

## ***Interactive comment on “Evaluation of changes in different climates of Iran, using De Martonne index and Mann–Kendall trend test” by A. R. Zareiee***

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Aridity index can be a measure for the tracking the climate change. The idea of mapping the local changes in the values of the indices over time to understand the changes in climate is not new. Zareiee (author) used the concept to identify the pattern of climate changes in Iran during a forty years period 1967–2005. Study based on the concept has also been carried out previously in Iran. Some'e et al. (2013) [Theor Appl Climatol (2013) 111:149] analyzed the trends of aridity index in the arid and semi-arid regions of Iran with same period of data 1966–2005 using the Mann–Kendall test as well as Theil–Sen's slope estimator. However, I believe that the present work of Zareiee is different from the previous studies. In the present study, author tried to show the changes

C518

in climatic zones (area) over the time period 1967–2005. The obtained results are also consistent with that obtained by Some'e (2013) where they found that aridity is increasing significantly in both arid and semi-arid region. I believe that the paper addressed relevant to the scope of NHESS. However, the paper does not present new data or novel methods. The obtained results may be interesting if properly presented. I have several sever concerns about the paper. In has been mentioned in the abstract as well as in introduction of the paper that the objective of the study is to identify the pattern of climate changes in Iran using De Martonne index. However, nothing has been reviewed or mentioned about previous research on climate change in Iran, study of aridity trends in the region, or similar studies in other parts of the world. A discussion has been made on climate change vulnerability, risk and adaptation in developing countries. But it does not have much value to establish the background of the study with such objectives.

Once it is mentioned that the stations are fairly distributed over the country. In the same paragraph, it is mentioned that the distribution of stations is rather sparsely in the central and south- eastern areas and densely in the northwestern part. It is also mentioned that topography of the region is very much heterogeneous. It can also be seen from the figure (Figure 1). I have doubt on the accuracy of climatic zones delineated with such number and distribution of stations for such heterogeneous region.

Detail description of stations is given in Table 1, but it is not mentioned what station belongs to which climatic zone. It is necessary to know how many stations are there in hyper arid, Hyper Humid and other zones. I suggest to prepare a map of climatic zone based on average data over the whole time period and show the station locations on that map.

Method used for estimation of aridity index and reveal the trends are not justified. Numerous numerical indices have been proposed to define climatic zones. All the methods do not delineate the exact boundaries between lands having different levels of aridity, although there is an agreement over the general location of climatic zones. Therefore, result may be different if different aridity index estimation methods are used.

C519

I suggest considering at least two more simple but robust methods along with De Martonne aridity index to show the changes.

It can be seen from the graphs in Figure 3 that in some years the size of humid zone and hyper-humid zone is zero. I assume that rainfalls recorded in those years in the stations located in those zones are very less and therefore, De Martonne index is less in those years. Is it justifiable to indicate that the area is no more humid? I believe that climatic zones are defined using long-term record. Rainfall deviations in few years do not change the defined climate of an area.

The results show that hyper-arid zone is increasing, but arid zone is not changing. How it is possible? The results should be critically analyzed for meaningful conclusions.

Figure 2 is not clear. I think bigger and clear maps for the years 1967, 1975, 1985, 1995 and 2005 is OK to show the change. I also believe that it is very essential to prepare another map to show the changes (significant changes) in climate regions over the whole period. The map can help to justify your conclusion more clearly.

In Table 5, change in humid region (A5) is 0.145 and p value is 0.00. However, it is not shown as significant. From the graph (3f), it seems a declining trend in humid area. But the obtained value using Mann-Kendall test show highly significant increasing trend. It can also be noticed that the trend in Humid area will be different if a single value (1969) is discarded. Author should go through proper quality control of data before using it. Impact of outliers on trend should be checked if those are present in data.

The method section is not clear. What are CV% and E% in equation (1)? What are t and R in equation 2? The paper is written in a very poor way. How N comes down to 37.5 after using equation 2. It has been mentioned that "the adequate number of station was determined with suitable scatter Eq. (1)". In another line it has been mentioned that "To determine the common duration of the suitable statistic period for all the stations, Eq. (2) was used". What those statements mean? The statements and methods are very ambiguous. The methods should be properly discussed and justified.

C520

First paragraph of conclusion is same as the results and discussion. The results are also contradictory. It is mentioned that the surface percent of the arid categories have had an insignificant trend. In the next sentence, it is mentioned that the surface percent of the arid areas of Iran is going to be increased. This contradiction can be found in both result and conclusion sections.

Table 4 is redundant as the values are presented as graphs in Figure 3.

Over all the quality of the paper is poor. The paper is not written clearly. Related literature are not reviewed properly. The methods used in the study are not discussed properly. Critical analyses of the results are not present in the paper. Finally, the conclusions drawn from the results are not appropriate or properly justified.

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C521