

Interactive comment on “Intrusion of coastal waters into the pelagic Eastern Mediterranean: in situ and satellite-based characterization” by S. Efrati et al.

S. Efrati et al.

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We are thankful to the reviewer for his thorough reading and constructive remarks. Below are our replies to the reviewer comments point by point.

1. Comment: P17976, L13-15: Nutrients are supplied from the deeper layer during the winter overturn. The authors should consider if this conclusion is true for all seasons or the limited period.

1. Reply: Since the Levantine basin characterized by a gradient in nutrients concentrations from the coast to the open sea during other seasons as well, our understanding is that horizontal advection is important throughout the year. Moreover, after the for-
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mation of the seasonal thermocline most of the production is recycled production.

2. Comment: P17976, L20-23: Neither Siokou-Frangou et al. (2010), Krom et al. (2010) nor Tanaka et al. (2007, 2011) is the paper reporting the hydrology of the Mediterranean Sea. Please cite the original paper.

2. Reply: The following reference was added: “POEM group, 1992”. The References list was modified accordingly: “POEM group: General circulation of the Eastern Mediterranean, Earth-Science Reviews, 32, 285-309, 1992.”.

3. Comment: P17979, L2124: Please indicate the detection limit and the precision of the nutrient analysis.

3. Reply: The following paragraph was added to the text: “The precision of the nitrate+nitrite, orthophosphate and silicic acid measurements were 0.02, 0.003 and 0.06 μM , respectively. The limits of detection were 0.08 μM , 0.008 μM and 0.03 μM for nitrate+nitrite, orthophosphate and silicic acid, respectively. The concentrations reported are the average values. ”

4. Comment: P17979, L21-26: Samples for nutrients and picophytoplankton were taken in duplicate. Please specify if the results are shown as average value of duplicated samples or based on single measurement.

4. Reply: Picophytoplankton samples were taken in duplicates, however only one sample was run and analyzed using flow cytometry. The sentence “Duplicate samples of 1.8 cm³ for picophytoplankton ..” was changed to “Samples of 1.8 cm³ for picophytoplankton ..”.

5. Comment: P17980, L12 and elsewhere: Please specify the average values \pm ‘what’? The \pm sign represents standard deviation from the mean.

5. Reply: Clarification was added: “... Chl concentrations are $0.16 \pm 0.08 \text{ mgm}^{-3}$ (mean and standard deviation, respectively. Unless stated otherwise, the same notation is used hereafter) within the patch and...”

6. Comment: P17982, L22-25: I understand that the rate of chlorophyll increase here presents the difference between growth and loss (i.e. net increasing rate). This may suggest that loss rate was insignificant compared to growth rate in this water.
6. Reply: Here we measured the "net" chlorophyll concentration, and not the rate. The fact that it was higher within the patch's stations (compared with the background waters) further highlights the coastal-waters signature.
7. Comment: P17983, L8-9 & L26-27: Please specify if the authors did correlation analysis or regression analysis, and if the relationship was statistically significant.
7. Reply: A t-test was used to determine the statistical validity between these variables. In both cases $P < 0.05$, so that the observations are statistically significant. This is clarified as follow: P17983 L8-9: "...linear relationship ($P < 0.05$, $R^2 = 0.5$) between..." P17983 L26-27: "... in the significant linear relationship ($P < 0.05$, $R^2 = 0.62$) between picoeukaryotes abundance and..."
8. Comment: P17983, L12-16: It would be interesting to analyze if concentration of Si(OH)_4 was anomalously high compared to that of $\text{NO}_3 + \text{NO}_2$ and PO_4 in the coast or $\text{NO}_3 + \text{NO}_2$ and PO_4 were preferentially consumed during the transport. How about spatial changes of nutrient stoichiometry?
8. Reply: While within the patch changes in silica concentrations corresponds to temp, attributed mainly to dilution, no detected changes were identified in nitrate and phosphate. Thus spatial changes of nutrient stoichiometry is considered not gradually but within and outside the patch. Because the concentrations of Nitrate+nitrite and phosphate were usually low and close to the detection limit of the methods (see Method section), the computation of the ratio would have a very large error and thus be impossible to use for comparison. Concerning Si(OH)_4 , the concentrations close to shore were always higher than Nitrate+nitrite and phosphate concentrations.
9. Comment: P17983, last paragraph: Please specify if only picoeukaryotes abun-

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dance showed significant relationship with water temperature. If *Synechococcus* abundance does not show significant relationship with water temperature but is higher inside the patch than outside, will the data interpretation be revised?

9. Reply: Both *Synechococcus* and picoeukaryotes were found to be higher in most of the patch's surface and salinity-minimum waters (i.e. 0 to ~50 m) compared with the background stations. We did detect a statistically-significant correlation with the picoeukaryotes and temperature which further strengthens our hypothesis that more complex cells (i.e. with nucleus) were associated with this nutrients coastal inputs.

10. Comment: Although the authors mention "It is reasonable to assume that the higher abundance of *Synechococcus* and picoeukaryotes inside the patch was a result of available nitrate and phosphate supplied from the near shore", they should consider that heterotrophic bacteria are also able to consume inorganic N and P.

10. Reply: We agree with the reviewer that the consumption by heterotrophic bacteria should also be considered. Indeed It is possible that heterotrophic bacteria also benefit from the nutrient-enriched seawater. However, since our goal was to examine spatial changes within the picophytoplankton community, bacterial abundance and productivity measurements are unavailable. Accordingly, the following sentence was added to the manuscript: "We note that heterotrophic bacteria could also consume inorganic N and P but were not measured during this study".

11. Comment: The authors may need to comment on why *Prochlorococcus* did not show any significant spatial trend. Physiological responses to nutrient availability may be different among these picophytoplankton groups?

11. Reply: The intrusion of the water was confined to the upper mixed layer (ca. 20 m). *Prochlorococcus* are usually found associate in the Mediterranean Sea with the deep chlorophyll maximum (low-light species, ~ 100 m) waters and not with the high-light depths. Thus it is not surprising that no change in their abundance/biomass was observed for these depths. The following sentence was added to the manuscript:

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“This is explained by the fact that in the Mediterranean *Prochlorococcus* are usually associated with deep chlorophyll maximum (low-light species, ~100 m), and are thus not affected by intrusion of waters at the upper 25 meters of the water column”

12. Comment: It would be interesting to compare chlorophyll concentration (a proxy of total phytoplankton biomass) with water temperature.

12. Reply: We agree that the relationship between temperature and phytoplankton abundance is of interest. The overall relationship between surface chlorophyll and temperature is shown in Fig. 2. Further examination of the relationship is done by correlating temperature and abundance of Picoeukaryotes (Fig. 8b), which was found to be significantly higher within the patch.

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