ABSTRACT

Abstract generally: I feel a lot of this amazing research is not represented well enough and gets lost in a rather unstructured paragraph.

We followed the suggestions by also including the contents of the lines 56 and 58 of the introduction as suggested. The abstract is now as follows:

- Line 3: Too vague. What and who's necessities shifted and why now? Who demands parametric solutions?

- Line 4: Too vague. Please rephrase "parametric solutions to compare [...] all the parameters". Avoid doubling word stems (parameter) and avoid being too general ("all the", "several types").

   Changed to (lines 3-4):

   However, due to the recent raise in popularity of Digital Outcrop Models (DOMs) and of stochastic Discrete Fracture Networks (DFNs), there is an increasing demand for distribution-based solutions that output a correct estimation of parameters for a given proposed model (e.g. mean and standard deviation).

- Line 5: Word order swap: Move "in geological literature" backwards. Work with the "absence of [something]" rather than interrupting this segment.

- Line 5: In line 3 present tense was used, now past tense. I recommend present tense here. Further: "These changing requirements" is fine to say once they are specified, else the link is lost (see comment line 4)

   Changed as such:
   This change in demand highlights in geological literature the absence of properly structured theoretical works on this topic.

- Line 6: When using "in particular" I recommend using "in general" beforehand to tie the parts together. Again, missing links in storyline.

- Line 7: At this point the reader does not necessarily know about right and left censoring, as only later explained in line 133. Either explain here or mention that it is a specific type of censoring that will be explained later in detail. Further: Mark word in italics?

   Changed lines 6 to 7 as such:

   Our methodology, presented for the first time in this contribution, represents a powerful alternative to non-parametrical methods, aimed to specifically treat censoring bias and obtain an unbiased trace length statistical model.

- Line: 11: I don't understand "modified" in this context or location. Further, please avoid long sentences; split this sentence into two sentences?

   Changed as suggested:

   As a second objective we propose a novel approach for selecting the most representative parametric model. We combine a direct visual approach and the

calculation of four statistics to quantify the distance between the proposed and the true underlying model.

- Line 12: How often or on how much data? Maybe place the term "correctly" more prominently; it gets a little lost while this is the main selling point!

Modified as such:

Finally, we apply survival analysis to correctly estimate statistical parameters of censored length dataset in three different case studies. We furthermore discuss the effects of censoring percentage on crude parametrical estimations that do not use this paradigm.

INTRODUCTION

- Line 16: composed of

Changed as suggested

- Line 19: Replace "Nowadays the increase in" with "Amplified"? Wording sounds dated. Does non-Italian research in DOMs exist? It feels biased. Try being more diverse in reference selection.

- Line 21: Grammar: Plural. DOMS allow the extraction of datasets? Try being more exact in wording.

Changed 19-21 as such:

19 The recent increase in computing power and the emergence of new approaches based on Digital Outcrop Models (DOMs) allow for the extraction of large datasets and facilitate the measurement of properties instead of just their estimation (Bistacchi et al., 2015; Tavani et al., 2016; Healy et al., 2017; Thiele et al., 2017; Marrett et al., 2018; Nyberg et al., 2018; Bistacchi et al., 2020; Martinelli et al., 2020; Bistacchi et al., 2022; Mittempergher and Bistacchi, 2022; Storti et al., 2022).

- Line 32: "only indirect geophysical methods may provide truly 3D datasets". Truly as adverb to provide? Or true as adjective to 3D datasets? Change word order or grammar. Further, is there a better way of saying it?

Changed "truly" with "complete"

- Line 34: "a rich literature" sounds odd. Try "vast research conducted" or else.

- Line 34: Please don't start sentences with "Because of". Try "Due to" or "Given" or else. Please follow academic writing guides.

- Line 35: "the 2D lines of intersection of 3D […] surfaces with the outcrop surface, or with topography" is too complicated. Please make sure to keep sentences short and clear.

We agree that the phrase is too long. We have applied the suggestions as such:

34 Due to this, a vast body of research focuses on the characterization of properties of discontinuity traces or lineaments, i.e. the 2D intersections of 3D discontinuity surfaces with the outcrop surface, or with topography (Dershowitz and Herda, 1992; Bonnet et

al., 2001; Manzocchi, 2002; Bistacchi et al., 2011; Bistacchi et al., 2011; Sanderson and Nixon, 2015; Martinelli et al., 2020; Storti et al., 2022).

- Line 41: "the Digital Outcrop approach". Is this a standardised method? It has not been mentioned in the text before. It is also not explained in more detail in the following sentence as the reader might expect. Please link the sentences more carefully and guide the reader better. Please consult academic writing guides.

We maybe understand the confusion. The wording may confuse the reader since it is not clear that we mean that DOMs are the tools used and not the methods for defining unbiased lengths. We rephrased as such:

39 In this contribution we focus on the problem of defining accurate and unbiased length (or height) distributions based on data collected on DOMs.

- Line 43: don't capitalize "authors"

Changed

- Line 44: "consists of"

Changed

- Line 47: Why reference here and not at the end of the sentence?

Modified

- Line 50: Here: DOM approach. Whereas in Line 41: Digital Outcrop approach. Please avoid using multiple versions of one term.

Changed to DOM

- Lines 50-52: Please don't put words in bold. They have no meaning individually here and the reader is able to read text just so. They stand out too much in light of the text here.

Removed bold

- Line 53: Please avoid disclosing information in brackets. Instead, convert them to separate sentences.

We have changed as follows (accommodating also the suggestion from Healy):

48 Thanks to its simple implementation in the field, this technique is widely used popular however it has an important limitation: lineament lengths are never directly measured. Due to this, analysis carried out with the circular scanline method yielded estimates of mean values without a complete characterization of the lineament length distribution and without any real statistical significance.

- Line 66: time spans. Also, please do not put in bold.

Changed

- Line 67: length measurements

We have changed the text following the suggestions of the lines 67-73 as follows:

67 Measuring length is straightforward with dedicated code or with a simple GIS software however, applying survival analysis and fitting robust unbiased parametric statistical distributions, needs a more detailed treatment. As the main topic of this contribution, we propose to adapt survival/reliability analysis techniques to correctly account for censored lengths and estimate robust trace length distributions derived from DOMs. Furthermore, we define a quantitative methodology to select the most representative estimated statistical model (i.e. parametric distribution) from a list of proposed models.

The theory and techniques presented in this paper are available as an open-source Python package called FracAbility that accepts shapefiles as input and allows to carry out a complete and unbiased statistical analysis workflow for fracture length data (https://github.com/gecos-lab/FracAbility).

FRACTURE SURVEYS AND TERMINOLOGY

We understand the disagreement and the comments on the style. We have followed the suggestions and tried to improve the text. We have also changed the order of the contents of this section to better accommodate the suggestions and improve readability. Here we only provide the changes referenced to the comments.

Previously modified with the comments provided by Laubach but we have expanded the contents of the reviewer's answer to be clearer:

78 Fractures are classified as shear or tensional fractures. Tensional fractures, when possible, can be further divided into joints when empty or veins when filled by minerals (Twiss and Moores, 2007; Davis et al., 2012). This distinction however is often difficult to make without an in-depth field and sample validation since many fractures have hybrid fill attributes (Laubach et al., 2019)

- Line 85-86: Avoid making multiple points in one sentence. It exhausts the reader too quickly.

- Line 88-90: Split in two sentences please.

- Line 94: Please rearrange the sentence order. Think about what point is trying to be made and move it either to the front or end of the sentence. Please check academic writing guides for this.

- Line 94: "impossible" is too emotional. Use "not feasible" or else.

- Line 95: Never use "…" in an academic manuscript.

- Line 91: Does the sampling area reach from a thin section to a satellite image? Language is not precise enough. Please improve.

- Line 92: Please do not put new points in brackets. Either make them a new sentence, if important, or leave them completely out.

- Line 93: Why "boundary nodes" in bold if not "nodes and branches" (line 98) in bold as well? Please stay consistent. Generally, avoid bold style.

- Line 100: If it is not a direct quote there is no need for a page reference

We have changed the text from line 84 to line 100:

84 Although three dimensional by nature, most of the times discontinuities appear as 2D lineaments or traces over a surface. These lineaments are the intersections of such discontinuities with a secondary surface, such as the topography, an outcrop, a borehole or a sample. In this work, following a common usage in outcrop studies, the term *fracture* is used as a generic term to indicate any type of discontinuity trace. Fractures with the same formation age, kinematics and orientation, can be grouped into families or sets. Multiple fracture sets present within an area, form a fracture network or system (Davis et al., 2012). Additionally, fracture networks present two other main components: *Boundaries* and *Nodes* (Figure 1A). The *boundaries* are the limits of the sampling area, that can be at the scale of a thin section or a satellite image, within which the sampled fracture traces are assumed to be complete. Ideally boundaries are strictly convex however this is often not the case. Boundaries often show tight bends, coves and holes and the final shapes are mostly controlled by localized alteration, anthropogenic activity, vegetation etc. (Figure1B).

Nodes are points in the network that define how fractures interact or don't interact with other elements of the network (other fractures, boundary, holes). Nodes can be classified by the number and type of segments (branches) that insist on the given point (Sanderson and Nixon, 2015):

....

- Line 106/107: Why future tense and not present tense? In line 110 present tense is used. Please stay consistent.

  Changed as follows (we also included the change from Laubach)

  In a non-porous rock with all open fractures, a network with a prevalence of I nodes is less connected and thus fluid flow is usually more restrained. Conversely, both Y/T and X nodes increase the connectivity of the network and thus increase both fluid flow and the permeability.

- Figure 1: Maybe mark the "hole" with red hatching? This makes it easier to find the "hole" quickly and follow the explanation.

  Changed as suggested

- Figure 2: "Topology" seems to be spelled with an odd character. Number 8 in the right-hand picture seems dislocated.

  Fixed

STATISTICAL MODELLING OF CENSORED LENGTH DATA

General: The manuscript needs a lot more structure at this point to avoid the impression of a random collection of thoughts. Introductory sentences of paragraphs need to start with catchy topics. Final sentences need to sum up the information or conclusion. One thought per sentence only. Keep sentences short. Start and end of paragraph need to communicate with one another.

We have followed the proposed suggestions to improve the text

- Line 114/115: The start of the sentence and paragraph is poor. Try "There is increased necessity for estimating parameters of statistical distribution in length datasets". Before "however" there should be a full stop. First person plural should be avoided.

- Avoid putting all but one word of a sentence in bold. It looks accidental. Maybe introduce the question with a colon or just don't make it bold.

- Line 119: "lines" = line

- Line 120: Do not write "on the other hand" if there is no "on the one hand".

- Line 122: "almost completely meaningless and useless" is too emotional. Use "impractical" or else.

- Line 124-126: This sentence makes no sense to me. Please rewrite.

114 Having a length dataset, there is usually the necessity of estimating the parameters of one or multiple statistical distributions. When doing so, censoring is inevitable as the boundary in which measures are carried out will always be limited. Then how can we carry out an unbiased estimation of such parameters? On one hand, common and simplistic approaches such as ignoring censoring (i.e. considering censored lengths as if they were complete) or excluding censored measurements (i.e. cherry-picking only non-censored data) should be avoided as they will always lead to an underestimation of the model parameters (see discussion for a more in-depth analysis). On the other hand, circular scanlines methods offer an unbiased estimate of the mean length, however, being non-parametric, they do not yield neither the distribution type (e.g. normal, exponential, etc.) nor distribution shape parameters (e.g. standard deviation, variance, etc.). This in turn makes the estimate's use-case quite limited and not apt to possible statistical modelling applications. To solve these problems, we propose to use survival analysis, a specialized field of statistics, developed to deal with censored data. Survival analysis focuses on the analysis of time of occurrence until an event of interest (Kalbfleisch and Prentice, 2002). Although in literature the terms survival times, time-to-failure, or more generally lifetimes (Lawless, 2003) seem to imply that time is the only valid variable, any non-negative continuous variable, such as length, can be valid (Kalbfleisch and Prentice, 2002; Lawless, 2003). The advantage of survival analysis over the methods discussed above is that it considers censored data as a valid datapoint, carrier of the information that the event did not occur up to the censoring time. This is a necessary shift in perspective that allows for an unbiased estimation of statistical models that will be described in the following sections of this chapter. We will start by describing the theory behind survival analysis in function of time, and then we will show how the same theory can be applied in space, to sets of length or distance measurements.

- Lines 133-140: Always start with a capitalized letter after a colon.

  Changed

- Line 134: Why first-person plural here? Please avoid. Use passive voice. Maybe use: "the event happens after the end of the study period and thus the length of the event is partially observed".

  Changed to: "The event happens after the end of the study period and thus the partial lifetime of the event is observed;"

- Lines 135-140: Follow advise from line 133.

  Changed (capitalization)

- Lines 142-145: Avoid writing in bold.

  Removed bold

- Line 145: time to failure or time-to-failure? Keep spelling constant. Also, this term was only mentioned in an example and inside brackets – explain this more in detail instead.

  Changed to "lifetime"

- Line 150: I understand "complement" as a supplement or accessory. Is "inverse" meant?

Changed to "opposite"

- Line 166: "non-negative continuous variable" is not defined and is not the opposite to "valid variable" yet seems to be the "central point of this work". The term needs more introduction if it holds such importance.

This was moved in the introductory paragraph of the chapter (comment for lines 114-126):

Although in literature the terms survival times, time-to-failure, or more generally lifetimes (Lawless, 2003) seem to imply that time is the only valid variable, any non-negative continuous variable, such as length, can be valid (Kalbfleisch and Prentice, 2002; Lawless, 2003).

Thus line 166 becomes:

166 Since length is, as time, a non-negative continuous variable, it is theoretically possible to apply survival analysis techniques to length datasets by considering (Fig. 6):

- Line 170: Why highlight a verb if else only nouns are put in bold? Stay consistent by changing wording or marking.

Removed bold for the verb also changed to lifetime

- Line 174: What are "the definitions of the different types of censoring"? They are not mentioned. The bullet point list mentions considerations. Why are definitions referred that are not mentioned in this subchapter?

We provided a link to the section where the types of censoring are described.

- Line 176: Why are sources of fracture genesis mentioned here in this subchapter? Is this not a topic for the introduction?

The sources in parentheses are related to secondary events not to fracture genesis, we changed the text as follows:

174 By applying the definitions of the different types of censoring (described in 3.1) to our specific application, it is reasonable to assume that only random censoring occurs in trace length analysis. Moreover, censoring is non-informative since the boundary is the product of secondary events (i.e. alteration, erosion, debris covering parts of the outcrop, vegetation, human activity, etc.) that occur after the fracture genesis and thus do not inform the occurrence of the event (see the discussion for a more in-depth analysis)

- Line 189: If a colon is used to present the main objective, avoid listing side points as bullet points. The message gets lost, and the reader is confused.

  Changed as follows:

  184 Given a statistical parametric model with density g(x, θ) (i.e. an assumed theoretical distribution) and a sample x of size n, the main objective of MLE is to estimate the parameters $\hat{\theta}$ such that the observations x are the most likely under g(x, $\hat{\theta}$) (Burnham and Anderson, 2002, 2004; Karim and Islam, 2019)

- Line 190: simples to simple

  Changed to "simplest"

- Line 196: Avoid putting words in bold

  Removed bold

- Line 209: uncertainty to uncertainties

  Changed to "uncertainties"

- Line 212: What are natural questions? Please clarify.

  Removed natural

- Line 213: Changing several short simple questions to a long complicated question is not "reducing". Starting a question with a side sentence is not recommended. Structure needs to be clearer.

  Changed as follows:

  With a series of fitted models it is important to understand which model better represents the data. In literature this is usually archived using a specific type of null hypothesis tests defined as goodness-of-fit (GoF) test (Storti et al., 2022).

- Line 216 ff: Do not use first person plural. Instead: "These types of tests…"

  Changed as indicated

- Line 224: "Sensible" sounds highly subjective if not explained how this is defined.

  Line 256: "models deemed reasonable by the researcher" again is very subjective. Can this be made more objective?

  We added the following to address these comments:

  224 By sensible candidates it is intended those models that make physical sense for the case study. For example, for fracture lengths, a power law can be considered a sensible candidate since it describes an observed pattern of fracture self-similarity. A lognormal is also an equally sensible candidate because of the effect of truncation. Conversely a normal distribution is not very sensible since values can be negative. Thus, for a normal model, either the average length is very high and standard deviation very low or a truncated normal should be tested. In the case studies section, we will cover different models purposefully adding non-sensible models (such as a standard normal) to showcase the model selection workflow.

- Line 226: Do not start a sentence with rather meaningless introduction words. The reader's interest is immediately lost. Instead start with the subject "Probability Integral Transform is [...]"

- Lines 228-231: Do not name the conditions (list) if the transformation statement is promised after the colon. Instead write line 231 first after the colon. The list gives too much importance to the conditions and limits the focus on the actual definition.

Changed 226-231 as following

228 The Probability Integral Transform (PIT) is a well-known visual transformation of continuous distributions which states that the frequency of Z is distributed following a standard uniform (Fisher, 1930) given:

....

- Line 233: Split sentences after "(Fig. 7A)". One thought per sentence only.

Added a full stop after fig7A

- Line 248: likelihood of...

Added "... the model"

- Line 295: Again, important messages need to be at the start or end of the paragraph. This is not the case here. Make sure "sensible guided choice" is put in the end.

Changed as suggested:

293 By comparing multiple rankings, even if different distances are ranked in differently, it is still possible to make a sensible guided choice, for example by using the PIT representation together with the mean ranking position or follow a specific type of distance.

- Figure 3 and line 136: "observations intervals" = observation intervals". A figure should always speak for itself. This figure does not make enough sense by itself and needs simplification. Reduce the number of colours, avoid unnecessary and unlisted abbreviation (e.g. start and end), make sure colours can be distinguished (e.g. black vs. grey; tightly-dashed vs. line), explain question marks, match thickness of lines in image and legend, standardise spacing behind "Complete" and "Interval", standardise font size for y-axis title, y-axis is not an axis, etc.

- Figure 4: standardise axis titles font sizes, match image and legend line thickness, explain "C" in figure, clarify definition for partial length, use "s" and "r" in the image if explained within the legend, A and B should be on the top left side of each image, full-stop missing in figure description.

- Figure 5: Standardise font size for A and B, make box clear unless figure B is red, increase all axis title and value font sizes, remove title for figure or increase font size, define axis title x.

- Figure 6: Match axis title font sizes to legend font size, Left: Match legend to image. Right: Match line thicknesses, clarify "n." on y-axis: title number would be abbreviated "no.", why clarify unit of length but not item (fracture length)?

- Figure 7: The numbering (A, B, C) would normally occur on the left-hand side of the sub-figures. The text appears rather small and might be increased – however the message is clear.

Improved images following the proposed suggestions

CASE STUDIES

- Line 297: "all the discussed theory" to "the discussed theory"

Changed to "the discussed theory"

- Line 298: In the sentence before it is "case studies" so one needs to introduce singular first: change "one" to "case study"

Changed to "the first case study"

- Line 307: Try to mirror sentences that belong together. If starting with "Pictured on the left…" continue similarly to guide the reader. Don't say "On the right it is represented" but try "Pictured on the right" or similar.

Changed to: "Pictured on the right, a subarea of the quarry with the boundary, fracture traces and boundary nodes (yellow pentagons)"

- Line 327: "Weibull seem" to "Weibull model seems"; "as" to "than"

- Line 328: Again, the last sentence has little value in the paragraph ("occupy the last two positions"). Maybe better: "rank lowest in comparison of the distances/models" or "are least representative".

Changed both as suggested:

323 For the calculated distances scores, the lognormal is followed by the gamma and Weibull models, however the rank scores of these last two models are not uniform. While the Koziol and Green distance favours the gamma model, the Anderson-Darling distance favours the Weibull model. Finally, the power law and normal models rank lowest in comparison to the other models indicating that they are less representative.

- Line 336, 337: Why past tense here when nowhere else?

Changed as following:

336 This leads to an inevitable deformation of the orthophoto (and thus of the measured lengths) along the extremities of the analysed area.

…

The analysed fractures ==are== subdivided in two main sets, striking NE-SW (Set 1) and NW-SE (Set 2), conforming to the general trend of the area for brittle deformation (Bistacchi et al., 2000; Bistacchi and Massironi, 2000; Bistacchi et al., 2001).

- Line 341. Do not start a paragraph and/or sentence with the least important information ("In Fig. 12").

- Line 341/342: Can this sentence be smoother?

Changed as follows:

341 The different estimated models are represented for both sets in Fig. 12. In both cases the lognormal model, overall, better fits the data.

- Line 346: replace "afterwards" as it is too figuratively. Try "at greater lengths" or else.

Changed with: "for longer length values"

- Line 349: "For the other models, looking at the mean rank value helps in understanding the final ranking showing that the gamma distribution is ranked lower than the exponential and the Weibull (at the second and third place respectively)" reads very clunkily. Try and rephrase.

Changed as such:

For the other models, the mean rank value can be used to assign a final ranking. The mean ranks show that the gamma distribution is less representative than both the exponential and the Weibull (respectively the second and third most representative models).

- Line 350: Case study 1 and 2 are locations whereas case study 3 is a topic. Maybe make that clearer by expanding the title, e.g. "Spacing analysis"

Changed subsection title as suggested

- Line 351: Do not start a paragraph or sentence with minor information like here. Start with "Survival analysis can be used…"

We have changed as suggested and also moved a suggestion from the Laubach review to improve the structure of the section (previously it was at the end of the section).

351 Survival analysis can be used also to analyse the spacing length distribution for each fracture set. Thus, the same workflow was applied to spacing measurements of both S1 and S2 of the Colle Salza dataset.

It is worth noting that censoring analysis is a secondary part in the analysis for spacing. Analysing the spatial arrangement of the fractures in the network (such as Marrett et al. 2018 and Bistacchi et.al 2020) is of fundamental importance however we decided not to include this analysis and focus mainly on censoring to avoid increasing the length of an already dense text.

- Line 366: Start new sentence with/at "Thus"

Changed as indicated

- Line 367: Add "model" to end of first sentence. "bad" to "poor".

- Line 368: Don't use "place". Try "rank" or else.

Changed as follows:

367 The poor fit of the lognormal model is also confirmed by the other distances that rank the lognormal lower than the Weibull and gamma models (ranking first and second respectively).

- Line 370: Do not use "on the other hand" if you haven't used "on the one hand". Mind structure and consistency please.

- Line 371: What does "converging all at the first place" mean?

- Line 370/371: Repeated use of word "quite"

Changed as follows:

370 Conversely, the lognormal model is clearly the most representative for set 2 (Fig 15B). The PIT plot showing a quite linear behaviour and all the calculated distances are ranking first.

- Figure 8: Text is very small. "Yellow pentagons" can't be identified at this scale. Second scale in left figure should be inside the zoom window.

- Figure 9: Remove title or make bigger, reference length double units name standardized/ true.

- Figure 10: Title is too large, table is too small. Numbers and axis titles are small and hard to read. I suggest putting numbering of subplots (A-D) on the left-hand side of each image. I would get rid of all articles to make the figure description consistent. Overall title: "plots"?

- Figure 11: Numbers and words need larger font. Insert scale of subplot left inside subplot box.

- Table 2: "indicating a worst fit in respect of the exponential and Weibull distributions positioned in second and third place respectively" reads very clunkily. "a worst fit" does not exist and "places" are only handed out at races. Try and rephrase.

Changed table caption as follows:

Models' distance and rank tables for both Colle Salza sets. The closer to 0 the better. For this length dataset, the lognormal is the most representative of the data for all the different distances. Using the mean rank, the lognormal is followed by the exponential, Weibull and gamma distributions. As with the first case study the Power law and normal distribution are the less representative.

- Figure 12: Increase font size of title and axis title. A and B should be on left-hand side of figure and potentially smaller (compare with other figures). The text could read better. Try "PIT visualization for the proposed length models is shown for Set 1 (A) and Set 2 (B) of the Colle Salza dataset. The red line represents the reference U(0,1); the closer a model's line is to this reference, the more representative the model. Among the models, the lognormal distribution demonstrates the closest fit to the reference line in both sets, although its fit is inferior to that observed in the first case study. Across both sets, all estimated models exhibit less linearity, with notable underestimation between 0.34 m and 1.5 m in Set 1 (A) and between 0.44 m and 2.57 m in Set 2 (B)." or similar.

- Figure 13: Reduce title font, increase table font, change numbering A-D to left-side please. Increase axis description. Here, all articles are kept consistent in the description. This is better than in Fig. 10.

- Figure 14: Reduce A-C numbering (compare with other figures). Increase legend. Explain all lines in legend. Purple colour hard to see. Stay consistent in your phrasing: Delete "Shows".

- Figure 15: Reduce numbering letter A and B and title, compare to other figures. Increase y-axis and clarify. Please correct figure description by the advice given above.

- Figure 16: Please adjust sizes referring to similar figures and comments above.

    Changed all figures as suggested

DISCUSSION

- Line 374: Please don't put information in brackets

    Changed by removing the brackets:

    With this work we delineate a robust statistical framework to quantitively analyse and statistically model fracture trace length ~~(and other parameters such as spacing)~~ and spacing

- Line 384/385: Repeated use of word "useful"

    Changed 384 as:

    Furthermore, having an unbiased statical model is also extremely ~~useful~~ important for engineering ~~approaches~~ applications.

- Line 407: Please only mention a "second point" if a "first point" was explicitly named (line 378 names a "crucial" point; maybe write "The first and crucial point"?

    Changed by adding: The first and crucial point

- Figure 17: Increase/ add axis titles and number. Increase titles (compared to numbering (A-D)). Increase legend size.

    Changed figure as suggested