

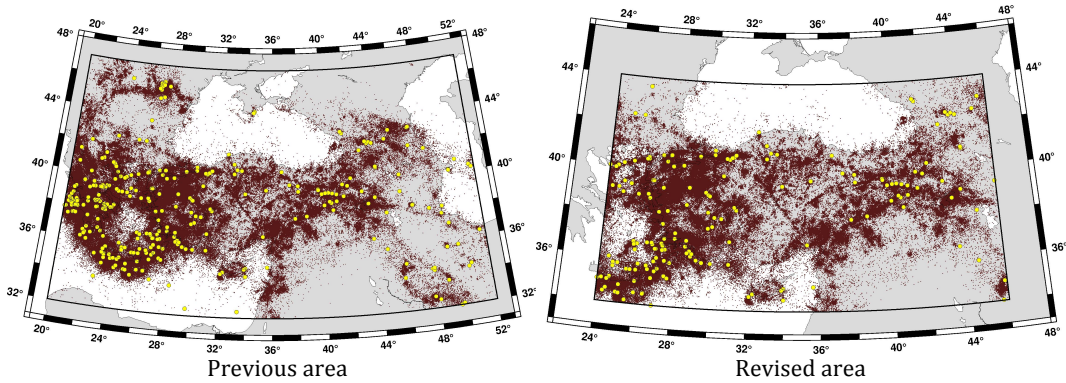
Response to the Referee #1
for
“A Homogeneous Earthquake Catalogue for Turkey ~~and Surrounding Region~~”
by Onur Tan

General

First, I want to thank all referees for their vulnerable comments. I revised the database and manuscript (MS) according to their comments.

The main revisions:

- The title was changed: "A Homogeneous Earthquake Catalogue for Turkey"
- The catalogue area was reduced according to the common comments: 34°-44° N 24°-46° E



- The events in the period of Jan-Oct 2018 were included because ISC updated the database.
- $M_w^* = 0.0$ events were removed from the database.
- The database was reanalysed.
- All numerical outputs, tables, and figures were updated

Response to Referee #1

> > All comments of Referee #1 on the supplementary PDF file (commented manuscript) are considered in detail.

The manuscript provides an earthquake catalogue. According to the title the earthquake catalogue refers to Turkey and Surrounding Region for the instrumental period 1900-2017, which could be of interest to geoscientists. But, the assessed region is too large, including many, event not neighboring to Turkey countries. It is strongly suggested to provide the earthquake catalogue of Turkey (and close surroundings) and not of other neighboring or countries with different seismotectonic regime, such as Albania, Romania, Greece, Syria or Iraq.

Of course, given that the area must be restricted all numbers and percentages mentioned in the manuscript must be updated.

The catalogue area was restricted, and all outputs were updated.

A description of the seismicity map taking into account the seismotectonics is missing. Which are the most seismically active regions and why?

I added a short information about seismicity into the Introduction section as follow:

The western Anatolia is the most seismically active part of Turkey. Both N-S extension in Aegean and the westward motion of Anatolian Plate along the NAFZ cause a dense deformation with small to moderate

earthquakes in western Turkey. The North and East Anatolian Fault zones are also the primary seismic sources that generate destructive earthquakes ($M_w \geq 6$).

Another question is if the catalogue is really compiled in order to be used in seismic hazard studies, as stated by the author several times. Are the different magnitude scales and the Institutes that calculated the magnitude needed for such studies or by civil engineers? The answer is rather negative. So, the author should analyze the advantages of the proposed catalogue.

The catalogue area is restricted, and all events with zero magnitudes are excluded.

The advantage of the catalogue is also mentioned in the Conclusion part.

Another major issue is that the use of the English language is problematic. The proper use of English language is required. The author should pay attention and be sure to avoid obvious mistakes. Certain points have been corrected but a person with experienced knowledge of the English language should check and correct the manuscript.

The MS was checked for grammatical errors. The mistakes were corrected.

Detailed comments, corrections and additions are included, mainly as sticky notes, in the pdf file: nhess-2020-368_reviewer_1

> > All comments on the supplementary PDF file (commented manuscript) are considered in detail.

Some of the main comments (also included in the .pdf file) are:

1. Title and region: The title of the paper is not consistent with the selected region. The selected region ($32^\circ - 47^\circ \text{ N}$, $20^\circ - 52^\circ \text{ E}$) is too large and not represented by the term "Turkey and Surrounding Region" of the title. It includes all the Balkan countries (e.g. Albania, Bulgaria, Greece, Serbia etc), Caucasus and Arabian countries, a totally inhomogeneous area. This is not "Turkey and Surrounding Region". I strongly suggest to restrict the study area to what the title says, i.e. to the following region: $35^\circ - 44^\circ \text{ N}$, $25^\circ - 46^\circ \text{ E}$.

As mentioned in the General section of this document, the study area was restricted ($34^\circ\text{-}44^\circ\text{N}$ $24^\circ\text{-}46^\circ\text{E}$).

2. Lines 39-40: "but it cannot be proved this type of man-made faults" What do you mean? Inappropriate use of the English language. Rephrase and explain what you mean.

This sentence was removed because it was not suitable for the context.

3. Line 42: "At this point, essential of a homogenised catalogue with a common magnitude arises." What do you mean? Inappropriate use of the English language. Rephrase and explain what you mean. Many other similar cases have been marked at the pdf file.

The sentences were rephrased as follows:

One common magnitude scale should be used to standardise analyses in the studies based on the parametric data such as hazard mitigation. Therefore, a homogenized catalogue with a unified magnitude scale becomes essential. In the last two decades, the studies on unifying earthquake magnitudes and generating improved catalogues are carried out for different regions on the Earth (i.e. Grünthal et al., 2009; Chang et al., 2016; Manchuel et al., 2018; Rovida et al., 2020).

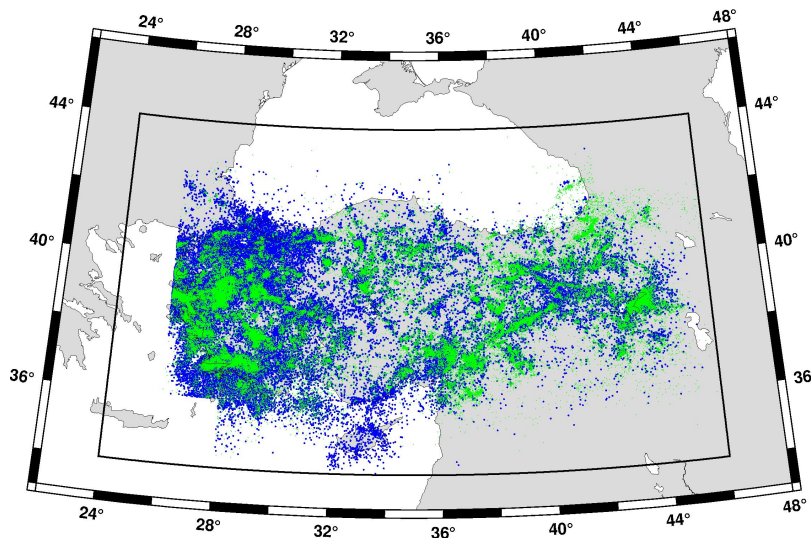
4. Lines 88-89: "and location procedure that is recently used by the ISC is implemented to all data." It should be "a location procedure". The author should briefly describe the location procedure.

The ISC location procedure is not applied in this study. Therefore the detail of the ISC process is not mentioned in the manuscript. The sentence is rewritten, and the reference of the location procedure is cited:

The ISC finished rebuilding the entire database in 2020 by utilizing a new location algorithm (Bondár and Storchak, 2011) with the ak135 seismic velocity model (Kennett et al., 1995). Furthermore, previously unavailable hypocentre and station phase readings from the permanent and temporary networks are added to the rebuild bulletin (ISC, 2020; Storchac et al., 2017). Therefore, the latest and revised international dataset is used in this study.

5. Lines 104-107: "In turn, ISK (Kandilli Observatory and Earthquake Research Institute, KOERI) and DDA (General Directorate of Disaster Affair until September 2017; Disaster and Emergency Management Presidency - AFAD after October 2017), which are the national seismological networks in Turkey, are selected." This is not rational for the huge area selected. Why use the ISK or DDA solution for an event that occurred in Bulgaria or Greece? This selection would be valid if the catalogue was restricted to Turkey, as proposed.

The Turkish seismology agencies (ISK and DDA) do not locate the events in far away from Turkey because the neighbouring countries are out of the networks. Rarely, moderate events in the neighbouring countries are reported by them. Out of the international agencies, e.g. the events in Greece and Bulgaria are reported by Obs. of Athens and Sofia National Institute of Geophysics, respectively. The selection algorithm used in this study (flowchart in Fig. 2) is checking the location (see the map below). If an event far away from the Turkish border is reported by ISK or DDA, the hypocentre parameters of both agencies are omitted and data of the local agencies is selected.



The events located by KOERI (blue) and DDA/AFAD (green) in the homogenised catalogue.

6. Line 116: "On the other hand, we have no evidence for that an institute calculates true magnitude for an earthquake." There are several sentences like this one in the manuscript (e.g. the interested area). All these should be rephrased. The proper use of English language is required. The author must pay attention in order to avoid such obvious mistakes.

Thank you very much. I checked and corrected this type of mistakes.

7. Line 123: "These limits cover an event that occurred 350 km away from Turkish borders". This is not true. The distances from Turkish borders reach or even exceed 500 km and this has to be changed.

8. Lines 125-126: "The study area also covers the Balkans, Black Sea, Caucasus, Syria, northern Iraq and northwest of Iran. The final catalogue contains 697,139 events occurred in the period from 1900 to the

end of 2017.” There is no reason to include such a huge and inhomogeneous area. It must be restricted (e.g. to 35° - 44° N, 25° - 46° E). So, all these numbers will change.

9. Lines 137-138: “However, the rate runs up to 6% only in 2010 and 2011 because ~5000 events without a magnitude are reported by the TIF (Georgia) for the Caucasus earthquakes.” Why do you need earthquakes from Georgia and Caucasus? These problems will disappear by changing the study area.

10. Lines: 139-140: “The earthquakes with no magnitude assigned are also included in the catalogue to be useful in future studies.” I strongly disagree. The author claims that the proposed catalogue will serve for seismic hazard studies. It is obvious that earthquakes with no magnitude are totally useless for such studies. Earthquakes with no magnitude assigned must be removed.

11. Lines 160-162: “After declustering, the earthquakes occurred after 1980 are selected because the national station networks and data analyses procedure become much more reliable in Turkey.” Again, this is not rational for the presented catalogue. It will be correct to do this, only if the catalogue is restricted to Turkey. Why should 1980 be correct for Georgia, Albania or Cyprus? The region must be restricted to Turkey (e.g. to 35°-44°N, 25°-46°E).

12. Lines 273-275: “The contour map given in Fig. 8 shows that the homogenised catalogue is complete down to M_w^* 3.0- 3.2 in Turkey and 3.2-3.3 in Greece. M_c increases dramatically up to 4.0-4.5 in the Caucasus and its abrupt transition follows the eastern border of Turkey” All the values referring to Greece and Caucasus will be removed if the catalogue is restricted in Turkey, as stated in the title.

Because the area is restricted, the comments in #7, 8, 9, 11, and 12 are disappeared.

The events with no magnitude are excluded from the catalogue as commented in #10. I agree with the referee.

According to the similar comments from the other referees, I did not use an M_c cut-off for the spatial distribution calculation in the revised version. After adding new events in Jan-Oct 2018, I re-calculated the b-value and M_c for the period of 1964-2018. Fig 7 and 8 were updated.

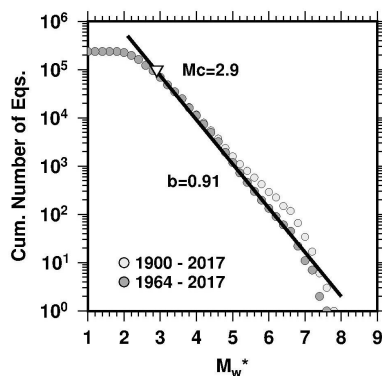


Fig 7 – previous

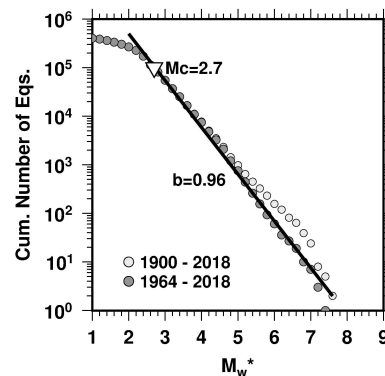


Fig 7 - updated

13. Lines 287-288: “Unfortunately, the importance of a large number of parameters and their uncertainties in a catalogue are missed, and the given datasets less useful for the studies other than seismic hazard analyses.” Apart, from the incorrect use of the English language in this sentence as well, which is a major disadvantage of the submitted manuscript, it has been stated several times that the main scope of the compilation of the proposed catalogue is to use it in seismic hazard studies. Now the contrary is implied, i.e. that other catalogues with less parameters are (which I believe is indeed the case) sufficient for seismic hazard studies. What is the case according to the author? Please clarify.

I am sorry for the discrepancy in the sentences. According to my experience in the SSHAC Level-2 for the Sinop Nuclear Power Plant (Turkey), the uncertainties of all available parameters must be included in the homogenised catalogue. I used the same steps given in Fig. 2 to prepare the catalogue for the power plant.

This part was rewritten as follows:

Unfortunately, the importance of providing more parameters and their uncertainties in the previous catalogues are missed. For example, the SSG-9 (item #3.27i) safety document of the International Atomic Agency for nuclear power plant requires the uncertainties of all earthquake parameters. Therefore, the previously given datasets are less useful, especially for seismic hazard analyses.