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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Active Faults sources of the Morelia-Acambay Fault System, Mexico based on Paleoseismology and the estimation of magnitude M_w from fault dimensions" *by* Avith Mendoza-Ponce et al.

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Dear Dr Pierre Lacan:

We are pleased to resubmit for publication the revised version of MS No.: nhess-2018-63 "Active Faults sources of the Morelia-Acambay Fault System, Mexico based on Paleoseismology and the estimation of magnitude Mw from fault dimensions" We appreciated your constructive criticisms.

We have changed the title by request of the other referees. "Active Faults Sources

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for the Pátzcuaro-Acambay Fault System (Mexico): Fractal Analysis of Slip Rates, and Magnitudes Mw Estimated from Fault Length". Traditionally this system has been named as Morelia-Acambay Fault System, in spite of, this extends to the city of Pátzcuaro. Thus, we consider that is more accurate to name it as Pátzcuaro-Acambay Fault System (PAFS).

REFERRE COMMENTS: The most substantial revision concerns the organization and the writing of the manuscript. We have addressed each of their concerns as outlined below.

1) General Organization: -The structure of paper is very confused and is not easy to find the elements to follow the reasoning of the authors.
We have restructured the paper to provide more clarity. The sections are: 1.Introduction; 2.Tectonic Setting of the PAFS; 3.Materials; 4.Methods for the Study of Faults using Fractal Analysis; 5.Results; 6.Discution; and 7.Conclusions.

-The introduction should introduce the problematic of the manuscript by removing all the generalities away from the objectives of the paper.
We have restructured the Introduction and we have highlighted the problem in the study area.

-The Seismotectonic Setting should be organized to set out the elements necessary for understanding the discussion. In its current form, everything is underneath and the state of art is not clear.
We have restructured the Seismotectonic Setting and added the following subsections: 2.1Paleoseismicity in the PAFS; 2.2Historical and Instrumental Seismicity in the PAFS and 2.3GPS measurements.

- What morphological evidences have been taken into account delimiting fault segments and main faults. Why so much difference with works published previously. In particular Lacan et al., 2018 calculated 48 km length for the Venta de Bravo fault, you should explain how do you calculate the different length (32.982 km?) and why is this

difference so important. Same for the Pastores Fault: 33 km for Langridge et al., 2013 and 38 km for you? and other faults.
We identified and defined fault segments on a 15-meter Digital Elevation Model. We used the imagery provided by the Instituto Nacional de Estadística y Geografía (INEGI, acronym in Spanish). The criterion for the tracing of fault segments was the union of small traces to form a larger one, but only if the geomorphological continuity was clear. The lengths of fault trajectories, which is the main object of study, corresponded to the lengths of mountain front sinuosity, and the scarp was measured at the maximum hillslope value for each fault.
We have expected differences in length with both the previous and the most recent works, due to the different resolutions and techniques used in each study. In cases such as Venta de Bravo fault, where there are several segments that may be the continuation of the same fault, but we do not know exactly which of them are the correct ones based on the 15-meter DEM, are managed as separate segments. However, we are open to improving the fault traces with better resolutions in future works. This information is reflected in subsection 3.1Mapping the Pátzcuaro-Acambay Fault System.

-The methods should be explained more carefully.
We have rewritten the Methods section and we changed the name section for Methods for the Study of Faults using Fractal Analysis.

- For the "2.4 Fractal analysis", you lose the reader with details explanations, but you do not explain what you want to calculate? Why do you think it's fractal? What does these calculations represent?
We have rewritten this section and added extra subsections (4.1Self-similar Behavior in Earth Science, 4.2The Hurst Exponent, 4.3Wavelet Variance Analysis, 4.4Box Dimension, 4.5Variograms, 4.6Intensity Scale (ESI 07), and 4.7Active Fault Definition) to provide more clarity. Here we can manage the fractal analysis because this fault population presents a self-similar behavior. This means

that the log-log plot of frequency versus lengths for the PAFS obeys an inverse power law as you can see in Fig. 1 (distribution on a straight line). Discontinuous red lines represent the linear regression model fitted using the least squares approach. In the Results section we have mentioned that this power law is binomial, because present two slopes values. This bimodality may reveal the existence of at least two different fracture processes in the PAFS. For more detail, we decided to use the Hurst analysis to delineate different zones of deformation processes. Finally, we have characterized by quantitative parameters the dynamics of the seismotectonic activity along the PAFS as we discuss during the Results and Discussion.

- The Result and Discussion part is confused. I strongly recommend separating the results from one side (explaining the results you get) and after, a discussion section where you discuss these results and their consequences. In the current form, we do not distinguish what is new from what was already known.
We have separated the Results and Discussion.

-In particular I do not understand the relationship between the results you present and the generation of major earthquakes. What is already known, including previous mapping of faulting in the area should be carefully presented in the seismotectonic setting.
The research involves fault lengths and its corresponding magnitudes Mw (spatial analysis) and slip-rates estimations of earlier studies (time analysis). The fractal method using in both the spatial and time domains allow to distinguish a non-random system and to identify the persistence of a trend within a time series (here slip-rates by the Hurst Exponent) and the micro-regionalization for the PAFS (spatial analysis of Mw by the Hurst Exponent).

- The conclusion is also confused. You should clearly state
We have restructured the section to provide more clarity. According to our analysis, we conclude that (1) the expected mean maximum earthquake magnitude for the study area was Mw 7.0, (2) we defined a micro-regionalization for

the PAFS (western, central and eastern) zones by the Hurst exponent based on magnitudes Mw and (3) we have validated the intrinsic definition of active fault proposed here by fractal analysis and variograms analysis.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-63/nhess-2018-63-AC1-supplement.pdf

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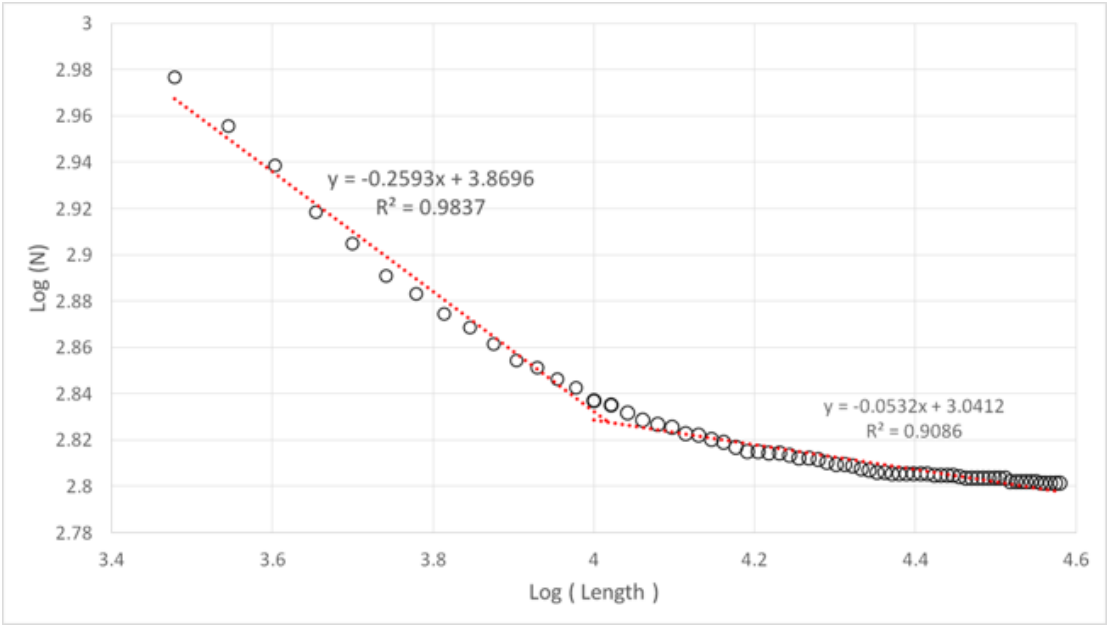

Fig. 1. Log-log plot of frequency versus lengths for the PAFS obeys an inverse power law

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