1. **A more detailed description of the seismicity that is being studied and also, the fundamental parameters of the used catalogue, are missing. For example, maximum and minimum magnitude of the catalogue, threshold magnitude, generic errors in the hypocentre's locations (and therefore, time sensitivity of the located hypocentres), etc.**

ANSWER TO REVIEWER:

We agree with the reviewer that although some information was included in the manuscript regarding number of events, maximum and minimum magnitude of the catalogue, maximum and minimum depth, etc. a more detailed description is now included by adding the threshold magnitude and the generic errors of the location. The following modifications have been made:

Lines 211-219:

> *"In order to apply the proposed methodology, the Spanish earthquake catalogue (https://www.ign.es/web/ign/portal/sis-catalogo-terremotos) was filtered selecting the events in a 40 km radius circumference centered at Lorca's earthquake epicenter. Events have been selected from year 2000 to 2021 to have enough data to plot the b-value (Figure 7). This catalogue has a total of 2962 events with magnitudes between 0.8 Mw and 5.0 Mw (low to moderate earthquakes) and depths that range from 0 to 32.0 km (shallow seismicity). Before November 1997, epicentral location uncertainties were calculated with Hypo71 (Lee and Lahr, 1975) and specified as the so-called ERH (standard horizontal error, in km), however since November 1997, epicentral location uncertainties calculated by Evloc (Carreño-Herrero and Valero - Zornza, 2011) are reported as error ellipses at 90 % confidence level in the full-format catalogue. The epicentral location and the focal depth has uncertainties usually lower than 5 km within the Iberian Peninsula (González, 2017). The threshold magnitude for shallow seismicity is Mw 1.8."*

Lines 227-234:

> *"It is noteworthy to highlight that all strong earthquakes registered have occurred at depths greater than 60 km, which have become the focus of research for this zone. The up-to-date catalogue of Romania can be found in the following address: http://www.infp.ro/index.php?i=romplus. Between 1990 and the end of 2013, locations were determined using the HYPOPLUS (Oncescu et al., 1996) program, a 1D velocity model and stations corrections. Starting with 2014, the earthquake location is obtained using Antelope software. In the present form, a single magnitude scale (Mw moment magnitude scale) is adopted for all the events. Different magnitude scales used before 2014 were converted into moment magnitude (Mw), based on calibration relations presented in Oncescu et al., 1999."*

Lines 247-249:

> *The catalogue contains 6615 events with magnitude ranging from Mw 0.1 to Mw 6.0, 35 % have shallow depth, 19 % have intermediate depth and 46 % have deep depth. As we can see the most of them (65 %) are intermediate and deep seismicity. The cut-off magnitude for this catalogue is Mw 2.70.*

References:

Oncescu M.C., Rizescu M., Bonjer K.P. (1996). SAPS – A completely automated and networked seismological acquisition and processing system, Computers & Geosciences 22, 89-97.

Oncescu M.C., Marza V.I., Rizescu M., Popa M. (1999). The Romanian earthquake catalogue between 984-1997, F.Wenzel et al. (eds.), Vrancea Earthquakes: Tectonics, Hazard and Risk Mitigation, 43-47, Kluwer Academic Publishers.

2. **Although throughout the paper the calculation of parameter b is frequently discussed, at no time is it indicated which method has been used for this purpose. The only reference is (line 91 to 93). From which it is assumed that the classic formula of Aki (1965) has been used. It should be clarified and if this has been the expression used, the authors should explain why the common improvement made from Utsu (1966) has not been used.**

ANSWER TO REVIEWER:

We agree with the comment and the manuscript has been improved to clarify that the maximum likelihood method using Utsu's formula (1966) has been used. Now lines 91 to 93 are written as:

> *"Another issue that has to be addressed is the method chosen for the estimation of the cut-off magnitude calculus. Recent work (Zhou et al., 2018) has shown that the characteristics of the seismic catalogue determine which algorithm suits better the cut-off or threshold magnitude calculus which is needed to calculate the b-value according to maximum likelihood method proposed by Aki (1965) and improved by Utsu (1966)."*

Reference:

Utsu, T.: A Statistical Significance Test of the Difference in b-value between Two Earthquake Groups, Journal of physics of the earth, 14, 37–40, 1966.

3. **Authors state that the exponential-type function fits to data better than the Gaussian (lines 183 and 184). It should be justified using the correlation coefficient from table 1, such as with table two they did.**

ANSWER TO REVIEWER:

We agree that there was a missing reference for the table 1 coefficient. The standard error of the model, S, has been deleted from the tables as the correlation coefficient, R^2, is more descriptive in terms of adjustment errors. The lines 183 and 184 have been changed as follows:

> *"The exponential-like function is a better fit for the inter-event distance distribution as it can be seen in both Figure 5 and Table 1, where the correlation coefficient - a measure of how much the points of the model function differ from those of the dataset -, R^2, is closer to 1 for the exponential-like function."*

4. **Abbreviation CPTI15 is not explained (line 106).**

ANSWER TO REVIEWER:

We agree that the definition of this acronym has not been presented in the text. The line 106 has been modified as follows:

> *"…contained in half of the Parametric Catalogue of the Historical Italian earthquakes (CPTI15) and obtained a smoothing parameter of 30 km for central Italy."*

5. **Although the number and quality of the references appropriate and they are accessible by scientists, there exist other significant advances (that should be added) and it bring this manuscript in accord with the recent literature; for instance, (line 47 to 50) can be re-written as follow:**

> *"Recent studies have shown the importance of the so-called b-value regarding seismic risk assessment by relating its low values (depending on the tectonic regime and the area) to tectonic stress build-up (Gulia and Wiemer, 2010) Moreover, the conclusions of this work agree with tests conducted in laboratory scale (Wiemer and Schorlemmer, 2007). **Therefore, the relationship demonstrated by De Santis et al. (2019) between b parameter and the Shannon Entropy has allowed the use of this thermodynamic variable as an indicator of the occurrence of an earthquake (Posadas et al., 2021, 2022); but, in addition, non-extensive entropy (Vallianatos et al. 2018, 2020) is also likely to be used in the same terms (Papadakis et al., 2015).** Finally, Galiana-50 Merino et al. (2022) proved the viability of using radon measurements to estimate the daily seismic activity rate."*

References:

De Santis, A., Abbattista, C., Alfonsi, L., Amoruso, L., Campuzano, S., Carbone, M., Cesaroni, C., Cianchini, G., De Franceschi, G., De Santis, A., Di Giovambattista, R., Marchetti, D., Martino, L., Perrone, L., Piscini, A., Rainone, M., Soldani, M., Spogli, L., Santoro, F., "Geosystemics View of Earthquakes", Entropy 21, 412-442 (2019).

Papadakis G, Vallianatos F, Sammonds P. A nonextensive statistical physics analysis of the 1995 Kobe, Japan earthquake. Pure ApplGeophys, 2015; 172:1923–31. https://doi.org/10.1007/s00024-014-0876-x.

Posadas, A., Morales, J., Ibáñez, J., Posadas-Garzon, A., Shaking earth: Non-linear seismic processes and the second law of thermodynamics: A case study from Canterbury (New Zealand) earthquakes, Chaos, Solitons and Fractals. Nonlinear Science, and Nonequilibrium and Complex Phenomena, 151, 2022. doi.org/10.1016/j.chaos.2021.111243.

Posadas, A., Morales, J., Posadas-Garzon, A., Earthquakes and entropy: Characterization of occurrence of earthquakes in southern Spain and Alboran Sea, Chaos: An Interdisciplinary Journal of Nonlinear Science, 31 (4), 2021. doi.org/10.1063/5.0031844.

Vallianatos, F., Michas, G., Papadakis., G., Nonextensive Statistical Seismology: An Overview. Complexity of Seismic Time Series. In Chelidze, T., Vallianatos, F., Telesca, L., editors. Complexity of Seismic Time Series: Measurement and Application. Elsevier, 2018, p25-59. https://doi.org/10.1016/B978-0-12-813138-1.00002-X.

Vallianatos, F., Michas, G., Complexity of Fracturing in Terms of Non-Extensive Statistical Physics: From Earthquake Faults to Arctic Sea Ice Fracturing, Entropy 2020, 22, 1194; doi:10.3390/e22111194.

ANSWER TO REVIEWER:

The manuscript has been changed and the references have been added as they are fitting for the state-of-the-art introduction.

6. **Figure and table captions are too short. One should be able to fully understand the meaning of the figure or table without appealing to the body of the manuscript. For example, in table 1 caption it is not explained what R is and what S is (nor in the main text) or, in figures 2 and 3, definition of spatial cell-event distance and the inter-event distances should be indicated. On the whole, a more detailed, broad and comprehensive captions are needed.**

ANSWER TO REVIEWER:

We agree that explanation is due for parameters such as R, inter-event and spatial cell-event distances. The following changes have been made:

The R^2 parameter has been referenced in both the captions of the tables and in lines 183-185 as seen in answer to question 3. As for the inter-event and spatial cell-event distances, these quantities have been now defined in lines 122-125 as follows:

> *"First, it is necessary to study both the inter-event distance and the spatial cell-event distance distribution. The inter-event distance is the distance between any two events of the catalogue (in any of case studies the distances between all the event pairs will be calculated), as for the spatial-cell event distance, it is defined as the distance between a spatial grid cell and an event from the catalogue (as in the former definition the distances between all the spatial cells and all the events will be calculated)."*

The captions of figures 1-3 have been modified in order to be more descriptive:

> *"Figure 1. Frequency-magnitude plot for the Italian CPTI15 earthquake catalogue. A total of 56309 events have been used."*

> *"Figure 2. Histograms of the distances between every spatial cell and event pair (spatial cell-event distances) of the CPTI15 Italian earthquake catalogue at different time periods."*

> *"Figure 3. Histograms of the distances between every event pair (inter-event distances) of the CPTI15 Italian earthquake catalogue at different time periods."*