

RC1: '[Comment on egusphere-2025-6247](#)', Anonymous Referee #1, 09 Feb 2026

We thank you for the improvements you proposed for our paper. We have taken into account all your suggestions. The modifications are detailed hereafter.

This scientific article presents several interesting and relevant ideas for analyzing rockfall activity. In particular, it offers an improved estimation of failure probabilities for low-frequency events, as well as insight into the relationship between joint spacing and the A-factor of power-law distributions. However, in its current form, the proposed approach is very difficult for the reader to follow and understand. Certain explanatory elements seem to be missing or are not presented with sufficient clarity. As a result, it is difficult for readers to assess whether the interpretations are solidly supported by the data.

Considering the potential originality of this contribution, the paper is fully aligned with international standards and with the scope of *NHESS*. Nevertheless, its structure and presentation require substantial revision. In its current form, the text appears to be composed of several components whose interconnections are difficult to discern. The authors may consider cutting non-essential elements in order to better highlight the key points.

MAJOR CORRECTIONS

In the text the term “spatio-temporal frequency “ points sometimes to F_{st} and sometimes to A_{st} . Is there a way to better distinguish these two parameters to help the reader?

Authors Reply: *In order to better distinguish the function $F_{st}(\text{volume})$ from the parameter A_{st} that is $F_{st}(1\text{m}^3)$, we systematically used the expression “spatio-temporal frequency of failures larger than 1 m^3 “, when dealing with A_{st} .*

Paragraph 2.3 describes a new way to estimate the mean failure frequencies. But it is not clear if and how it is used later in the paper. Is it something completely disconnected from the rest of the paper or used in A_{st} calculations?

A. R.: *This new method is used in the following analysis. In order to clarify this point, we added this sentence in paragraph 2.3: “This method was applied in this study to estimate the confidence interval of the spatio-temporal frequency of failures larger than 1 m^3 for 22 natural mountain rock walls, from the number of observed failure (Tables 2 and 3).”*

From line 205: It is not clear how the different A_{st} (obs, min, max, mod) are calculated. For instance, I tried to calculate A_{st} -obs based on table 2 and 3 for the two first lines, dividing the number of blocks $>1\text{m}^3$ by the sampling extent of table 2. But the results do not fit the A_{st} -obs of table 3. All the calculation of A_{st} parameters must be clearly explained (obs, min, max, mod); presently I am not able to understand where these numbers are coming from.

A.R.: *Indeed, this point must be clarified. For that purpose, line 205 was completed as follows: “For each study site, we calculated the confidence interval of A_{st} [A_{stmin}, A_{stmax}] using the method described in paragraph 2.3.” Also, we modified the beginning of the paragraph 4 (Results, line 267) as follows: “Table 3 and Figure 3 present the 95% confidence interval of the spatio-temporal frequency of failures larger than 1 m^3 (A_{st}), obtained using the method described in paragraph 2.3 and Figure 1. As the hazard level is typically characterized by the decimal logarithm of the rockfall frequency (Fell et al., 2008), we used the geometric mean of*

the lower and upper confidence interval bounds (A_{stobs}), which corresponds to the midpoint of the interval on a logarithmic scale.” We also added the following sentence (line 275): “In Table 4, we compared the A_{st} values obtained using the method described in paragraph 2.3 (A_{stobs}) with those obtained using the power law model described in paragraph 2.4 (A_{stmod}).”

L210-215: We don't have access in the paper or supplementary material to the data from the literature used in the compilation of tables 2 to 4. As one major limitation of this contribution is the joint spacing assessment, why use the ISRM81 (pre-lidar) intervals? original data may be better than this rough classification? In particular since the use of point clouds. Please discuss.

A.R.: *Unfortunately, most of the studies used to obtain data about failure frequency contain only summary information about joint spacing, even those using point clouds. We agree that this point is a major limitation of our contribution and we highlighted this point in the discussion and in the conclusion, by adding the following sentences. In the discussion (line 340): “Note that most of the studies used contain only summary information about joint spacing. More precise information about joint spacing should become available in the future by means of point clouds, allowing to refine the analysis”. In the conclusion: “We encourage the researchers in this field to better describe the joint spacing in future studies.”*

Figure 5: this figure looks completely useless. Generating data by Monte Carlo simulations to extract a linear regression does not really make sense. In addition, the joint spacing is a discrete variable (2 classes), which makes a very weird distribution of points. That would be much more informative to have the mean value with error bars for each dataset. And the final regression coefficient should not be very different than eq10 anyway.

A.R.: *We suppressed this analysis based on Monte Carlo simulations and we considered only the mean values. Indeed, the coefficients obtained are not very different. The removed part was replaced by: “We precised this relationship for all the cliffs above a stable slope included in this study, which belong to groups 1 or 3 (no cases in group 2). Using the geometric mean values of spacing and A_{st} , we obtained:*

$$A_{st} = 0.15S^{-1.12} \quad (10)$$

For joint spacing > 2 m, we considered the interval [2 m, 6 m] according to ISRM (1981).”

L480-482: I do not understand how you reach this statement based on table 8. Please develop.

A.R.: *We modified as: “For example, if we extrapolate from 1 m^3 to 100 m^3 (two orders of magnitude) for the cliffs in group 1 ($B = 0.5 \pm 0.2$), the extrapolated frequency $F_{st}(100)$ is 0.1 with an uncertainty interval [0.04,0.25]. Therefore $\log F_{st}(100) = -1 \pm 0.4$, which is acceptable (lower than 0.5). More generally, extrapolation of two orders of magnitude is acceptable for the cliffs in group 1. For group 2 and 3 cliffs, extrapolation is acceptable only from 1 m^3 to 10 m^3 (one order of magnitude).”*

L499-502: a new idea (pseudo-RQD) is introduced here but not really explained, and it is not explained how it is used. Then you can properly develop it, or remove it and keep it for a future paper (it looks like a good idea, I am looking forward to see real results when you get them).

A.R.: We removed it.

MINOR CORRECTIONS

L78-81: “garbage” text to be removed

Done

L85-86: fuzzy statement (“appropriate”, “sufficient”) that does not provide any information – rephrase or remove this sentence and correct the typo “volumethat”

The sentence “The minimum volume is the smallest measurable or appropriate volume that potentially produces sufficient damage at the given study site” was replaced by “This minimum volume is the smallest measurable volume or a minimal volume to be considered according to the elements at risk”.

L102 -Eq1: “Poisson(P(...))” Check the equation: is the “P” needed compared to eq(2) ?

Indeed, the “P” is not needed. We corrected.

L110 – Eq3: explain the factor 1 at the end of the equation. The rate ?

We added the sentence: “The Erlang distribution has two parameters: the shape parameter (here $N+1$) and the rate parameter (here equal to 1)”.

L113: in Erlang function, when the rate = 1, then mean= standard deviation. Is there anything to say about this property in the context of rockfalls?

We did not see anything to draw out of it.

L126: “smaller” than what ? complete the sentence

We clarified “far smaller than 10”.

L132-133: “the mean frequency ...” Not clear. Better explain why that can be of interest.

We suppressed the sentence “provided that the observation area is large enough. Alternatively, or even complementarily, extending the observation period increases confidence in satisfying the hypotheses”, which was too far from the topic of the paragraph.

Table 1: Is there a reason why the number of significant figures is not consistent in the table?

We do not understand this question.

Tables 2 to 4: explain the meaning of colors in the legend of table 2 (types of rocks) - if any colors are possible for tables (?)

Done

Figure3: how is the 95% confidence interval calculated ? based on what ?

We added this sentence at the beginning of the paragraph 4: “obtained using the method described in paragraph 2.3 and Figure 1”.

Line 300: intervals of what? complete sentence

We modified as: “two groups corresponding respectively to A_{st} intervals [0.01-0.1] and [0.1-1]”.

Line 379: explain “growth disturbances”

We clarified as: “growth disturbances in tree-ring series”.

L544: why uppercase letters?

Typing error corrected.

L605: extra-line to remove

Done

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