Highlights

This is a specimen a_b title

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- Research highlights item 1

- Research highlights item 2

- Research highlights item 3

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ARTICLE INFO

ABSTRACT

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1. Introduction

2. Methods

We modeled tidal platform elevation (ζ) using a zero-dimensional mass balance model using the basic formulation provided by Krone Krone (1987) and further refined by Allen Allen (1990), French French (1993), and Temmerman et al. Temmerman, Govers, Meire and Wartel (2003); Temmerman, Govers, Wartel and Meire (2004). The rate of tidal platform elevation change is described as

$$\frac{d\eta}{dt} = \frac{dS_M}{dt} + \frac{dS_O}{dt} + \frac{dP}{dt} + \frac{dM}{dt},$$ (1)

where S_M is mineral sedimentation, S_O is organic matter sedimentation, P is compaction, and M is tectonic subsidence. Each term of equation 1 can be further expanded.

We approximate S_M as

$$S_M(t) = \int \frac{w_s C(t)}{\rho_b} dt,$$ (2)

where w_s is the characteristic settling velocity of a given grain size, $C(t)$ is the depth-averaged and time-varying sediment concentration in the water column, and ρ_b is the dry bulk density of the sediment. We assume there is no resuspension of mineral sediment which is consistent with Krone's Krone (1987) initial formulation.

w_s is calculated for a given grain size by using Stokes' law to determine the terminal velocity of a sphere falling through a fluid given by

$$w_s = \frac{2}{9} \frac{\rho_p - \rho_f}{\mu} g R^2$$ (3)

[⋆]This document is the results of the research project funded by the National Science Foundation.

[⋆⋆]The second title footnote which is a longer text matter to fill through the whole text width and overflow into another line in the footnotes area of the first page.

This note has no numbers. In this work we demonstrate a_b the formation Y_1 of a new type of polariton on the interface between a cuprous oxide slab and a polystyrene micro-sphere placed on the slab.

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[1]This is the first author footnote. but is common to third author as well.

[2]Another author footnote, this is a very long footnote and it should be a really long footnote. But this footnote is not yet sufficiently long enough to make two lines of footnote text.

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where ρ_p is the mass density of the particle or grain, ρ_f is the mass density of the fluid, μ is the dynamic viscosity of the fluid, g is the acceleration due to gravity, and R is the radius of the grain. This is approximation for w_s is consistent with previous similar studies Allen (1990); Temmerman et al. (2003, 2004). We assume basic properties of water for ρ_f ($1000 \, \mathrm{kg \, m^{-3}}$) and μ ($1 \times 10^{-3} \, \mathrm{kg \, m^{-1} \, s^{-1}}$) for simplicity. Salinity does vary seasonally which will change these values, but had little affect on the model output.

We capture the temporal variation of $C(t)$ through the mass balance given as

$$\frac{d[h(t) - \zeta(t)]C(t)}{dt} = -w_s C(t) + C_{in}\frac{dh}{dt}, \tag{4}$$

where h is the height of the water column and C_{in} is the incoming suspended sediment concentration of the adjacent water column. We consider ζ to be a function of time and update it at every timestep which differs from previous studies Krone (1987); Allen (1990); French (1993); Temmerman et al. (2003, 2004); French (2006) which only update ζ after every tidal cycle. The physical interpretation of equation 4 is that the first term is the mass flux above an area on the tidal platform, the second term is the mass flux extracted from the water column, and the third term is the mass flux from the adjacent water column. Further derivation of equation 4 results in

$$\frac{dC}{dt}[h(t) - \zeta(t)] = -w_s C(t) + [C_{in} - C(t)]\frac{dh}{dt} + C(t)\frac{d\zeta}{dt} \tag{5}$$

From equation 5, we can approximate the solution for concentration numerically.

Model inputs

We obtained model inputs from field measurements. We observed tidal height, grain size, suspended sediment concentration (SSC), and dry bulk density around Polder 32 over multiple field seasons from 2011 to 2016 Auerbach, Jr, Mondal, Wilson, Ahmed, Roy, Steckler, Small, Gilligan and Ackerly (2015); Hale, Bain, Goodbred Jr. and Best (2019a); Hale, Wilson and Bomer (2019b).

For h, we extracted one year of contiguous tidal data from from a pressure sensor deployed within the tidal channel near Polder 32. We used the oce package in R (3.6.3) to create an idealized tidal curve from our data **?**. The tidal curve was then shifted down so that mean higher high water would be 0.3 m above the Sundarban platform and 1.8 m above the polder surface (ζ). We replicated this tidal curve for each subsequent year for the length of the model run. Field observations confirm these benchmark elevation Auerbach et al. (2015); Hale et al. (2019b); Bomer, Wilson, Hale, Hossain and Rahman (2020). In order to simulate sea level rise, the subsequent year tidal curves were increased at a linear rate of $2 \, \mathrm{mm \, yr^{-1}}$ which is consistent with field observations.

For C_{in}, we use observed values of SSC from Hale et al. Hale et al. (2019a) that are characteristic of the tidal channels in the region. Similar to Temmerman et al. Temmerman et al. (2003, 2004), we scaled the observed tidal channel SSC by a factor as the flood waters are expected to have a lower SSC than the tidal channel due to lower flow velocities. For our preliminary study, we use a k-factor of 0.7. In future model iterations, we will better explore this relationship and determine an appropriate k-factor.

For ρ, we used values derived from conversations with Steven Goodbred and Carol Wilson.

3. Results

4. Discussion

5. Conclusions

6. Bibliography

CRediT authorship contribution statement

C. Tasich: Conceptualization of this study, Methodology, Software. **CV Rajagopal:** Data curation, Writing - Original draft preparation.

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