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Title: On the calculus of smoothing kernels for seismic parameter spatial mapping: methodology and examples

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This paper presents a new method to display information about seismic parameters of a certain area by using smoothing kernels, that is, the spatial mapping of relevant information to enable operational earthquake forecasting (OEF) and, also, to define the tectonic source profiling. The scope of Natural Hazards and Earth System Sciences (NHESS) covers earthquake hazards and, in fact, some of the aims of the journal are (1) the study of the evolution of natural systems towards extreme conditions, and the detection and monitoring of precursors of the evolution, (2) the detection, monitoring, and modelling of natural phenomena, and the integration of measurements and models for the understanding and forecasting of the behaviour and the spatial and temporal evolution of hazardous natural events as well as their consequences and (3) the design, development, experimentation, and validation of new techniques, methods, and tools for the detection, mapping, monitoring, and modelling of natural hazards and their human, environmental, and societal consequences. Without a shadow of a doubt, the topic is suitable for Natural Hazards and Earth System Sciences and it is of broad international interest. Due to I am not a native English speaker, I have not any recommendation about English grammar or use of this language.

Basically, the proposed method replaces the spatial cell-event distance by the inter-event distances to built-up the kernel function; this has the advantage that while in the former it is necessary to take an arbitrary distance (7.5 km) from which the events are regard as to be uncorrelated, in the latter this is not necessary. In order to obtain the smoothing kernel, two functions have been considered as fit for the data: the Gaussian function and an exponential-like function and after fitting data, authors concluded that the second one is better than the first one. Then, they calibrated the function by using a previous study in Italy earthquakes catalogue (with respect to Taroni et al, 2021 paper) and finally, they applied the method to Lorca (Spain) earthquakes and to Vancrea (Romania) earthquakes.

In my opinion, this study on the whole is up to international standards and the assumptions to apply the new methodology from authors are reasonable. Moreover, I think that several meaningful conclusions are reached from results. I strongly believe that the revised manuscript has an excellent scientific quality and, of course, there is not misconceptions.

However, I am concern about some aspects and statements in the paper and I really recommend authors to incorporate them in order to clarify the final manuscript.

1. To my point of view, 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 hypocentres locations (and therefore, time sensitivity of the located hypocentres), etc.

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):

> *"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 Aki (1965)."*

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.

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.

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

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."*
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> *References:*
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> *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).*

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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.

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 is R and what is S (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.

Finally, in my view, the paper is concise and properly organized (introduction, methodology, results and discussion and, at the end, conclusions). Reading only the title, I can easily imagine what the aim of the paper is and then, reading the abstract, I can get enough information about methods and conclusions of the manuscript. Concerning with data, they are public and they are available from corresponding author upon request. In addition, conclusions are directly supported by data.

In short, the present manuscript is worthwhile of publication in Natural Hazards and Earth System Sciences provided that the aforementioned points will be appropriately addressed by the authors.