Response to the editor — third revision

Recent thermohaline shifts in the Adriatic Sea and their potential consequences

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Dear Dr Hoppema,

Thank you for reading the revised manuscript so carefully. We agree with every comment and have incorporated all of them; each is answered below, with the line numbers of the version you read. Two of your general remarks concern the whole text.

Verbosity. We went through the manuscript sentence by sentence. Long sentences were split, nested clauses removed, uncommon words replaced by common ones, and the verb "carry" replaced wherever a cast or a series was said to carry something. Beyond the passages you listed, well over a hundred further passages, from single sentences to short paragraphs, were reworded in this way, in every section, and Sect. 3.5 was reorganised so that the resolution test, the matched record, the step and its checks follow in that order. The change-point results of Sect. 3.5, which the text listed subset by subset, are now collected in Table 5, and the cast subsets are defined in Sect. 2.5; one sentence on the month mix of the northern Adriatic autumn casts was added in Sect. 3.2. All changes are marked in the version with tracked changes. No result or conclusion changed; one incidental count in Sect. 3.5, the SeaDataNet casts after 2009, was corrected when the section was rewritten.

Figure and table captions. All fifteen captions were shortened, from about 2550 words in total to about 1230. Every statement that repeated the text was removed, together with the interpretive sentences; what remains is what is needed to read the figure or table, with a pointer to the section that discusses it. The caption of Fig. 3 remains the longest, because it annotates two worked examples whose values appear only there.

With best regards,
Elena Terzić and Ivica Vilibić

Response to the line comments

L3–4

I suggest: ... Argo profiles from the Southern Adriatic Pit to quantify the vertical structure of the changes and to test for regime shifts.

Response. Adopted.

L6 — "which the two periods sample differently"

I do not understand this. Periods cannot sample.

Response. Now "where the sampling differs between the two periods".

L6 — "relative to the entire Mediterranean"

add: entire

Response. We wrote "relative to the rest of the Mediterranean" here and at the two other places where the phrase occurs (Introduction, Conclusions). The reference is the median over the 25 sub-basins outside the Adriatic (Sect. 2.4), so "entire" would include the Adriatic itself; we hope "the rest of the Mediterranean" conveys the intended meaning while staying exact.

L9–10

This sentence is hard to understand; I suggest: ... to about 40 %; this regime shift is only provable if vertical resolution and platform are accounted for.

Response. Adopted, and the same wording is used in the Conclusions.

L56

This sentence, especially the first part, is not clear. I think you mean and suggest: The analyses make use of three kinds of the data, ...

Response. The three kinds are kinds of analysis rather than of data, which is why the sentence was unclear. It now reads: "The analyses are of three kinds, each with its own requirements on the data, and the methods are organised accordingly."

L58 — "and needs an uncertainty estimate that allows for casts taken on the same cruise not being independent"

This is not clear to me. Please rephrase.

Response. Now "and needs an uncertainty estimate that accounts for the fact that casts from the same cruise are not independent."

L58–59 — "the rate comparison ... fits trends to the same casts arranged as monthly series"

Not clear, please rephrase.

Response. Now "The rate comparison with the rest of the Mediterranean (Sect. 2.4) uses the same casts, averaged into monthly series, to fit trends."

L64

change to: ... and only use Argo profiles.

Response. Done.

L92

delete: of that table

Response. Deleted.

L138, 142, 143

deseasonalized, not deseasoned

Response. Changed throughout, including the captions of Table 3 and Fig. A2.

L163–165 and L164

This sentence is really hard to understand. Please rephrase. / delete usual

Response. Now "The break year is the one for which the model fits the casts best. Years whose fit is almost as good, within the 95 % likelihood margin of the best fit, are reported with it, because the data cannot distinguish between them."

L170–172

This is a very long sentence with different parts. Please split it to increase its readability

Response. Split into three sentences.

L192

delete: one above the other

Response. Deleted.

L193–194 — "is described by two and any change in their separation can be measured"

This is not clear to me. What measurement? The data show the separation or not.

Response. Now "so that a cast with two maxima is described by both of them and the distance between them is known." The distance is what Sect. 3.4 compares between the periods.

L197

. . . at least 0.010, i.e., ten times . . .

Response. Done.

L199

I suggest: This is considered as one maximum, . . .

Response. Done.

L207

I think you mean: Those casts date from 1972–1998; of these 88 % are from 1990–1998; for the period 2010–2025 99 % of the casts are Argo profiles.

Response. Yes. Now "Those casts date from 1972–1998, of which 88 % are from 1990–1998, and from 2010–2025, of which 99 % are Argo profiles."

L208–211

Please split this very long sentence for better readability

Response. Split into three sentences.

L215, L222, L236, L570 — "carry", "carried", "carrying"

Why not just "have" instead of carry? / taken, not carried / having, not carrying

Response. "Have" and "having" adopted; at L236 the shallowest observation is now "extrapolated as a constant to the surface". The same verb was replaced at every other place where a cast, a profile, a grid or a series was said to carry something ("have", "contain", "show"). The three remaining uses of "carry" refer to water carrying salt or oxygen.

L216 — "Each maximum carries its depth, salinity, temperature and σ_0"

This is trivial. Why write this here again?

Response. Deleted.

L216–217 — "the density distinguishes a maximum displaced along its isopycnal from one made of different water"

Not clear what is meant here. Please explain

Response. Now "The density of each maximum shows whether a maximum that has changed depth is the same water moved along its isopycnal, with its density unchanged, or different water with a different density."

L217

What is native resolution?

Response. The vertical resolution at which each profile was measured. Now "Detection runs at the original vertical resolution of each profile"; the same wording replaces "native" in Sect. 3.4 and in the caption of Fig. 5.

L222–225

Very long sentence. Please split for better readability

Response. Split into three sentences.

L272

Is it getting warmer and saltier within each of these climatologies, or from the first period to the second? Please clarify.

Response. From the first period to the second. Now "From the 1950–1999 to the 2000–2025 climatology the southern Adriatic (DJ3) became warmer and saltier at every depth from 5 to 1200 m and in every season".

L308

dampens

Response. Done.

L313–314

delete sentence ... Because this is exactly the same as in the previous sentence with numbers.

Response. Deleted.

L381

meet (not meets)

Response. Done.

L429

different

Response. The sentence now reads "the difference of the same quantities between the two climatologies of Sect. 2.2 is also expressed as a rate".

L462

Please do not use "report" for floats

Response. Now "the float profiles have more levels in the later years", here and in Sect. 2.9.

L488 — "this same split"

It is not clear which split is meant. Please be more specific.

Response. Now "the signature of the same two pathways of salt, one at depth and one near the surface", which is the split described in the preceding paragraph.

L509

"result" here is not specific. Please modify. "locates" seems to be incorrectly used here

Response. Now "The double-diffusive diagnostics point to another mechanism, active in the recent decade."

L512–513 — "already close to saturation in extent"

What is meant here? Saturation of what?

Response. Of the extent of the regime, that is, of the fraction of levels in the salt-finger regime, which was already near 100 %. Now "the deep layer, in which nearly all levels were already finger-favourable"; the corresponding sentence in Sect. 3.7 now says "the regime already occupied 92.1 % of levels before 2017".

L522

pathways of what? Please be more specific

Response. Now "The following are plausible pathways by which the changes reported above may affect biogeochemistry and ecosystems; they are not effects quantified here."

L523–524

Or write: It stabilizes the upper column ...

Response. Done.

L526

carbon dioxide, not just carbon

Response. Done.

L526–527 — "Elevated salinity also constrains growth directly through osmotic stress"

Does that follow from the citated work, or is this speculation?

Response. The osmotic stress was our interpretation, not a finding of the cited work, and it has been removed. The sentence now states only what Beg Paklar et al. (2020) document: that the record salinities of 2017 coincided with markedly lower bacterial production and lower abundances of most picoplankton groups than in the preceding decade.

L551

. . . water mass formation region . . .

Response. Done, here and in the last paragraph of Sect. 4.4.

L552

. . . that is, weaker heat loss

Response. Done.

L562

I suggest to add: . . . to the full Mediterranean . . . , or: to the entire Mediterranean

Response. Changed to "the rest of the Mediterranean", for the reason given under L6.

L570

having, not carrying

Response. Now "the share of casts with two maxima".

L573 — "bear on the mechanism"

Which mechanism?

Response. Now "Two further results bear on how the salt is redistributed."

Figure 4

at C–F please insert in parentheses behind the terms, the abbreviations as used in the figure panels

Response. Done: density gradient (DG), core depth (zSG), salinity gradient (SG) and temperature gradient (TG).

Caption Figure 6

The last sentence should be deleted

Response. Deleted.