

Review: Biological response to hydrodynamic factors in estuarine-coastal systems: a numerical analysis in a micro-tidal bay.

In this manuscript F-Pedrera Balsells and colleagues present the results of a numerical modelling exercise in which the role of the wind and land-based freshwater discharge on the spatial distribution of phytoplankton in a microtidal bay is explored (Fangar Bay, SP). This is done by altering starting conditions and forcings on an existing coupled ROMS-NPZD model of said bay. In short, the authors conclude that the wind direction and intensity do indeed play a role, potentially causing large heterogeneity in phytoplankton concentrations in what is a relatively small bay. The manuscript is very clearly written with equally clear figures. The aims of the study are well articulated and are also addressed in the results and discussion. Since the modelling setup has previously been published I assume that the model represents the system well. However three things are lacking for me: (1) more validation of the results coupled to (2) a longer reported output of the model, and (3) some sort of ecological discussion beyond a mention of the biomass.

1. The validation of experiments is presented to the reader as two figures of satellite output (figure 5). These images to me personally are not very convincing and I would like to see more satellite images or field data and model output be compared, possibly also through difference plots such as figure 4a. If a time series of photos can be found, then perhaps multiple successive satellite images can be compared to show how realistic the model output also is when a longer output is considered.
2. Now the output of 5 days is presented, but it should be longer. Looking at figure 2 D for example, the phytoplankton concentration in M4 (UW12) is increasing exponentially. When I see this, I wonder how high the phytoplankton concentration gets on such a short timespan and whether this is realistic. What are the peak concentrations that are reached in this bay in the year? The dynamics of zooplankton are only mentioned, since the output is too short to show the lagged response of zooplankton to phytoplankton availability. Also, once such a wind-event occurs and all the nitrogen has been depleted, how long does it take before a second bloom occurs? Or how long before the dynamics return to “normal” for example? These are all dynamics that can be explored in this manuscript to make it more fulfilling. Some of these things are mentioned in the conclusion as “future work”, but since the modelling setup was all there from previous work I wonder why some of it was not already included (e.g. including P).
3. In the first sentences of the introduction a mention is made of socio-economic services, problems caused by aquaculture, ecosystem value,... Please couple back to this in the discussion. Because of the very short output of results, and a no discussion of the meaning in a biogeochemical sense, it is not clear why the results are important.

Please find minor remarks below.

L20: no dynamic

L35-36: This sentence seems out of place here.

L39: may control the inner water

L44: Please add older references here describing this phenomenon.

L48: create hypotheses and numerical experiments

L51: What is meant with “the biological mechanisms”?

L54-55: ...an important source of both organic and inorganic nutrients for coastal areas.

L59: a larger variability compared to other *Mediterranean* coastal domains (?). In more northern latitudes such seasonality is highly common. Please indicate here also the phytoplankton values that can be expected throughout the year, and how they usually fluctuate.

L68: spatial-temporal -> spatio-temporal.

L77-82: This paragraph is not necessary as this is obvious from the text itself.

L87: I don't understand how the delta can reach 25 km offshore, please clarify this.

L108: How does nutrient input fluctuate with this opening and closing of the canals?

L129: A set of numerical experiments was...

L136: double brackets around the references.

L145: coupled with the ROMS model

L151: What is the mole fraction of Chl a? I do not see it in the table.

L155: Six experiments were designed with varying wind intensity and direction, and varying freshwater input from channels.

Remaining questions about the model after reading the materials and methods and appendix:

- Does it include wave activity?
- There is a finer scale 23 m grid available, why was this not used? Please also show the performance of the 70 m grid in the appendix as validation.
- Do the channel inflows represent a nutrient input in ROMS as well?
- Are processes such as sediment input and water column turbidity included (referred to in line 270) and if so do they affect the light profiles used in the NPZD model?

L182: Four points within the bay were chosen

L187: consistently -> consistent

Figure 2: Why are the results of UW12fr not shown?

L195-196: Remove "for strong wind episodes".

L202: Leading to a larger presence

L204: lesser -> less

L208: perhaps change "comparison" to "similarity"? Also suggestions are best kept for the discussion.

L210: Please show longer output so that these differences in growth rates can be observed by the reader as well.

L239: Is it possible to add a panel to figure 4 with the nitrate concentrations? I wonder if the increasing phytoplankton concentrations may also be caused by nutrient inputs in the plumes.

L271: Again, please discuss how these factors are included in the ROMS-NPZD model and how they have affected the phytoplankton dynamics.

L274: is complex due to its intricate bathymetry. (its shallowness is part of the bathymetry already).

L275-281: please move this part to the introduction to better frame the study.

L281: What is meant with “the bio-hydrodynamics are well defined” ?

L282-283: Where is the magnitude of currents and the formation of fronts discussed in the results section?

L293: the presence of sea breezes -> the absence of sea breezes ?

L304: Non-uniformly -> non-uniform / heterogeneous.

L307: What is this classification, why does it matter, and in which typologies may Fangar bay be included?

L316-317: Which data is being interpreted?

L325: Ultimately, in a small, shallow,....

L329: So please show also plots of the nitrate concentrations as suggested previously. It is now not really clear whether the plume effect is only due to the nutrient inputs or also the salinity differences. It would be interesting to also discuss which phytoplankton species are present: are these marine species or more estuarine adapted species that thrive towards fresh water?

L331: Chl a concentrations are higher in... and decrease as salinity decreases.

L350: Which *in situ* observations are presented in the manuscript?

Figure 6: Very nice figure to explain what is going on. I suggest to use it also in the discussion to clarify processes.

L373: I am missing more evidence of these different phytoplankton patterns in need of an explanation, besides the two satellite pictures shown.