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Review and rebuttal of the paper

A design method for rock groynes exposed to overtopping from long-period ship wave loads

Seemann et al.

Editor handling the paper: Nils Goseberg

1 The reviewers remain anonymous.

1st Round of Review

1.1 Reviewer #1

For author and editor

General comments:

The title of the manuscript indicates a rock groynes design against the log-period ship waves overtopping. As it appears from the manuscript title, the long-period ship waves are the principal cause of the overtopping phenomenon that surprisingly is not discussed in the manuscript body. In other words, if the title of the research is stressed by a subject introduced as the main cause of a phenomenon, it is expected to find in the paper how the studied phenomenon is affected by that subject.

If the main purpose of the current study is the groynes design against the ship-induced waves, the manuscript should start with the ship-induced waves considering all effective wave parameters. The authors say that the current study is based on the field measurements conducted by Melling et al. (2021). It is important to know that also Melling et al. (2021) field measurements do not consider any effects of the wave parameters like wave period, and wavelength and only the wave height has been measured. It has to be noted that ship-induced waves are low-height waves with long periods which their long period is an extremely important parameter that has to be measured and has to be taken into account in the analysis.

As the groynes are permeable structures, the groynes stability is also a function of the wave-induced pore pressure inside the porose media and the pore velocity inside the groynes is directly a function of the wave period that increasing the pore velocity will diminish the groyne stability. This is not discussed in this study.

The measured velocities are registered by ADVs in a long period of data acquisition that maybe all velocities are not related to the wave overtopping and maybe are from the river flow overtopping. Location of the study site at Juelssand with pilot study groynes (Melling et al., 2021), is a classic restricted navigation channel that is affected by the river flow velocity as well. This is a very complex phenomenon and needs to be considered both ship-induced waves and river flow velocity together.

This study is more focused on the current velocity and also the riprap design methods explained in the manuscript are related to the river flow velocity. These methods do not have any congruence with the protection against the waves. I propose to remove the “long-period ship wave loads” from the title and replace it with “Hydraulic loading”.

In the end, I see too many similarities between the current study and the study conducted by Melling et al. (2021). It has to be explained well the differences between these two studies that practically used the same dataset.

1.2 Reviewer #2

For author and editor

The submitted manuscript presents the results of an analysis of data from a prototype experiment of groynes exposed to long period ship waves. The authors follow the aim of describing the hydraulic processes by using existing design formulae based on which a design method for groyne rock amour layer is proposed. Generally, the topic suit JCHS; however, some revisions are required before the manuscript can be accepted for publication. The author's are kindly asked to revise the manuscript based on the comments given below.

General comments

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- In the reviewers opinion, the abstract suggests that the documentation of the experimental field campaign is part of this problem. However, in Section 2.1 it is stated that the experimental field campaign has been documented and analysed in a previous paper. Please revise the abstract in order to prevent confusion.

- The authors are advised to revise the language throughout the manuscript. In particular the punctuation should be corrected

- In parts, the reviewer finds it hard to follow the elaborations of the authors. In the reviewer's opinion, this is due to the overall length of the manuscript, which, in turn, might be driven by the non-concise and partly imprecise language. The author's are advised to revise the manuscript, making it more concise. Some of the specific comments may be helpful in this regard.

Specific comments

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- Please add the structure of the paper at the end of section 1

- Please add a reference to Table 1 in Section 2.1

- In Figure 3, the root and middle cross-section are highlighted. Please provide those accordingly

- Equation (4): Please indicate the difference between the slope angle, alpha, and the inclination of the slope, S, used in Eq. (3). In addition, is the slope gradient, S, stated in Line 215 the same as the inclination of the slope? If not, please used appropriate and unique notation. Same for the slope angle phi in line 236. Please check your notation throughout the manuscript.

- Line 204: Please provide, if possible, a quantification of the performance of the formula in eq. (6). Similarly for the formulae mentioned in lines 207ff.

- Line 208: "the groyne prototype experiment" I can't quite follow, which prototype experiments you are referring to here. Please clarify

- Eq. (7): For the sake of consistency, please rearrange the equation such that it's given as a formula for D50

- Eq. (13) please indicate, if the definition of the correction factor stems from previous literature or if it is an own development.

- Line 258: I cannot follow you statement "Subsequently, those findings were generalized to be applicable to the other groynes and measurement periods." Please clarify what "findings" exactly are generalised and how this is done specifically.

- Line 271 & Eq. (17): I can't quite follow where Eq. (17) stems from. Please clarify

- Line 280: The definition h_crest,calc/h is not shown in Figure 6. In the reviewer's opinion, the definition of h_crest,calc needs to be clarified by providing more details on the data shown in Figure 6. To some extend this is done in Lines 285ff., which should be moved before Eq. (18) for a better understanding.

- Line 317: What is meant by "reduce these events". Please clarify.

- Figure 8: I am questioning the added benefit of showing the middle panel in Figure 8, which is a differential plot of differential plots. Please consider removing this or clarify the added benefit. It would rather be beneficial to show an example plot of the category "light or local erosion"

- Line 356: Here you are stating "This analysis showed large variability". I cannot quite follow if you are referring to previously presented results or, in fact, results that will be presented in the following. If the latter, please consider to first properly describe the results to make it easier for the reader to follow your observations.

- Line 363: It is hard to follow when you are stating "For this period the equations by..." What period are you referring to? Please clarify

- Section 4.2 and Table 3: Please comment if a missed prediction is, in fact, worse than a false positive, leading to more conservative/safer designs. This is render The Thornton equation worse

Minor comments

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- Line 25: Please correct "23 could are predicted correctly"

- Line 56: Replace "cf" with "see"

- Line 58 Please correct "Exemplary ship wave event in response to the groyne"

- Line 72 Please correct "and [to] develop a method"

- Line 96 Please correct "The thickness [of the] riprap layer is "

- Line 143 Please correct "similarities with weir flow [are] apparent"

- Line 153 Please correct "the Poleni equation was [s]elected."

- Line 161 Please avoid "they"

- Figure 5: The RMSE is missing a unit

- Line 301 replace "greater" by "significant"

- Line 310 & 311: I am not sure if "decayed" is the correct term here. Please revise

- Figure 8 is missing x- & y-labels

- Figure 9: Please increase the size of the figure for better legibility

- Figure 10: Please consider only showing the critical discharge for the relevant stone classes in the different panels of the figure to improve legibility

- Line 543 Please correct "can therefore [be] considered"

- Line 563 Please correct "The findings in this paper"

2 2nd Round of Review after Revisions of Authors

2.1 Reviewer #1

For author and editor

The reviewer is satisfied with the response to the provided comments and suggests the paper to be accepted for publication. For the submission of the final version of the manuscript, the authors are advised to correct some remaining editorial shortcomings, e.g., Table 1 referenced too late in the manuscript, wrong unit in Fig. 4, punctuation, not all mathematical symbols are appearing in the notation, S is still not called slope inclination uniformly throughout the manuscript.

Also, for future reference, the authors are advised to ensure that the provided line numbers in the rebuttal letter correspond to the correct line numbers in the manuscript.

2.2 Reviewer #2

Dear Editor,

As I haven't been involved in the first round of the review process, I checked the author's answers to the reviewers and the Editor and I found a critical request from the Editor that in my opinion is not answered well and the manuscript still is ambiguous regarding this matter. Editor Asked:

"The introduction is lacking scientific background with respect to the topic, a typical introduction contains more literature references and critical discussion of existing vs. lack of knowledge. The authors are also asked to review literature pertaining to riprap literature in riverine conditions knowing that their manuscript is focussing on long-period ship waves in estuarine waters. A hint for a starter is the work of Kurdistani et al. (2019), https://doi.org/10.1016/j.wse.2019.05.002 [Add to Citavi project by DOI])."

The authors answered: "Thank you for your reasonable suggestion. We rewrote most parts of the introduction to better embed our investigation in the literature and provide context."

When I read the paper, I see that the authors just in one line mentioned also the work of Kurdistani et al. (2019) in the Introduction, and in my opinion they thought that the Editor is one of the authors of Kurdistani et al. (2019) and it could be only for having citations. But we know well that it is not like this and because the Editor found the current manuscript close to the work of Kurdistani et al. (2019), the Editor gave the authors this indication. Now, what is the problem with this manuscript?

The problem is this. In Melling et al. (2019), Fig. 4 shows the location of the groynes that are constructed in an estuary. This confirms that the Editor found well that the phenomenon has to be very close to the one studied by Kurdistani et al. (2019). In my opinion, the authors didn't want to change their study approach and gave a short mention in the manuscript regarding the work carried out by Kurdistani et al. (2019) as: "There are stone sizing equations created for secondary wave attack (Verhey and Bogaerts 1989) and secondary wave combined with river flow (Kurdistani et al. 2019) as well as design guidelines for bank protection for inland waterways (GBB 2010; CIRIA 2007)." If we read the paper of Kurdistani et al. (2019), never is spoken about the secondary waves, and on the contrary, all the sediment transport process is based on the drawdown height and the drawdown velocity (page 131 of Kurdistani et al., 2019). The most important parameter is the measured ship-induced wave height arrived at the riverbank that Kurdistani et al. (2019) studied on the maximum ship-induced wave heights registered at the Gota Alv River in Sweden, data from Goransson et al. (2014).

I can conclude my review in this way: As the groynes are located in an estuary, the estuary hydraulic conditions, as well as the ship movement direction (toward upstream or downstream), should be considered in the rock size determination process. The flow velocity inside the estuary and the Froude number are not negligible parameters. I believe that the overtopping velocity is not the only parameter causing the groyne failure.

In the title of the paper: "A design method for rock groynes exposed to overtopping from long-period ship wave loads", the wave period is introduced as an important parameter and surprisingly, it is not considered as a parameter to determine the rock size.

The lack of a "Dimensional Analysis" also is another weak point of the current study.

2.3 Reviewer #3

Reviewer #3 is essentially satisfied with the manuscript, however has provided a very thorough review with respect to grammar and punctuation, within the original manuscript document, which is not repeated in the review report.