Review of the first revised version of

"Implementation and assessment of a carbonate system model (Eco3M-CarbOxv1.1) in a highly-dynamic Mediterranean coastal site (Bay of Marseille, France)"

submitted for publication to *Geoscientific Model Development*
by K. Lajaunie-Salla and co-authors

1 General comments

The authors' reply the revised manuscript are not very "reviewer-friendly." It is nowadays standard practice to provide a "track change" (or a LATEXDIFF) version of the manuscript clearly identifying the changes made to the text, right in the text. The equivalent information is seemingly given in the reply, except that the line numbers provided there do not match, so that one has to search manually for the exact location of the changes.

The preparation of the manuscript would also have benefited from some extra care. Page numbers restart at 1 after page 23 without any apparent reason.

1.1 Appreciation of the replies to reviewers

The authors have all in all well responded to the referees' comments, with one exception though. In the response to my comment 2.3, regarding the missing effect of river intrusions on DIC — TA perturbations are taken into account, but as these are carried mainly by HCO_3^-, they also generate DIC perturbations of the same magnitude, which are neglected — I read at the top of the fourth page (page numbers in the response would have been helpful) that

> "Concerning the riverine inputs scenarii, we decide to focus on nitrate and alkalinity supply. In fact the model simulates the DIC increases, as is observed, which highlight that the carbonate system module is well resolved."

The reply to the comments is somewhat ambiguous as suggests that DIC changes are taken into account, while they are actually not, as stated in the manuscript at lines 413–414

> "[. . .] the experimental design on the Rhone River supply only considers the TA perturbation on the carbonate system but not that due to the DIC supply."

So, even if the model reproduces the observed DIC increases (as stated in the reply), this must obviously be for the wrong reasons, as only one half of the effects of the perturbation due to river intrusions is taken into account. By the way, no one argued that the carbonate system module was not well resolved.

1.2 Appreciation of the revised manuscript

The model description has been improved and the rationale behind the carbonate speciation calculations is now presented in a new appendix. Unfortunately, the layout of that appendix is rather chaotic which makes it difficult to read.

2 Specific comments

2.1 River intrusion experiments: poor justification

The justification added at lines 414–417 for taking the effect of river intrusions into account only in terms of the resulting TA but not DIC perturbations is rather cavalier and scientifically untenable. This is a completely unrealistic assumption that makes the outcome of the experiment meaningless and thus essentially invalidates any conclusion drawn from it.
I only see two options to address this shortcoming:

1. the river intrusion experiments are repeated with the effect on DIC included (which should be rather straightforward to correct) and the discussion of the results adapted;

2. these experiments are simply taken out of the paper as the current results are essentially unfounded.

Even in preliminary experiments, one must not chose to disregard one of two effects of a perturbation if these are of the same order of magnitude. Such arbitrary choices lead to arbitrary results.

3 Technical comments

Page 1, line 22: "the year 2017 that is a period for which" should read "the year 2017 for which"

Page 1, line 25: "of most of variables of carbonate system except Total Alkalinity." should read "of most of the variables of the carbonate system except for Total Alkalinity."

Page 1, line 26: "experiments were also conducted" should read "experiments were conducted"

Page 1, line 26: "to (i) seawater" should read "to (i) a seawater"

Page 1, line 27: "Rhône River plume intrusion" should read "Rhône River plume intrusions"; by the way: the name of that river is sometimes spelled "Rhône", more often "Rhone" — please use the same spelling consistently throughout

Page 1, line 35: "external forcing have" should read "external forcings have"

Page 5, line 188: "a salinity threshold of 37 has been chosen" – is this correct? A threshold of 37 looks rather high to me.

Page 6, line 226: "during MWC period" should read "during the MWC period"

Page 7, line 271: "15 March and 6 May" should either read "15th March and 6th May" or "March 15th and May 6th" (as on line 277, p. 8)

Page 11, line 390: "Moreover, previous study" should read "Moreover, a previous study", or even better reformulate the sentence to read "Moreover, Fraysse et al. (2013) highlight that …" and discard the citation in brackets.

Page 11, line 402: "a longer period *ca.* 15 days" should read "a longer period of ca. 15 days"

Page 11, lines 402–403: "high atmospheric pCO$_2$ value and wind speed" better had to read "high atmospheric pCO$_2$ and high wind speeds"

Page 11, line 411: "due to some two" should read "due to two"

29th and 30th pages (pages nr. 6 and 7), throughout: "in the pH scale" should read "on the pH scale"

29th page (page nr. 6): "Concentration in Total Fluoride (*TF*) ions" should read "Total Fluoride concentration" (without "ions," as *TF* includes the non ionic HF)

29th page (page nr. 6): "Concentration in Total Sulphate (*TS*) ions" should read "Total Sulphate concentration" ("ions" is superfluous)

29th page (page nr. 6): "Concentration in Total Boron (*TB*)" should read "total boron concentration" (without "ions," as *TB* includes the non ionic B(OH)$_3$)

29th page (page nr. 6): K_F is the dissociation constant of hydrogen fluoride (or of hydrofluoric acid), not of fluoride ions

29th page (page nr. 6): in the expression for K_F, the exponent for *Ions* should be 0.5 (or $\frac{1}{2}$) and not 1.5

30th page (page nr. 7): "Every constant are corrected by the hydrostatic pressure" should read "All the constants are corrected for the effect of hydrostatic pressure"

Guy Munhoven
Liège, 9th October 2020

3