF) whatever the time lag (no time, 1 lag and 2 lags). TPF at 500 m and CVV for the same mooring show the best and significant correlation with 1 lag (about 10 days). Concerning mooring 2 the

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best and significant correlation between TPF at 500 m and CVV was calculated without time lag. How this could make sense? It would mean that all processes leading to fluxes events (production of settling material by primary production, then aggregation/degradation of primary production/repackaging via the food web/remineralization etc... would happen in less than 10 days concerning mooring 2 and mooring 1 regarding the none lag correlation, or could take up to 20 days regarding the 2 lags correlation (only mooring 1 at 2800 m). This needs careful explanation. Mechanism proposed by the authors would need to be supported by other data. For example chlorophyll satellite data could be correlated to the CVV field with and without time lags and also spatially and temporarily correlated to the 500 and 2800 m sediment traps fluxes data. This could give stronger support to the authors' hypothesis. Is there any existing *in situ* primary production/Tchl_a data that could be correlated to the CVV and fluxes at both sites? I know that such data may be particularly hard to get simultaneously but if any of this comparison (*in situ*/satellite Tchl_a and CVV or/and fluxes correlation) can be done the paper would be highly improved. Since then, the hypothesis of the authors remains weak.

Finally, I'm not a specialist but I thought that non linear Ekman pumping could generate vertical velocities of $10\text{s } m.d^{-1}$ at sub-mesoscale. The authors calculated small Ekman vertical velocities. Did they calculate the total, linear or non linear Ekman vertical velocities? Again, I'm not a specialist but could the authors provide more information about this mechanism?

Specific comments

- The authors should give more information regarding the sediment traps used in the experiment
- Page 6 end of paragraph 2, Malinverno et al (in preparation). Since the paper is in preparation more details need to be included in the present manuscript.
- Page 14 last paragraph, the authors calculated a significant correlation between TPF

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and TCF and conclude that this suggest an abundance of coccoliths in the total particle flux as well as a common sinking mechanism. I disagree; correlation has nothing to do with composition of the flux. All component of the flux are usually correlated to the total mass flux. What is the relative flux of coccoliths compare to the total mass flux? Then details about "common sinking mechanism" need to be provided in the manuscript.

- Page 15 paragraph 2: Correlations with TPFs at 500 and 2800 m are significant with 10 and 20 days lags. Why? What does it indicate about the flux composition? Is there any information on the size/composition of aggregates in the sediment traps that could be used to explain variations of the sinking rates calculations (100 to 200 $m.d^{-1}$).

- Page 22 paragraph 3: Two mechanisms are mentioned by the authors in order to explain observed fluxes events. 1) Pulses of primary production, triggered by upward current vertical velocities, followed by grazing and macro-zooplankton-related biogenic flux that rapidly conveys the material in the deep ocean. 2) Large Sahara dust events. The authors do not mentioned the coagulation of primary producers that could also generate large marine snow particles with fast sinking rates (100s $m.d^{-1}$) that would highly contribute to the total flux. Is there any chance that this mechanism happens?

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