Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-439-RC1, 2020

Hydrology and Earth System Sciences
Open Access
Discussions

Interactive comment on "Accretion, retreat and transgression of coastal wetlands experiencing sea-level rise" *by* Angelo Breda et al.

Anonymous Referee #1

Received and published: 29 September 2020

General comments:

The paper "Accretion, retreat and transgression of coastal wetlands experiencing sea-level rise" by Breda et al. presents a novel model to simulate the effects of sea-level rise (SLR) on coastal wetlands. They have compared a conventional "bathtub" approach which is incapable of including common wetlands features like channels, transition of vegetation, or culverts, with their new modelling framework that can include these features. The models were used to simulate the resilience of four simplified representations of areas in the Kooragang wetlands, SE Australia, against SLR. The authors conclude that a bathtub approach substantially overestimates the resilience of wetlands to SLR, both in terms of sediment accretion and wetland area. They attribute the overestimation of resilience to SLR in the bathtub model to the omission of sediment

transport within the domain and the influence of wetland features on the hydroperiod.

The manuscript is excellently written, presents a novel methodology and reaches substantial conclusions. The paper has has managed to address one of the key limitations of previous studies on marsh retreat and SLR. The paper could be slightly improved with some minor clarifications and discussion of the model limitations (see below). All in all, the manuscript shows a significant step forward in quantifying the long-term resilience of wetlands against sea-level rise.

Still, the initial set-up of the different "experiments" is not yet clear to me. Figure 1 seems to suggest actual sites in the Kooragang wetland were simulated, though section 2.1 also suggests only simplified domains were used. A figure of the exact initial bottom elevation and vegetation cover in each experiment would be of great help.

As the authors correctly stated, the interactions between all different dynamic process in tidal wetlands are highly complex. From a modelling perspective it is perfectly reasonable to limit the amount processes included in a model. However, it does seem some discussion on the limitations resulting from this selection is missing. It would be of great value to the field and the applicability of the model if in the discussion the authors can elaborate on the limitations of their model. For example, could processes like waves, irregular storm events, soil compaction, etc. not substantially influence the results at different sites or could they still be incorporated in their model framework when needed?

Specific comments:

P2.L51: What do you consider to be the entrance of the wetland? Is this the inlet or river mouth? P2.L68: Clearly not all mechanisms were included. Wave transport, sediment compaction, grazing, etc. can all be relevant for landscape features but were omitted in this study. It would be good to discuss why you think these processes were less relevant for your study-site. P2.L79: "our" implies the authors own the wetland in question P3.L85: and onwards: Consider replacing "experiments" with "simulations" as you do later in the paper. Experiments would suggest the results are from a field study rather than a numerical simulation. P3.L104-108: Consider describing the simulations in order from 1 to 5, rather than starting with 2. P3.L115-119: Given that there is bound to be a storm event in the considered time period (100 years) and the seemingly large influence of these storm events on sediment supply. Should the effects of storm events not be incorporated across both scenarios to simulate accretion rates? P4.L127: Why is the model quasi-2D? P4.L131: 10m x 10m cells seem too large to accurately include the small channels found in wetlands. Could you elaborate how the inner channel of experiment 3 was represented in the model? P5.L164-167: Is it assumed in the model that mangroves and marshes die and re-establish immediately when conditions change or is growth/die-off modeled through time? P6.L215: After solving equations 4,5, and 6, one can solve for deposition directly following a mass balance. What is the reason for not using the deposition calculated by the sediment transport model and instead using an empirical equation? P6.L233: How was the culvert implemented? Culverts have a fixed width so I would not expect the results to be homogeneous in the transverse direction. P7.L241-242: I do not see mounts in figure 2a. Do you refer to figure 3? P10.L366: What is meant with the entrance of the wetland? P11.L403-423: This section seems to be presenting new results rather than furthering the discussion. Consider moving this part to the results section of your paper. P11.L424: Do more detailed domains show a different response than your model? A comparison of your model with studies modelling more complex domains would be useful here P18. Figure 3: Please add since when the sediment was accumulating (I presume 2000) for clarity. To make comparing the plots between periods easier, please consider maintaining the same y-axis for all plots. At first glance the bumps seem to erode over time until you notice the changing y-scale.

Technical corrections:

The paper was already excellently written.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-439, 2020.