

Anonymous Referee #2

Received and published: 26 May 2019

Comments on Bivariate trend assessment of dust storm frequency in relation to climate drivers by Reza Modarres

This paper examines the existent statistical relationship between the observed trend in the frequency of dust storms and the trends of a set of climatic variables recorded at 25 synoptic stations distributed over semi-arid and arid areas of central-eastern Iran. I found the subject and the aims of the study very interesting, considering that it is always interesting to know which climate variables contribute to dust storms phenomenon in the region. The usage of univariate MK test to examine trends in the considered climate variable is very common in climate analysis. However, the application of bivariate MK tests to uncover the possible co-variability of trends of dust storm frequency and the climate variables (annual rainfall, annual maximum wind speed, average wind speed, annual maximum temperature, and average temperature) is relatively new (as far as I know), particularly for the region which is heavily prone to frequent dust storms. I think the manuscript needs an in-depth revision in order to improve the quality of the paper before possible publication. Below are my comments that should be taken into consideration.

Major comments:

1- Although the results of bivariate MK trend analysis show a statistical association between dust storm frequency and some of the climate variables at some stations more convenience justifications are required for the locations where the opposite trends observed. It should also be valuable to use alternative approaches (if available) to uncover joint variability of dust storm frequency and climate variables and examine if they also confirm the bivariate MK test.

REPLY: In this manuscript we introduce bivariate trend test. If there is any other alternative model, it can be applied for future studies as the author has now suggested some of them in section 6. As a pioneer work on dust storm bivariate trend, this study shows the advantage of the proposed methods to show how change in climate variables may affect change in dust storm. However, many more studies are required for better understanding of this process in different regions of the world.

2- In the text, the author divided the stations into 3 groups based on the direction of the trend signs but when looking in the tables it is impossible to distinguish between the groups of stations. Therefore, I suggest adding another column in Table 1 through 6 and assign the group of each station there.

REPLY: The groups were assigned to the tables.

Moreover, showing the results of the test in Tables is the easiest way for illustrating the results but it is less informative and tractable for the readers who are not familiar with the region. Particularly, from climatological and geographical points of view, it is more interesting to see if the stations falling in the same group come from the same geographical

area. Therefore, I may suggest illustrating the results of the MK trends test through figures (maps) rather than by tables. In this way, the results can be graphically represented and the geographical logic behind the achieved results can be easily understood by the readers.

REPLY: The author comment is correct but now in the revised version we have added 6 more figures and adding another one will exceed the essential number of figures. If there is any regional group, the reader can easily see the map of station locations.

3- The author used short sentences to describe the results. In many cases, a given sentence can be combined with the subsequent sentence to give more meaningful information. For example, the two sentences in lines 32-35 (abstract) should be combined because the second sentence has no link to the previous sentence.

REPLY: The mentioned sentence was rewritten.

4- I observed many grammatical and typesetting errors in the manuscript. Therefore, I suggest a careful reconsideration of the English style of the text.

REPLY: The author went through the manuscript and correct as many grammatical errors as possible.

Minor comments:

1- Line 37: " : : . in climatic variables". Add the before climate.

REPLY: Corrected

2- Line 49: replace play significant with play a significant:

REPLY: Corrected.

3- Line 56: relevance to what?. I think something is missing here. The sentences should be controlled and rephrase.

REPLY: the sentence was revised.

4- Lines 67-68: This might not be always the case, so it is better to indicate the region where Gao et al studied the subject. Additionally, the sentence should be rewritten as it is not correct in the present form.

REPLY: The region was added and the sentence was corrected.

5- Line 76: Please delete "be helpful".

6- REPLY: deleted.

7- Line 85: Use through the climate change instead of through climate change.

REPLY: Corrected.

8- Line 109-110 partly is a repetition of the sentence given in line 104.

REPLY: The paragraph describing the region was moved to the first part of section 2 and repletion was deleted.

8- Line 110: the order of the values should be reversed i.,e., between 50 and 250 mm. The sentence given here is not the correct statement for reasoning the low precipitation in the region, please refer to Razinei et a., (2014) who analyzed precipitation variability in Iran using GPCC precipitation dataset.

REPLY: In definition of arid regions of Iran, 50-100 mm of annual rainfall may be mentioned but this study includes arid and semi- arid regions where 50-250 mm would be correct.

9- Line 114: replace variable with variables.

REPLY: Corrected.

10- Line 115: replace emission change with emission changed.

REPLY: Corrected.

11- Line 116: replace tend with trend.

REPLY: Corrected.

12- Line 170: delete “does not”.

REPLY: corrected

13- Line 170: replace (n=10) with (n<=10).

REPLY: corrected.

14- Line 171: replace sample size with sample sizes.

REPLY: corrected.

15- Line 174: replace the best method with the best result.

REPLY: Corrected.

16- Line 183: replace across region with across the region.

REPLY: Corrected

17- Line 196: How is it possible ”different and similar sign”?. I think this sentence need rephrasing.

REPLY: This term indicates if the sign of multivariate MK is the same as the sign of univariate MK or not. However, the sentence is now changed for a better description.

17-Line 251: replace wins with wind.

REPLY: corrected

18-Line 305: delete “temporal”.

REPLY: Corrected.

19-Line 318: effective or reduce the effects?

REPLY: it means "reduce the effectiveness of climate variable". The sentence was corrected.