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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Role of intertidal wetlands for tidal and storm tide attenuation along a confined estuary: a model study" *by* S. Smolders et al.

S. Smolders et al.

sven.smolders@mow.vlaanderen.be

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Dear Dr. Ibanez,

I first wanted to thank you for reviewing our manuscript. The questions you pose, give me the opportunity to elaborate on these topics that were kept deliberately short in the manuscript.

Your first question in the general comments and also in the specific comments is about not including frictional effects and topological properties in the scenarios we presented. One of the first things we tested with our model was a changing value for the bottom

friction coëfficiënt in the wetland/marsh area. The large tidal marsh area (Saeftinghe) that we have in the Scheldt estuary was in 1930 a huge bare mud flat (Wang and Temmerman, 2013). Modeling this area as a large marsh would imply using a larger bottom friction coëfficiënt as when we model it as a large bare mud flat. Also in the scenarios presented in this manuscript we changed the bottom friction coëfficiënt. A larger bottom friction results in a slower filling of the wetland with storm water. The result is that in the end less water will be stored on the wetland. This results is comparable with the same wetland having a higher elevation. I say "comparable" because, as you mentioned yourself, the effects are not linear. How interesting this discussion might be, in the current manuscript we already have a lot of scenarios that we discuss. In order to keep the article readable, structured and within reasonalbe page range we decided not to include this discussion in the paper. We only tested the change in bottom friction coëfficiënt, as this was easy to do in the modeling software. We did not look at the influences of the vegetation. This is not yet standard in the software, but extra code to take this into account can be written and included in the software. There are several possibilities to take vegetation and the volume of vegetation into account in the model: 1. in some software packages it is possible to add or define structure that represent different stems of the plants. These structures will have a certain volume and result in a higher friction and drag. 2. another way to deal with plants is to define a bottom friction coëfficiënt that is dependent on the free water level (Baptist et al., 2007). We did not test this, but the vegetation would hinder the inflow of storm water into the wetland, resulting in less storm water storage onto the wetland. Like a higher bottom friction this would be comparable with the same wetland, but with a higher elevation.

I would like to refer to some work of my colleague who is investigating in further detail the filling and emptying of a large existing marsh area under storm conditions and is trying to model the observations of a storm in the Scheldt estuary on December 6th, 2013 (Stark et al., 2015).

Your second comment/question was about the presence of a tipping point in the scenar-

ios with different surface area. I'm really happy you saw this in our results. Theoretically the more surface area, the more space to store storm water, but in reality in a estuary the tide is creating a time frame in which the water level rises above the wetland elevation and thus there is only a limited time that water can flow onto the wetland. A larger surface area is thus only effective if there is time enough for the water to reach it. This depends of course also on the magnitude of the storm surge entering the estuary. We are currently working on a kind of follow up article that is all about this tipping point or to find the optimal parameters (elevation, surface area, kind of connection with the estuary main channel) for a wetland/marsh/mud flat at a certain location within the estuary and for different storm surge levels. In this article we also include the effect of bottom friction, but not yet the effect of plants on the vegetation volume. It still needs a lot of work and simulations, but when it's finished we would like to invite you as one of the reviewers.

Concerning the large number of figures: this is true, we have a lot of figures. We had more in previous versions of the manuscript and cut ted down to this. We have also a large number of scenarios and we believe all the results should be in the paper. By not discussion the influence of the bottom friction on the scenarios we already improved the structure, focus and readability of the paper and cut down in figures.

Sincerely,

Ir. Sven Smolders

References:

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 3181, 2015.