Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-128-RC1, 2020

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Evaluation of global seismicity along Northern and Southern hemispheres" *by* Olaide Sakiru Hammed et al.

Anonymous Referee #1

Received and published: 5 June 2020

general comment: The paper by Hammed et al., attempts to estimate the Gutenberg-Richter law b-value, depth distribution and seismic energy release of earthquakes occurred across latitudinal zones, parallel to the equator. In general, the manuscript is way too brief and its content is inadequate to sufficiently cover such a topic. Most important, there are major methodological and conceptual issues leading to ambiguous results and erroneous interpretations. As a result, the manuscript's scientific quality, scientific significance and presentation quality do not meet the expectations of NHESS. Therefore it cannot be accepted for publication.

specific comments: The manuscript is rather short and the language is often plain, needing revision in several points. The quality of figures is also rather poor. The reference list could be updated with more relevant and more recent studies. Even the

title 'Evaluation of global seismicity along Northern 1 and Southern hemispheres' is misleading, since the analysis is focused in a narrow zone (20oS to 20oN) and not to the entire hemispheres. However, linguistic and technical issues are only secondary in comparison with the major methodological and conceptual issues summarized below: 1) Concept. The authors estimate seismicity parameters (b-values, energy release and depth distribution) in 'the study area, which is a strip of width 40o around the globe with the equator at the middle, was subdivided into four regions, each of 5o widths along the Northern and Southern hemispheres' (lines 57-59 of the manuscript). This approach leads to a cascade of conceptual issues which make the study problematic. What is the physical meaning of selecting such areas? A global latitudinal division leads to datasets with events belonging to completely different seismogenic zones, thus demonstrating different properties such as activity rate, magnitude distribution, focal mechanisms, relative plate velocities, stress-strain accumulation, and depth distribution. This horizontal division followed by the authors dissects specific seismotectonic zones with strongly variable properties. For the same reason, technical issues such as hypocentral uncertainties and completeness magnitude are also strongly heterogeneous within each zone. The division and study of smaller and tectonically defined areas (such as the Flinn–Engdahl regions), would be a preferable approach. 2) Methodology: There is no information on how the b-values are calculated. It seems to me that the authors use the least square technique, which has been continuously proven to be inferior to the widely accepted maximum likelihood estimator (e.g. Aki, 1965). The completeness of the datasets is not thoroughly justified as well. How Mc=6.0 arises? Is this level the same for all zones? Is this level homogeneous across each zone? Is this level the same throughout the 55 years of the study period (shown in figure 16)? The authors themselves indicate that 'This deviation could have been due to improved monitoring of the equatorial region' (lines 157-158). Nevertheless, they conclude that 'The temporal distribution of seismicity along the hemispheres revealed that the earthquakes increase with time, and decade wise'. This conclusion is not supported at all by the analysis they present. It is also unclear, which magnitude scale the authors use. Equa-

tions 2 and 3 refer to body wave (mb) and surface wave (Ms) magnitudes, however, there is no clear statement which one (or any other) was used for their analysis. Both mb and Ms saturate ($\sim$6.5 and $\sim$8.0, respectively), therefore they are inappropriate for studying global seismicity with magnitudes up to 9.0.

3) Results: The b-values were found to vary between 0.82-1.16. Even assuming that these values are uniform within each zone and are correctly estimated (see point 2), do they really differ? The authors should provide an analysis to show that the differences of b-values in each zone are statistical significant. The same stands for the seismic activity rates and generally, with any quantitative comparison. According to the authors the smallest b-value and largest energy release occurs in Northern Hemisphere 0o-5oN (figure 2). This is tightly connected with the fact that in this area the two strongest events (M=9.0 and M=8.6) occurred in this area. All other events in all zones have M$\leq$8.5. These M>8.5 are very strong events dominating the energy plot. The authors conclude that 'There is a strong plausibility that the regions around the equator may be prone to disastrous earthquakes in the future' (lines 239-240). This conclusion is definitely not supported by the evidence they provide. Earthquakes with M>8.5 are very rare and the instrumental record does not provide adequate evidence to study how these events occur during centuries, even millennia. The fact that an M>9.0 event has not been recorded during a $\sim$50 year period does not provide any evidence that such events are not plausible.

technical corrections: Technical corrections are of secondary importance and were not listed in this review.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-128, 2020.