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Interactive comment on "Inverse Gaussian distribution of wave set-up heights along a shoreline with complicated geometry" *by* Tarmo Soomere and Katri Pindsoo

Anonymous Referee #1

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Review of

Inverse Gaussian distribution of wave set-up heights along a shoreline with complicated geometry

by Tarmo Soonere and Katri Pindso

Synopsis

The paper investigates the probability density distribution (PDF), and especially its largest values, of wave run-up heights. Run-up is derived from wave heights, which are obtained from a wave model (WAM). The wave model is driven by winds from just one measurement location, which is considered representative for the Gulf of Finland. Run-up heights are evaluated at 175 grid points with a distance of 470 m along the Gulf of Finland coast of Estonia. The chosen coastline is very complicated, with stretches of it at any angle with respect to the predominant wave and wind directions. The run-up heights are found to be distributed according to a an inverse Gaussian distribution, implying that the highest run-ups can be much higher than the highest one ever observed. Due to refraction, very high run-ups can also be found at seemingly sheltered locations.

Discussion

Although the topic and the results presented in this paper are relevant and interesting, I cannot recommend publication of the paper in its present form. There are two reasons, namely

- The presentation is unclear. Several times I had to re-read parts of the text, and I am still not sure whether I understood what was written. The instances in question are detailed below. A thorough re-writing of the paper is necessary.
- More importantly the analysis method used is inadequate. A fit of the whole distribution is sought in order to infer the behaviour of its tail. This approach is notoriously error-prone because the precise shape of the fitted distribution depends on the few cases in its tail. To infer the behaviour of the extreme values, extreme value statistics should be applied, e.g., by fitting a GEV (or, if possible, a Gumbel distribution) to the annual maxima. Other possibilities are POT or r-largest. The book of Coles (An Introduction to Statistical Modeling of Extreme Values, Springer, 2001) discusses them. The paper of Van den Brink and Können (Int. J. Climatol., 2009, DOI: 10.1002/joc.2047) discusses methods to test

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Discussion paper

the adequacy of the chosen fit if a lot of data points are available. This is here the case (175 points along the coast), and according to the claim of the authors they all follow the same PDF. This should be reflected by the test.

Detailed comments

p 1, l 16 that → than

p1, l 28 insert a comma after *drivers*

p 4, l 3 with → to

p 4, eq. (1) The symbol S_{xx} is not used in the following. That might be ok, but I was wondering why is it then introduced?

p 4, l 7 I do not understand why S_{xx} should approximately equal $\sin\theta$, and why it is the approach angle. The angle is θ, isn't it?

p 4, l 17 at → of

p 4, eq. (4) I do not understand the difference between $\overline{\eta}$ and $\hat{\eta}$, nor do I understand the sentence preceding the equation. Probably a sketch of the situation would help.

p 6, l 13 insert *of* before *precomputed*

p 6, l 12-20 I am not sure whether I get this correctly. What I understand is that you run WAM for a lot of wind cases. Then you run through your 100,000 measurements, determine which of your pre-run cases corresponds to it, and take the result of that calculation for the current situation. Is this really what you are doing?

p 8, l 3 propagation → propagating

p 8, l 13-15 I do not understand. How can a sub-set of cases (small incident angel) give higher values than the full set? Why did you expect it? Furthermore, the second and third sentence of this para directly contradict each other. The former says results are equal, the latter the opposite.

p 8, l 16 What do you mean by *relatively different*?

p 8, l 21 change to "... so that even beaches that are seemingly well sheltered ..."

p 9, l 3-8 This para is on a different topic (decadal variability) and interrupts the argument to be made. Delete or move to an extra (sub)section.

p 9, l 10 on → at

p 9, l 18 *concave upward* - is this significant? I mean, are there enough points out in the tail of the distribution? 10^{-2}% of 100,000 is 10, and 10^{-3}% is just 1, so your conclusion hinges on very few points. Are you sure that it isn't just sampling? - See my main concern #2 above.

p 9, l 27 What is p? $\ln \eta$?

p 10, 1st para Can you give error bounds for coefficients a, b, and c?

p 10, l 11 Which particular way?

p 10, l 15 advance → advanced

p 10, l 17 insert *the* before *probability*

p 10, l 28-32 Why is it intriguing that the inverse Gaussian is rare in geophysics? Is it more predominant in other areas?

p 16, 2nd line of legend about → of about; and *at* → *of*

p 17, 2nd line of legend fig. 3 *these* → *those*; and *rhombi*: I think that this shape is usually denoted as *diamond*.

p 19, 2nd line of legend fig. 5 *the first gap* - what is this? It is nowhere referred to and explained in the main text.