Replies to the reviewer's comments on "Analysing the spatial patterns of erosion scars using point process theory at the coastal chalk cliff of Mesnil-Val, (Normandy, Northern France)". (NHESSD, 2, C2384–C2387, 2014)

We would like to thank the anonymous reviewer for his/her constructive comments. We agree with most of his/her suggestions and, therefore, we have modified the manuscript to take on board his/her comments. In the following we recall the review (in italics) and we reply to each of the comments in turn (in blue). Additions and changes in the manuscript are indicated in blue. In addition, we made some minor editorial changes following our own internal review.

Please note that the indicated page numbers correspond to the manuscript posted on the discussion forum.

Reviewer N°1

Title. Please consider "Analysing the spatial patterns of erosion scars using point process theory at the coastal chalk cliff of Mesnil-Val, Normandy, Northern France"
The title was modified as suggested.

The Introduction is probably too long. The authors should consider splitting the Introduction in two parts i.e., the "real" introduction to the work, and a new section presenting background information and the review of the literature.
We agree that the introduction may be too long. We propose to remove the paragraph from line 3 to 14, on page 6071, which are redundant with the qualitative description of processes acting on the cliff at Mesnil-Val (lines 1 to 14, on page 6075) and with the discussion section on page 6086. The introduction is now reduced by 135 words (initial total number of words of 875).

Page 6072, Question 1. At this point it is not clear if "heterogeneously" means at random. This is indeed clarified in Section 3.1, but it would be good to say something here, also.
A clarification was added as follows: "Do the underlying physical processes and disturbances act evenly over space (i.e. are they spatially homogeneous) or at specific locations (spatially heterogeneous)?"

Page 6073, line 17. (Mortimore et al, 2001) should be (Mortimore et al., 2001), with a "." after "al" – Note that other similar typos are present throughout the text.
This has been corrected.

Page 6073, line 19. "(Fig. 1b" should be (Fig. 1b). In the same line, what is IGN? Pleas spell out.
IGN corresponds to name of the French national geographic institute. This was added.

Page 6074, line 18-19. ": is assumed to be related to a single erosion event." The author should clarify if this assumption is realistic, or not, and what effect has on the analyses.

A clarification was added: “This assumption depends on the six-monthly temporal resolution on our survey, which is further discussed in Sect. 5.” The impact of this assumption is difficulty to assess, but the conclusions of our study can be put into perspective like in Sect 5, on page 6088, lines 23-26: “We acknowledge that estimating the chronology of subsequent rock fall sequences at Mesnil Val would require higher time resolutions to pin point Stock’s et al. (2012) spatio-temporal pattern. However, the analysis of Sect. 4.3 can be useful to constrain the reset time of the rock face […]”.Further work should be conducted using datasets with higher temporal resolutions to verify this dependence (as indicated on page 6090, lines 1-2).

Page 6075, line 1. Is this an empirical evidence from the available data? Unclear.
It is empirical. We clarified the sentence as follows: “Our observations show that erosion scars preferentially occur during winters and towards the base of the cliff.”

Page 6076, line 1. “establish” ?? is this the right word?
The sentence was modified as follows: “Using Fig. 2A and B, the threshold for selecting acceptable point-like scars from the complete inventory is estimated”.

Page 6076, line 24. “in a quasi-uniform manner”. Define this. Isn’t this also a result of the geometry of the system? The largest possible failures at higher elevations are necessarily smaller than the largest possible failures at the base of the cliff.
The sentence was modified as follows: “small events seem to spread almost uniformly over the entire cliff”.

It is true that the geometry of the system plays a role, but as discussed in Sect. 5 on page 6086, the control can also be of structural nature: “A second causative mechanism, possibly tangled with the effect of breaking waves, can be related to the presence of mechanical discontinuities: the Lewes Marl (see location of the geological marker unit in Fig. 10) and harder nodular chalk beds called hardgrounds (Mortimore et al., 2001). These mechanical contacts between rocks of dissimilar properties stop or deflect fracture propagation depending on properties contrasts (see e.g., He and Hutchinson, 1989). As it turns out on this cliff section, hardgrounds only occur in the lower section of the cliff below an elevation of 30m and the Lewes marl depositional geometry undulate between 15 and 20m of elevation.”

Page 6077, line 14. Clarify – only for the sake of clarity – if this is the geometrical or mass centroid.
It is the geometrical one.

Page 6078, line 12. : : : can be said to be “un-predictable”, in space.
The clarification “in space” was added.

Page 6081, line 13. “reference” should be “references”
This was corrected.

Page 6082, line 23. For consistency, use “Supplementary materials” throughout the paper.
This was corrected.

Page 6083, line 24. Here, and in other parts of the text, the authors use a different number of decimal digits for the same type of measurements. I presume that all measurements had the

same accuracy. If so, all the measurements should be given with the same number of decimal digits.
This was corrected.

Same place in the text: Do the authors have an idea why the thresholds are smaller for the summer and larger for the winter? Do they think the differences are significant?
The differences in those values should be treated with cautious: the value in summer may appear lower, but this may also due to the small number of events in summer epochs, particularly for summer 2007 (with only 469 events as indicated in Table 1). No clear tendency has been identified for the moment and will require further analysis using additional epochs of measurement.

Page 6084, line 4. "summer epoch" should be "summer epochs"?
This was corrected.

Page 6084, line 5. Same as above on the number of decimal digits.
This was corrected.

Page 6084, line 9. The statement of Rosser et al. (2007) is general i.e., it is valid "always" and "everywhere" or is it specific to this area?
The statement is site-specific. This was clarified as follows: "Regarding this issue, Rosser et al. (2007) have analysed, during several months, the spatio-temporal distribution of rockfalls at the coast of the North York Moors National Park, UK."

Page 6084, line 19. "point location" should be "point locations".
This was corrected.

Page 6085, line 13. Consider deleting "Note that", and writing "The non- rectangular shape : : :"
This was corrected.

Page 6085, line 25. Consider "small than" instead of "inferior".
This was corrected.

Page 6086, line 12 "with a tide coefficient of 116." Please, clarify the meaning of this figure.
The following clarification was added: "(indicating high tide amplitude, to be compared to a maximum of 120 for the highest theoretically possible tide)".

Page 6087-6088. "This implies that calibrating that : : :". This is an important point. Does it mean that the power law scaling is controlled only by the geometry of the system?
Here, we highlighted the importance of estimating the minimum volume threshold of power-law, because small and large rockfalls may not have similar behaviour (as supported by our study, but also suggested by Royan et al., 2013).

Once this threshold has been identified, the distribution events above it may follow a power-law-type law (not necessarily, this should be carefully checked). As far as we understand, the geometry may limit the spreading of the very large events, by constraining them so that they might deviate from the power-law distribution. Once the vertical dimension of the rockfall has reached the whole cliff height, the rockfall volume can only further increase by expanding laterally the portion of the cliff experiencing the failure (and in the depth of the cliff), contrary

to smaller events, which can both expand vertically and laterally. Thus, once this limiting vertical dimension has been reached, the aspect ratio of the rock mass is expected to change abruptly and drastically. The existence of a limiting size should result in a "bent-down" of the power-law tail. Nonetheless, the story may be more complicated as the structural factor (here the presence of large faults, but also the spatial distribution of different rock facies) may also play a role as testified by the largest event of our catalogue (see further details in Rohmer and Dewez, 2013, available online: http://ics2013.org/papers/Paper3722_rev.pdf).

Page 6088, line 14. Number of decimal digits.
This was corrected.

Page 6089, lines 1-2. Triggers and predisposing factors might also be different in France and in Yosemite.
We agree. The text was modified as follows (on page 6088, line 18): "A second explanation may be related to the dynamics of the progressive failures once a region of the cliff has failed. Though triggers and predisposing factors may be different, the study of Stock et al. (2012) at Yosemite Valley (USA) is instructive:"

Page 6092, line 6, "pro?les" ??? Page 6092, line 16, "de?ection" ???
The first term corresponds to profiles and the second one to deflection. These are due to the conversion of the document in pdf format.

Figures:

Comments on the figures will be integrated in the revised version of the manuscript. Please find below the replies to the comments.

Figure 1.
Page 6074, line 26. "Fig 1b synthesizes all scars on the cliff profiles at different measurement epochs". This is not really clear to me looking at Fig 1b. The authors may consider improving the readability of this Figure.
Page 6075, line 10, "(see caves at the base of cliff on Fig. 1a)." This is not really evident looking at Fig 1a.
The difficulty is related to the dimensions of the studied area: ~70m by 700m. In addition to figure 1, we propose to add a second figure showing the distributions of the events during each epoch of measurement in a similar manner as Figure 2 in Dewez et al., 2013 (available at: http://ics2013.org/papers/Paper4025_rev.pdf).

Figure 2. In the Figure you use A) and)B and in the caption (a) and (b). Be consistent. I personally prefer the labels used in the captions. Note that the same problem exists in other Figures.
This problem appeared after the conversion of the submitted manuscript into the NHESSD format.

Figure 3. The ellipses are confusing. Try using different colours.
Page 6077, lines 2 & 4. No "circle" shown in Figure 3, and there are multiple arrows in Figure 3.
The readability of the figure has been improved by deleting the arrows and using black-coloured markers.

Figures 4, 5 and other similar figures. Use "small" and "large" at the top, for improved readability of the figures.
The terms were added to the figures.

Figure 6. Remove grid, add full year in the legend [and consider moving the legend in the caption], and use different colours. The existing colours are difficult to separate.
The suggestions were taken into account.

Orleans,
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