

Editor (egusphere-2025-53) --response

"I thank the reviewers for their effort reviewing this manuscript.

The review reports have different views on the scientific importance of the study. I would therefore like to give the authors the opportunity to clarify and emphasise the importance of this study, by addressing the points raised by the reviewers. The revised paper can then be reconsidered for publication."

Our response:

We thank the Editor for obtaining the two referee reports on our manuscript and for letting us submitting a revised version of the paper. We addressed in details all the points raised by the referees and hope that the Editor will find our revised manuscript suitable for publication in Ocean Science.

Referee #1 (egusphere-2025-53) --response

We thank referee #1 for the thoughtful report and comments. Please find below our detailed response to these comments.

Referee comment:

"Review of the manuscript 'Statistical analysis of ocean currents in the Eastern Mediterranean' by Ashkenazy et al.

The authors investigate the probability density function (PDF) of current speeds in the eastern Mediterranean Sea, based on a deep-water mooring, for the period November 2016 to March 2024. The authors discuss three typical distributions and their associated parameters, including the Weibull, the General Extreme Value, and the Generalized Gamma. They also find that the three-parameter Generalized Gamma distribution best describes the PDFs of the observed current speed series. In addition,

the current speed PDFs of a high-resolution (1 km) simulation and reanalysis daily mean currents (4.6 km resolution) are also compared with some discrepancies to the observations. After reading the paper, I find that the manuscript well written and logically clear. However, I regret that I cannot recommend the manuscript for publication at this time due to the lack of the basic ocean dynamics or some interesting phenomenon analysis. The detailed reasons are as follows."

Our response:

We have enhanced the discussion of the ocean dynamics and the related analysis. Please see our detailed response below.

Referee comment:

"The scientific importance of studying the PDF of currents is not well explained in the manuscript. Especially for the eastern Mediterranean. Are there some special oceanic environments that are significantly different from the open ocean, so as to induce the special PDF in the eastern Mediterranean Sea?"

Our response:

In light of the reviewer's comment we added the following paragraph to the Introduction section of the revised manuscript.

'Studying the statistical properties of ocean currents is essential for enhancing our understanding and modeling of ocean dynamics and for estimating the likelihood of rare current events. In addition, for devising better parameterizations for sub-grid mixing, one should understand the velocity distribution and its relation to the various forcing of surface ocean circulation. This knowledge also supports the effective management and protection of marine ecosystems and is critical for the safe and efficient design of offshore structures. Since the statistical behavior of ocean currents varies across different regions (see more details below), our focus on the currents of the Eastern Mediterranean will contribute insights and improve the modeling of this area.'

Referee comment:

"The manuscript only gives the PDF of the observed or simulated results, but does not link the PDFs to any other interesting oceanic dynamics or some interesting phenomenon. This is very much expected in the study."

Our response:

We now explain in the Introduction section the link between the PDFs of the ocean current and other oceanic/atmospheric phenomena as follows:

'The pdfs of upper ocean currents are influenced by the statistical properties of wind stress (e.g., Chu, 2008b, 2009; Ashkenazy et al., 2015). In particular, resonance between wind stress and the Coriolis force (the inertial frequency)—often referred to as the “chimney effect”—can significantly impact ocean currents and their statistical characteristics, even at considerable depths (Lee and Niiler, 1998; Alford et al., 2016); we note that the inertial frequency is dominant in our current records (Solodoch et al., 2023). Additionally, other factors such as density-driven currents (convection), bathymetry, tides, and persistent mesoscale eddies can also affect the statistical properties of ocean currents. Among these, long-lived eddies may be especially relevant in our region of study.'

Referee comment:

"The analysis of the PDFs and associated parameters is too detailed. I mean, the authors can just give the best three-parameter generalised gamma distribution and then use it to demonstrate the different ocean dynamics with depth, seasonal or interannual variations (if any). That is to say, to discuss some ocean dynamics or phenomenon from the perspective of PDFs."

Our response:

We thank the referee for this insightful comment. The comment is particularly relevant to Figures 5–7, where we present the estimated parameters for all three PDFs analyzed in our study. This presentation is intended to enable readers to independently assess

our conclusion that the generalized gamma distribution provides the best fit to the observed ocean current data. Additionally, it allows for a meaningful comparison between the different distributions. Regarding the discussion on ocean dynamics, we refer the referee to our response to the previous comment. We note that the second referee of our study suggested to include the figures of the Appendix in the main text.

Referee comment:

"I am confused as to why the authors compare the PDFs of the observations with those of the high resolution (~1 km) simulation. Is it to show that the statistical properties of the high resolution (~1 km) cannot represent the observations well, and thus to show that the simulations are not very good? However, model evaluation is not the focus of the study."

Our response:

Yes, the comparison with the high resolution model simulation is aimed to assess the ability of the model to reproduce the statistical properties of the data. This may help to improve the model's performance. We agree that this is not the main focus of our study, yet, we believe that this aspect strengthens the importance of our study. To clarify this point we added (in Section 2.1) the following explanation to the revised manuscript.

'We analyze the model's currents to verify the ability of the model to reproduce the statistical properties of the observed currents. Such a comparison may help to improve the performance of the model, eventually leading to better prediction and understanding of the ocean dynamics.'

Referee #2:

We thank referee #2 for the thoughtful report and comments. Please find below our detailed response to these comments.

Referee comment:

"The paper by Ashkenazy et al "Statistical analysis of ocean currents in the Eastern Mediterranean" considers data from a vertical array of instrument off Israeli coast called DeepLev. The paper compares probability fits of several distribution functions for observed and modelled data and reports the results in a systematic way. It is well written and can be published after a minor revision as follows."

Our response:

Thank you.

Referee comment:

"The abstract does not mention that observed data is from a single-location vertical array, and the initial impression about the studied data from the abstract may be a little misleading – it is necessary to mention DeepLev explicitly in the abstract."

Our response:

We agree and modified the first sentence of the abstract as follows:

'We examined the probability density function (pdf) of current speeds at the DeepLev station, located in the Eastern Mediterranean Sea near the central coast of Israel.'

Referee comment:

"At some point, numbering of figures changes to A. In fact, Appendix does not seem to be necessary, so I suggest numbering all figures consequently."

Our response:

We thank the referee for this helpful comment. Indeed, we carefully considered whether to include all figures in the main text or to move some to the appendix. Ultimately, to enhance readability and maintain clarity, we decided to include in the main text only the figures that present the observed current data and their comparison with the model results. The remaining figures were placed in the appendix. We believe this structure enables readers to more easily follow the central arguments of the paper, while still providing access to additional details for those interested.

Referee comment:

"The authors use Delta measure, which does not have a significance estimate. Isn't it better to use Kolmogorov-Smirnov two-sample test and corresponding critical values for significance? I understand the authors wish to capture full information about the tails of distributions, but in this case goodness-of-fit is difficult to formalise."

Our response:

Thank you for suggesting this interesting idea. To our knowledge, the Kolmogorov-Smirnov (KS) two-sample test may be applied to samples of data and not on pdfs. Thus, we cannot apply the KS test, at least in its standard form, to compare between the observed pdf and the fitted pdfs.

Referee comment:

"The abstract mentions that "difference between consecutive current speeds exhibits less long-term variability". This is an immediate consequence of discrete differentiation, and trivial – no need to include this in the abstract. The abstract is written in parts using past tense and in parts using present tense – better to write in one style (preferably in present tense in the abstract)."

Our response:

Following the referee's comment we rewrote the sentence regarding the current speed increments as follows:

'We also study the time series of the difference between consecutive current speeds and found that the stretched exponential pdf describes better (than the normal distribution) their statistics.'

We also used the present tense in the revised abstract.

MINOR COMMENTS

Referee comment:

"Several figures have main titles on top that repeat the content of the captions. Remove these titles in figures 2, 4, A1, A2, A6, A7, A9, A13."

Our response:

Done.

Referee comment:

"The caption of figure A6 does not explain what data is used – observed?"

Our response:

Done. The beginning of Fig. A6 now reads: 'The observed data daily mean...!'

Referee comment:

"The caption of figure A8 – reanalysis data"

Our response:

Done. The beginning of Fig. A8 now reads: 'The data (blue) and Copernicus reanalysis (light brown) pdfs ...!'

Referee comment:

"La Nina, El Nino – with a LaTeX tilde."

Our response:

Done.

Referee comment:

"Line 78 – in section 2.1 title, Area should be capitalised"

Our response:

Done.

Referee comment:

"Line 81 – freshwater flow"

Our response:

Done. This sentence now reads: '!... where relatively cold and fresh water flow to the ... !'.

Referee comment:

"Line 98 – farther than 100km"

Our response:

Done.

Referee comment:

"Line 118 – spatial resolution"

Our response:

Done. We change 'lateral resolution' to 'spatial resolution'.

Referee comment:

"Line 125 – reanalysis data"

Our response:

Done.

Referee comment:

"Line 126 – observed data"

Our response:

Done.

Referee comment:

"Line 223 – better simple “of” than “that are based on”"

Our response:

Done.

Referee comment:

"Line 228 – “Following the above” can be omitted"

Our response:

Done.

Referee comment:

"Line 339 – remove 2nd “since”"

Our response:

Done.

