Geoscientific
Model Development
Discussions

Interactive comment on "Exploring coral reef responses to millennial scale climatic forcings: insights from a 1-D numerical tool pyReef-Core v1.0" *by* Tristan Salles et al.

Tristan Salles et al.

tristan.salles@sydney.edu.au

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We would like to thank Jon Hill for his insightful comments on the paper, as these comments led us to an improvement of the work. Our revisions reflect all reviewer' suggestions and comments. Detailed responses to reviewers are given below. An update version of the manuscript is available as a pdf as a supplement.

General comment:

Comment: The paper is well written and easy to understand. My only criticism is that the paper contains perhaps too much detail on the controls on carbonate growth which

have been well established in the literature for decades (sec 3.1 to 3.3). However, these sections then seem to come to the conclusion we don't know that much, but they are going to be in the model anyway. Perhaps shorter, more succinct summaries with a clear reason for inclusion in the model would clarify this? Another suggestion would be to move the discussion part of these intro sections to the discussion part of the manuscript? I'll leave this to the authors to decide here.

Response: Following reviewer's comment we have shorten by half (from 3 to 1.5 pages) the literature part on environmental controls (subsections 3.1 to 3.3). We believe these 3 sections are more useful before the part describing pyReef-Core (section 4) than in the discussion as they put in perspective the different parameters that the model intents to simulate and also highlight the main forcing conditions that drive coral assemblages evolution in our 1D framework. We have modified the last section (3.3) so that we acknowledge more the work done in respect to the control of sediment input on coral communities evolution. The fact that some of the effects of these environmental conditions are still unknown is the main reason why we should aim to try to simulate them in order to gain some insights from numerical models and potentially improve our general understanding of the complex interactions between corals and their environments.

Specific comments:

Comment: Pg 1, ln 1: Unclear opening sentence to abstract. Do you mean laterally perpendicular to shore, alongshore or both (in which case, perhaps "spatially" is a better term)? The lateral change and progradation/accretion/retrogression is responsible for the change in core depth: i.e. they are the same thing are they not?

Response: Following reviewer's comment, we have modified the first sentence and used the term spatially as suggested by the reviewer.

Comment: Pg 1, ln 5: poorly constrained on centennial to geological timescales, no?

Response: We have changed millennial to geological timescales.

Comment: Pg 1, ln 6: it doesn't do the inverse though?

Response: Following reviewer's comment, we have remove the term inverse in the sentence as it was misleading.

Comment: Pg 2, ln 33: Add Hill et al 2012 as a heuristic tool Hill, Jon, Rachel Wood, Andrew Curtis, and Daniel M. Tetzlaff. 2012. "Preservation of Forcing Signals in Shallow Water Carbonate Sediments." Sedimentary Geology 275-276 (1): 79–92.

Response: We have added the reference to Hill et al., 2012.

Comment: Pg 3, ln 14: typo \textsc you forgot the \

Response: We have corrected the typo.

Comment: Pg 5, ln 6. Does this need a new paragraph?

Response: We have merged the 2 paragraphs together.

Comment: Pg 6, ln 10. So how can you encapsulate this in an algorithm if there's no data? Perhaps some of this needs moving into the discussion? See above general comment.

Response: This point has been addressed now, as explained in our response to the general comment.

Comment: Pg 6, ln 10. Remove sentence: "This objective....". I don't think it adds anything.

Response: Following reviewer's suggestion, we have removed the sentence.

Comment: Pg 7, ln 9-10: As general comment on moving to discussion.

Response: This point has been addressed now, as explained in our response to the general comment.

Comment: Pg 11, sec 4.7. 50% is rather arbitrary! Can you give any insight on how

the resultant core varies if this is altered to say 25% or 75%? How did you arrive at 50%!?

Response: First we would like to state that this parameter is user-defined in pyReef-Core and can be changed in the XmL file by adjusting the facOpt parameter (https://github.com/pyReef-model/pyReefCore#-habitats-structure): <!– Turn-on criterion. Population growth only occurs when the optimum is met. This reflects the notion that reef 'turn on' events occur because of a confluence of optimal conditions [0,1]. –> <facOpt>0.3</facOpt> Following reviewer's comment, we have modified the section 4.7 and added a new sentence at the end to reflect the fact that this parameter can be set by the user. The change in 'turn-on' criteria value will result in different evolution and therefore can change significantly the resulting core. This is especially true for simulations in which assemblage population number fall to 0 due for example to reef drowning or aerial exposure. Difference between a value of 25% compare to 75% will enable assemblages to start growing even though their optimal environmental conditions are not reached. A high value like 75% could result in simulations in which particular coral assemblages will never be able to grow due to more restrictive environmental conditions.

Comment: Pg 22, ln 30+: I'm not sure this is relevant here. You don't tackle the inverse problem in this paper and whilst I don't disagree with this at all (as you know!), the linkage to inverse in the abstract and this is tenuous. Perhaps leave removing the inverse and removing the reference to pyReef-Bayes is sufficient here; i.e. you still get to stake out the fact that the inverse problem is what we are trying to solve (as a community), but it's the implication you are doing that in this paper which I don't think sits well.

Response: Following reviewer's suggestions, we have removed 'inverse' in the abstract as well as the reference to pyReef-Bayes from this section, the inverse problem and the MCMC approach is indeed not relevant to the work described in this paper and will be published later.

Please also note the supplement to this comment:
https://www.geosci-model-dev-discuss.net/gmd-2018-29/gmd-2018-29-AC2-supplement.pdf

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