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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Environmental controls on surf zone injuries on high-energy beaches" *by* Bruno Castelle et al.

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We thank Reviewer #2 for their support for publication. Below you will see that we did our best to address all their comments. Two of the comments raised by Reviewer #2 could not be addressed rightfully because of the lack of exposure and beach profile data. We hope that we convincingly demonstrate that these two comments cannot be addressed, and we hope that the changes made regarding all the other comments will satisfy the Editor and Reviewer #2 and that our manuscript is now suitable for publication in NHESS.

General comments Exposure.- The results seems to be strongly correlated with exposure (as the authors pointed out) which explains the peaks in the SZI during early

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August (when most of the people in France are in vacations) and holydays (weekend of July 14th). Therefore, I think that the environmental factors would be more clearly observed by normalizing the data set by a factor accounting for the number of beach users. I know that analyzing the images from the videocameras might be out of the scope of this work but I guess some statistics about the occupation in coastal cities might be available or testing an existing algorithm is worth to explore. This is something that at least should be more explicitly addressed in the revise ms.

* Response to general comment on exposure : We tried different ways to address exposure. It was not possible to use video cameras for this purpose (see detailed response to a later comment and corresponding changes in the text). We tried other ways to address exposure. Statistic on occupation from coastal cities or camp sites is not a good proxy, given that during bad weather conditions tourists are still “occupant” but they are not at the beach, and therefore they do not expose themselves to hazards. Beach attendance and exposure (number of beachgoers in the water) was not indicated in the injury report forms. Note that exposure estimation (number of people in the water) will now be systematically provided in the forms starting this summer after discussion we had with lifeguards earlier this year. The only notable possibility to estimate attendance (but not exposure) is using automated detection of mobile phones passing by beach entries. This has been performed during an entire summer at a given beach by a private company. However, that summer (2017) was not studied here, and the data was not open access anyway. Finally, it must be further highlighted that beach attendance is not necessarily a good proxy of exposure to hazard. In another effort at another site with another dataset (Tellier et al., 2019) and implementing a Bayesian network, one can show that even for high beach attendance, exposure to shorebreak waves is strongly reduced for waves >1.5m as such conditions typically discourage beachgoers to enter the water. Although the absence of attendance/exposure data was already pointed out in our manuscript, according to this comment by Reviewer #2 we now provide more insight into the lack of exposure data P21 L15-20 of our revised manuscript (see also additional changes in the reply to comments on the video system): "Statistics

on occupation from coastal cities or camp sites is not a good beach attendance proxy, given that during bad weather conditions tourists do not go to the beach. Finally, it is important to note that beach attendance is not necessarily a good proxy for exposure as, for instance, high surf or cold water temperature can discourage beachgoers to enter the water. This research has highlighted that in order to definitely correlate SZI hazard to environmental parameters, exposure must be quantitatively known. Therefore, a major outcome of this work is that lifeguards will now count people and will systematically provide this information in the new injury report forms."

* Response to comment on breaking type parametrization : Once again, this was not possible, given that beach profile data during the studied summer are only available at Truc Vert in the south of Gironde coast, with only 2 surveys per summer, which is not representative of the entire coast nor of the detailed evolution during the summer. Therefore, it was not possible to use the beach profile data, instead tide elevation was considered as a proxy of beach slope. Other parameters have been explored but did not show much improvement and often distracted from the influence of single or existing composite parameters. For instance, given that there is no beach surveys along the entire coast and assuming that beach slope increases with increased beach elevation the parameter Bf = ηT02Hs0.5 is a good proxy of the surf similarity. Fig 1 below shows the corresponding normalised frequency distributions for shore-break related injuries. Not surprisingly, more shore-break related injuries occur for large Bf, but this does not add much to the existing plots of tide level η, mean wave period T02, and significant wave height Hs. The fact that other parameters have been tested is now briefly discussed in the revised manuscript P24 L6-11: "Other composite parameters were tested for shore-break related SZIs, but none of them provided additional insight into environmental controls. For instance, it is well established that the surf similarity parameter is indicative of breaking wave type, with large values promoting plunging and shore-break waves. Given that beach slope was not available along the entire coast and that one can assume that beach slope increases with elevation up to the berm crest, the modified surf similarity parameter Bf=ηT02$\sqrt{}$Hs was tested. Not surprisingly,

results (not shown) indicate that more shore-break related injuries occur for large (>5) Bf values."

* Response of comment on weekday / July 14: We do not think this is important, given that Saturday is week-end anyway. In addition, there is no other Sunday following a national holiday in our time series to further verify if this is important. Contrary to what is happening out of summer holidays, it is important to point out that there is no strong increased exposure during weekends. This can be further shown by the average proportion of SZIs for each weekday, which can be considered as a good proxy of average beach attendance (see Fig. 2 below). This shows that only slightly more SZIs tend to occur on Sundays, while Saturdays are average. This can be explained by most tourists leaving or arriving on Saturdays, and therefore being less likely to go to the beach and expose themselves to hazards.

* Response to comment on video systems tp provide a good proxy of beach users: This is a relevant comment and this method of inferring exposure has been explored at the beginning of our project. However, the only decent video monitoring station along this stretch of coast is Biscarrosse, from which the snapshots of Fig. 6 have been taken. It is however not possible to use the method of Guillen et al. or others at this site for two primary reasons: the video station is not satisfactorily maintained and as a result (1) there are many days without images acquired; (2) when the video station was working, during most of the summers only one camera was working which is that looking at the main beach entrance (Fig. 3 below). Given that this stretch of beach is easily packed during sunny days, with most beachgoers spreading along adjacent more remote beaches further north or further south the number of people on the snapshot is not a good proxy of beach attendance. This is however pointed out in our revised manuscript stating that video systems with large coverage could provide relevant information on beach attendance and exposure to hazards P21 L7-15: "Although no beachgoer exposure data was available in this study, such environmental conditions are commonly found to contribute to increased beach attendance and beachgoer ex-

posure to hazards (e.g. Ibarra, 2011; Balouin et al., 2014). It is possible to estimate beach attendance using video monitoring systems (e.g. Guillen et al., 2008), however it was not possible to apply such an approach in this study. The Biscarrosse video station (Angnuureng et al., 2017), which is the only suitable video station along this coast, has long periods with no image. In addition, during most of the summers studied here, only one camera was working (Fig. 6). This camera covers a narrow stretch of beach facing the main entry of the coastal resort. This area is rapidly filled on sunny days, with thousands of beachgoers going further north or south along the beach to find some on the dry beach. Accordingly, the number of people from this single camera is not a good proxy for the overall beach attendance."

* We agree with all the other minor comments, and changes have been made accordingly.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2019-96, 2019.

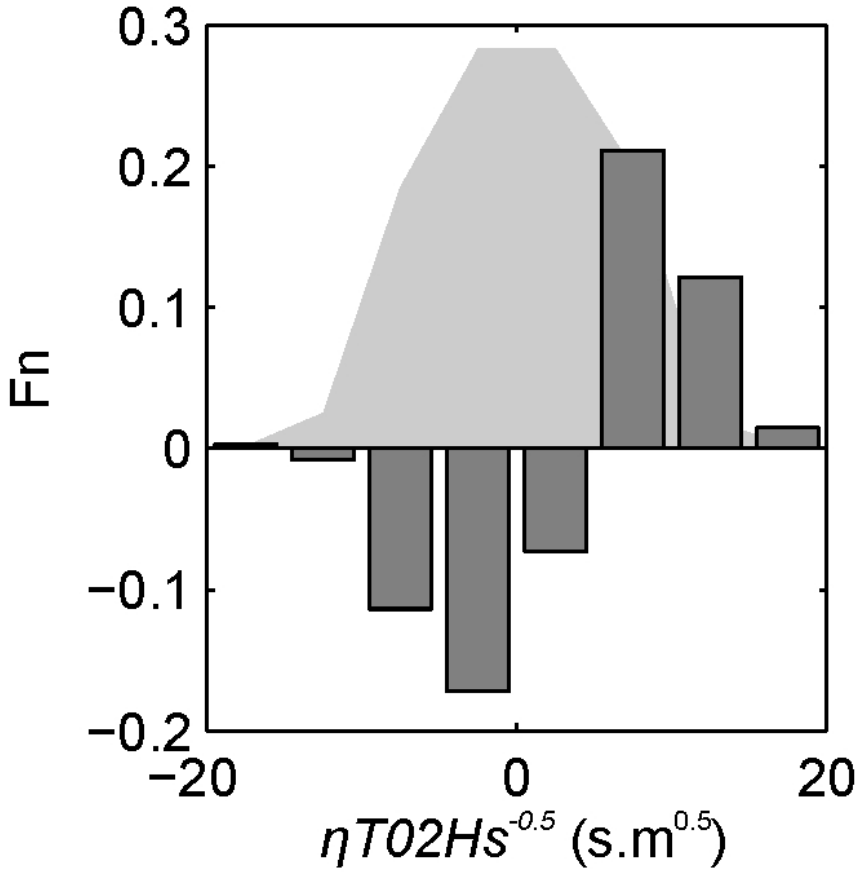

Fig. 1. Normalised frequency distributions Fn during the summers of 2007, 2009 and 2015 (light grey region), referred to as 'average' background distribution of Bf = ηT02Hs0.5 with the dark grey bars showing

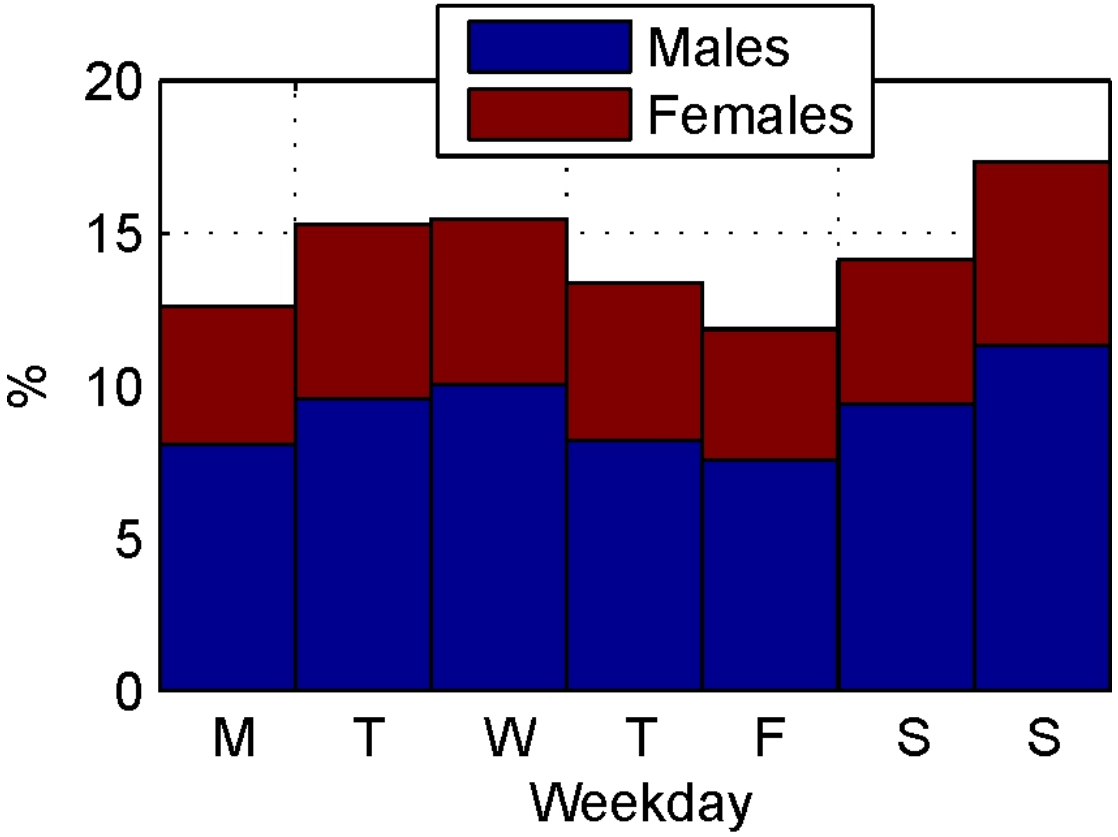

Fig. 2. Average number of SZI during weekdays

Fig. 3. Snapshot of Biscarrosse Beach at the main beach entry on August 4, 2009. The dry beach is packed with holiday-makers in the camera view field. The area is "saturated" and beachgoers all go further sou

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