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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Spatial and temporal patterns of recent and future climate extremes in the Eastern Mediterranean and Middle East region" *by* E. Kostopoulou et al.

E. Kostopoulou et al.

ekostopoulou@aegean.gr

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Anonymous Referee #2

The paper "Spatial and temporal patterns of recent and future climate extremes in the Eastern Mediterranean and Middle East region" presents climate indexes for the Eastern Mediterranean region as calculated from one regional climate model for a present day and a future time period, as well as climate indexes calculated from few climate stations. As the region of interest is not well studied, it could be a relevant paper. However, the manuscript has to undergo major revision in order to answer the

following questions: What is the aim of the study? What has been done? Why is the work relevant? What are the limitations of the data and methods used? What are the implications of the results? Especially the methods used need to be described and carefully checked for appropriateness. So far the study is a display of indices calculated from different data. I am missing the bigger picture such as the discussion of analogous studies, the relevance of the results and their critical interpretation. Additionally, there are many imprecise statements, for a selection see specific comments. Also a revision of the title should be considered. The title implies an explicit analysis of the spatial and temporal patterns, but so far a spatial-temporal phenomenon is analyzed point-wise without discussing neither spatial nor temporal dependencies.

We thank the anonymous reviewer for the constructive comments, which have assisted in improving our revised manuscript. Following the reviewers general recommendations we have thoroughly revise our manuscript and reorganise its structure. Some parts of the text were removed in other sections, new ones were added when necessary, many sections were rewritten to incorporate new material and all sections were carefully updated to clearly state the aim of the study, the data and methods used and the results of the study. Additional references were included in the revised manuscript to discuss the findings of relative studies. Ta data used for the calculation of the indices are derived from the PRECIS regional climate model. The observed datasets from stations are only used for the evaluation of the model. In the revised version of the manuscript we have tried to be as explicit as possible about the data and the methods used in the study. The methodology section was particularly revised to inform the reader in a clear and concise manner about the methods employed in the current study. The seasonal cycles have been recalculated, while a new feature added in the evaluation of the Regional Climate Model. We used the non-parametric Kernel density estimator to construct estimates of the density function for every pair of observed and model climate series (for maximum, minimum temperature and precipitation on a seasonal scale). These distributions provided information about the structure of the data and used to determine similarity between the compared series and evaluate the

RCM. In the revised manuscript we present information for all seasons. We have drawn new figures and we now show the present and future trends for maximum, minimum temperature and precipitation for every season. In every case we first discuss all the decadal trends found and then we emphasise on the regions where statistically significant trends have been revealed. Title is changed from 'Spatial and temporal patterns..' to 'Spatio-temporal patterns..'.

By sections: For the introduction, I am missing a section on projected changes of extremes for the studied area (e.g., IPCC SREX and more recent studies). The section on the methodological approach still reads as belonging to the introduction. I am missing an adequate description of the methods used. Also the definition of the indexes is missing. It is inadequate to use the the same methods for temperature as for precipitation. It is vital to give all information on the estimation performed. The section on model evaluation has to be revised completely. Please read the literature! Clearly describe the methods used, discuss the difference between station data and RCM output, if using the control run, state so! If not there should not be a correlation in time. If there exists one, as in temperature, you are most likely detecting the annual cycle. Also, consider using a relative measure for assessing the precipitation bias (mean percentage error, for instance). Since the methods used are not explained, I cannot asses their appropriateness nor the interpretation of the results. The selection of the indices calculated is not motivated. Relevant for human health, for instance, would be the spell length of tropical nights or the length and intensity of heat waves. In general, the results are not well discussed. For example, since you are using absolute thresholds for defining the indices a discussion on the bias of the model would be appropriate. Can you assume the bias to be stationary in a changing climate?

In the revised manuscript we have cited additional studies regarding analysis of extremes, although most studies found in the literature refer to western part of our study region (Mediterranean basin).The methodological section, as we noted in the previous section, has been extensively revised. Methods and the description of extreme climate

indices are explicitly explained in the revised manuscript. The evaluation section was largely revised. We discuss the difference between station data and RCM output. We are using the control run and calculate the correlation in time. We relate the indices studied with implications on socio-economic sectors in EMME. In principal, it is not possible to assume that bias will be stationary in a changing climate. This is discussed in the revised manuscript.

Few specific comments: 4427, 9 "better projections" in what sense? Please rephrase considering that the goodness of projections cannot be assessed; the idea that accuracy today implies accuracy in future is only an assumptions. Response: We agree with the reviewer's comment. This part of the manuscript was largely modified.

4427, 19 Please rephrase "small research". Response: Following the reviewer's suggestion, we have removed the word "small" and we have added this statement in the revised manuscript: 'There are relatively few studies relating to climate extremes for this part of the world due to data unavailability'.

4428, 24-26 Please read carefully, for instance the cited IPCC report, on the use of RCMs. Response: We thank the reviewer for this recommendation. As this sentence seems to be questionable it has been omitted from the revised manuscript. 4428, 24-28 Please do not use acronyms in the introduction without explanation (RCM, CIMME, PRECIS, EMME). Response: We have revised the manuscript and every abbreviated word, in their first occurrence, is now followed by its full form in parentheses.

4429, 2-4 What are their results? Response: In response to this comment, we have modified this part of the text to include results of the study by Lelieveld et al., 2012. We have added the following text in the revised manuscript: '..the study projected increases for nighttime and daytime temperatures particularly during summer, combined with a general drying tendency'.

4429, 16-17 horizontal resolution of 25km? 4429, 17 "easily applicable" - please give appropriate reference. Response: In response to these comments, a revision in this

part of the text was made that improves the clarity of the manuscript, and the following reference is added: Jones, R. G., Noguer, M., Hassell, D. C., Hudson, D., Wilson, S. S., Jenkins, G. J., and Mitchell, J. F. B.: Generating high resolution climate change scenarios using PRECIS, Met Office Hadley Centre, Exeter, UK, 40 pp., 2004.

4430, 12-14 Please give more detail on the outcome of the evaluation. Monthly values are not appropriate for evaluating daily performance for neither daily temperature extremes nor daily precipitation extremes; as well as station data is not suited to evaluate gridded precipitation. Please rephrase throughout the article, as not to convey a false sense of reliability of the model. Response: We have calculated the mean annual cycle using daily data. For the maximum and minimum temperature, we have used a 3-day window centred on the calendar day and then applied a smoothing spline. Similarly we have applied smoothing to the precipitation annual cycle and the results are presented in a redrawing of figure 1. The associated text has been accordingly modified.

4430, 16-18 Statement not suited for methodological approach section, either delete or provide a reference or an argument for it. Response: This statement was removed in section 3.2 'Model simulation of Present-day climate'.

4430,20 "local" needs more explanation since you are working with regional climate model output which is not independent across grid points. Response: We agree with the reviewer, here there is confusion about the scale we have used, and hence the word 'local' was removed and replaced by 'regional'.

4430,20-21 Reference is more appropriate in the introduction. Response: This sentence has been moved to the section 1 'introduction' to improve the flow of the text.

4431,22 "contrasting patterns"? Please rephrase. Response: Following the reviewer's comment we have re-worded this part of the text.

4435, 8-9 spatial patterns instead of distribution Response: The correction was done according to reviewer's recommendation.

4435,12 "projected to continue" you have not shown this since you performed a time-slice based analysis Response: The phrase was removed from the revised version of the manuscript.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 4425, 2013.