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# *Interactive comment on* "Spatio-temporal trends in the hydroclimate of Turkey for the last decades based on two reanalysis datasets" *by* Mustafa Gokmen

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The author would like to thank Referee #2 for his/her valuable and constructive comments. We have considered the comments of Reviewer 2, and hereby try to correspond to them within our knowledge. Based on the comments, we will make the necessary revisions, which will contribute improving the quality of the manuscript. We hope that our replies will satisfy the Referee.

Anonymous Referee #2 Received and published: 18 March 2016

This is a well structured and generally well written paper looking into the trends in temperature and several other hydroclimatological variables over Turkey, using two variants of ERA reanalysis data sets. It is useful for assessing both the long term climate change for the country and how this change manifests itself in large scale gridded data sets. However, the manuscript misses some major points which, in my opinion, should have been included in the analysis and the discussion.

1) As the Anonymous Referee #1 also pointed out, the data should have definitely been analyzed for seasonal trends as well. Turkey is a Mediterranean country that exhibits a distinct seasonality in most of its climatic variables. Therefore, an annual-only trend analysis will obscure possibly stronger seasonal trends, which could have significant implications for climate and hydrology of the country. I advise the author to analyze the data sets for seasonal trends as well (for all variables originally chosen). This may lengthen the paper quite a bit, so the author should be selective in what he discusses and may feel free not to include every figure produced from the new analyses.

Reply of the Author (1): i. As suggested by the Referee #2 (and Referee #1), the spatio-temporal trends in precipitation were analyzed at seasonal scale and the results will included in the revised manuscript.

Figure1. The presence and the direction of Total Precipitation trends by ERA-Interim for a) Winter, b) Spring, c) Summer and d) Autumn.

Figure2. The magnitudes of the Total Precipitation trends (32-years total) by ERA-Interim for a) Winter, b) Spring, c) Summer and d) Autumn.

Figure3. The presence and the direction of Total Precipitation trends by Interim/Land for a) Winter, b) Spring, c) Summer and d) Autumn.

Figure4. The magnitudes of the Total Precipitation trends (32-years total) by Interim/Land for a) Winter, b) Spring, c) Summer and d) Autumn.

As the Reviewer #2 pointed out, to prevent a lengthy paper is an important concern for me. To be selective on including the seasonal analyses of the variables, I assessed the correlations between the variables for both datasets. As the below results reveal, all the hydrological variables (Runoff, SWE and ET over land) are positively correlated with Precipitation for the majority of the study area. Such high correlations also confirm the fact that, land surface models included in Reanalysis datasets (in this case ECMWF) are mainly driven by the atmospheric variables (i.e. Precipitation) rather than land use dynamics (e.g. irrigation). Therefore, I would rather limit the seasonal trend analysis to the Precipitation, as its seasonal trends would also be expressed especially in seasonal trends of Runoff and ET. With respect to Snow Water Equivalent, as the snow accumulation and melting is mostly taking place in Winter and Spring, a separate seasonal analysis of SWE was considered unnecessary.

Figure5. The correlation between (a) total Precipitation and Runoff, (b) total Precipitation and SWE, (c) total Precipitation and ET for Interim/Land dataset.

2) Again, as the Anonymous Referee #1 wrote, the comparison with the raw meteorological observations could have been done in a more systematic manner, using as many stations as possible. For instance, I would like to see a map of inconsistencies between station data and renanalysis data sets in terms of their long term trends. Which stations (or, parts of the country) differ from the reanalysis in terms of trends? Should there be regionally coherent inconsistencies, conclusions about long term climate change would perhaps be problematic. Again, the author should focus on significant results only.

Reply of the Author (2): Thanks to the freely available yearly precipitation data for 81 provinces (source: http://dmi.gov.tr/veridegerlendirme/yillik-toplam-yagis-verileri.aspx#sfU), I applied the trend analysis for the point precipitation data from the 81 meteo-stations and revised Figure 4 accordingly. The overlay of the trends for the in-situ data allowed a better comparison of reanalysis dataset performances geographically, as suggested by the Reviewer #2.

Figure6. The presence of the significant total Precipitation trends by (a) ERA-Interim vs. rain gauges, (b) Interim/Land vs. rain gauges. The magnitudes of 32-years to-

tal Precipitation trends by (c) ERA-Interim vs. rain gauges, (d) Interim/Land vs. rain gauges. In figures a-b, the upward/downward triangles indicate the significant increasing/decreasing trends, circles indicate no trend and the colors indicate the degree of the significance. In figures c-d, the numbers indicate the total increasing/decreasing trends at the stations with significant trends.

With respect to temperature, previously the stations data was only available for an inland basin because that basin was the study area for my (completed) PhD research and the data was available from that. Thanks to the temperature data provided by Dr. Faize Saris from Canakkale 18 Mart University, the comparison now extended to around 100 stations distributed over the country. The revised Figure 2 (shown below) presents an overlaid comparison of the significance (Fig. 2a) and magnitude (Fig. 2b) of the temperature trends by the ERA-Interim and meteo-stations.

Figure7. The comparison of the (a) presence of the significant Air Temperature trends and (b) the magnitudes of 32-years total Air Temperature trends between the ERA-I dataset and the meteo-stations. In Figure (a) upward triangles/circles indicate the presence/absence of increasing trends, while the colors indicate the degree of the significance.

3) The length of the analysis period can have an effect on the significance of trends. Therefore, I advise to extend the analysis to include recent years as well, if this is possible. Since these are major points and could change the manuscript remarkably, I am not going to comment on the technical issues at this time.

Reply of the Author (3): Initially I had started the analysis to cover up-to-date data. However, although ERA-Interim dataset is available up-to-date, the recently introduced Interim/Land dataset is available only for 1979-2010 period. Therefore, the study period had to be limited for the 1979-2010 period to allow a consistent comparison of the trends between the two datasets.

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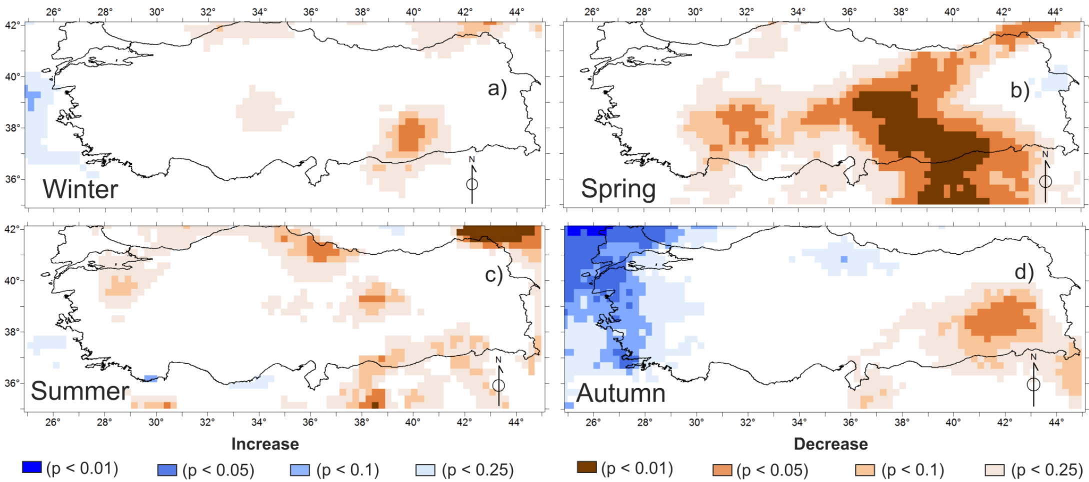


**Fig. 1.** Fig1 The presence and the direction of TotalP trends by ERA-I for a) Winter, b) Spring, c) Summer and d) Autumn

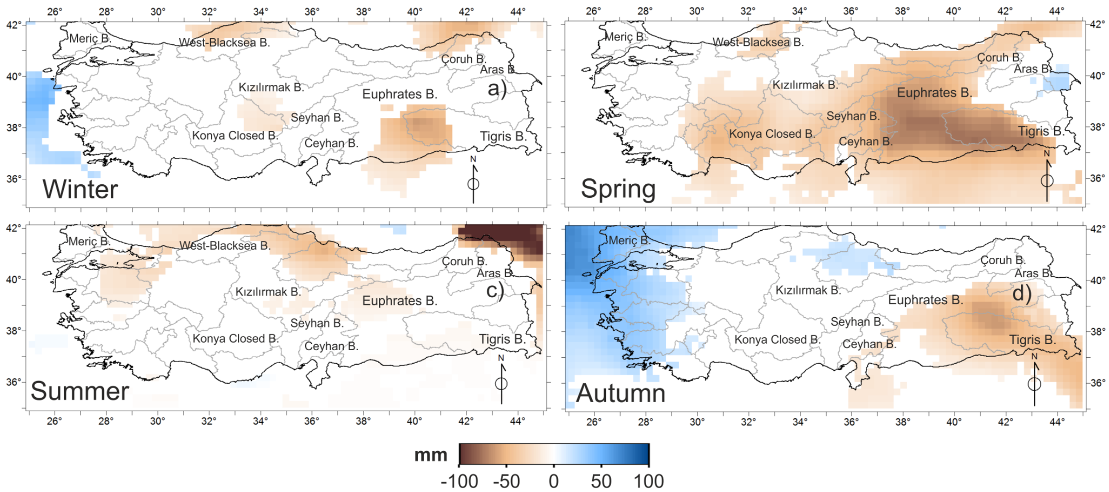


**Fig. 2.** Fig2 The magnitudes of the TotalP trends (32-years total) by ERA-I for a) Winter, b) Spring, c) Summer and d) Autumn

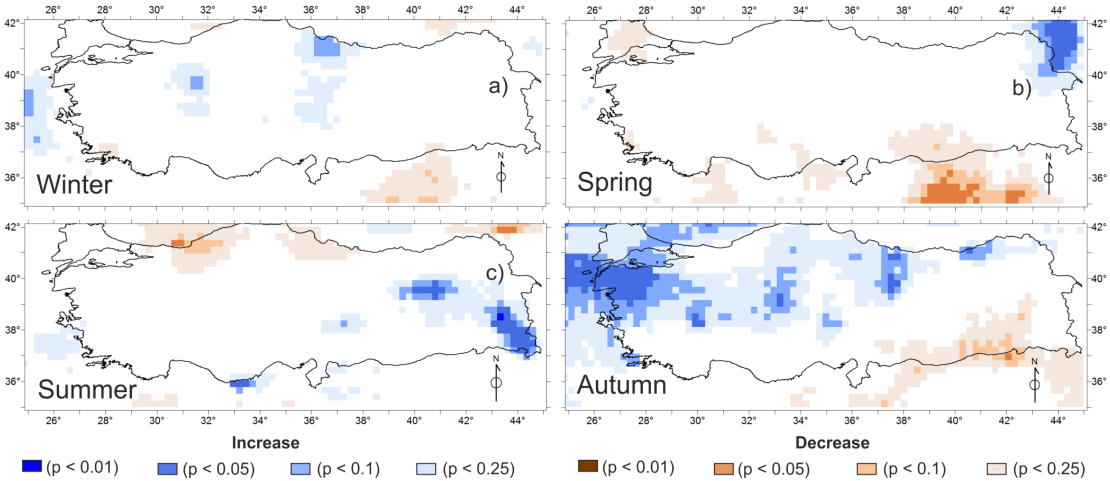


**Fig. 3.** Fig3 The presence and the direction of TotalP trends by I-L for a) Winter, b) Spring, c) Summer and d) Autumn

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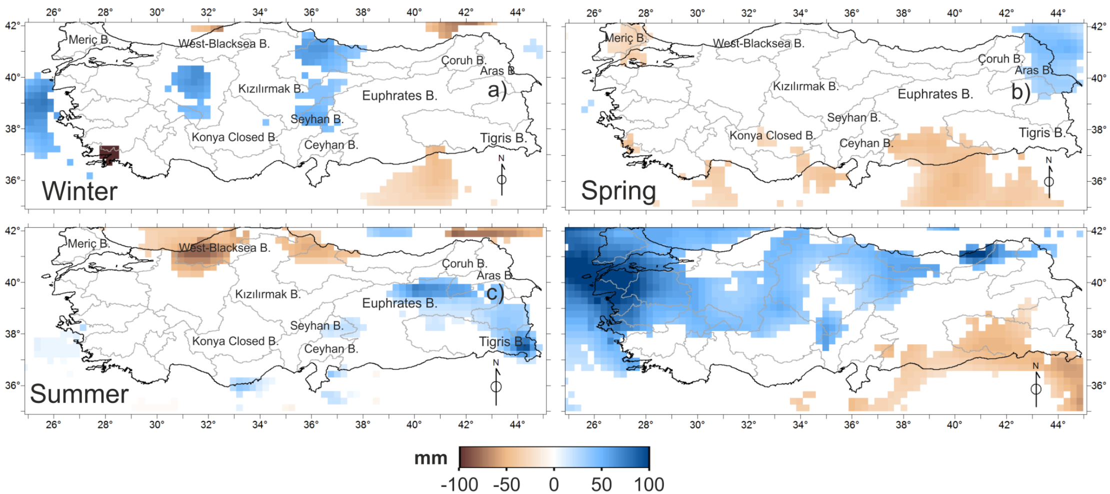


**Fig. 4.** Fig4 The magnitudes of the TotalP trends (32-years total) by I-L for a) Winter, b) Spring, c) Summer and d) Autumn)



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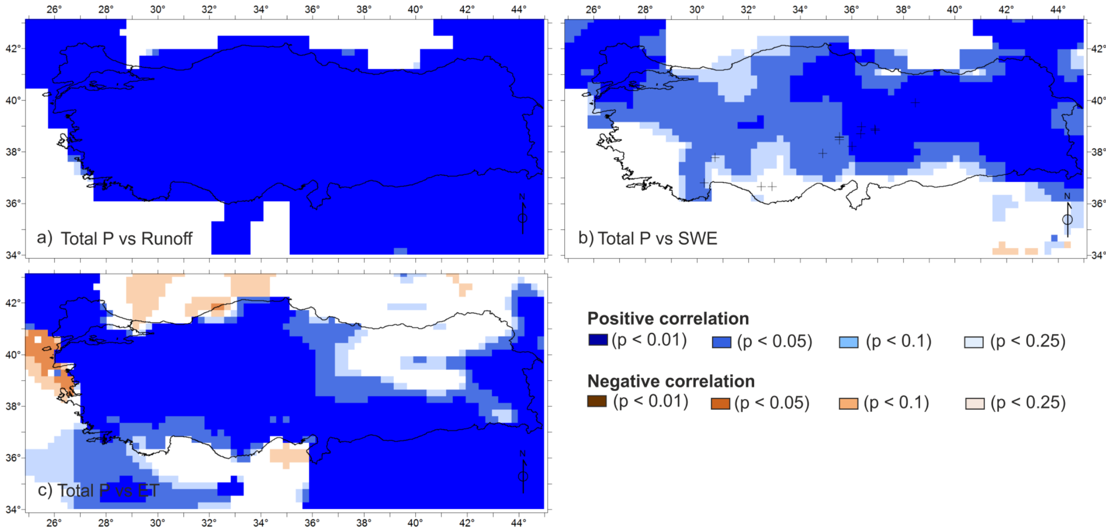


**Fig. 5.** Fig5 The correlation between (a) totalP and Runoff, (b) totalP and SWE, (c) totalP and ET for InterimLand dataset

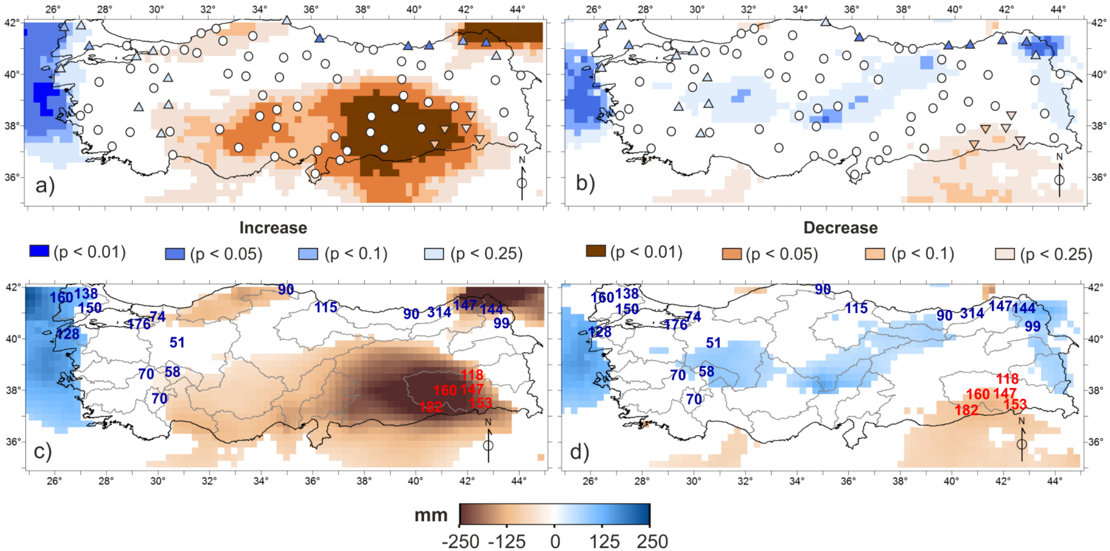


**Fig. 6.** Fig6 The presence of the significant totalP trends by (a) ERA-I vs. rain gauges, (b) I-L vs. rain gauges. The magnitudes of 32-years totalP trends by (c) ERA-I vs. gauges, (d) I-L vs gauges



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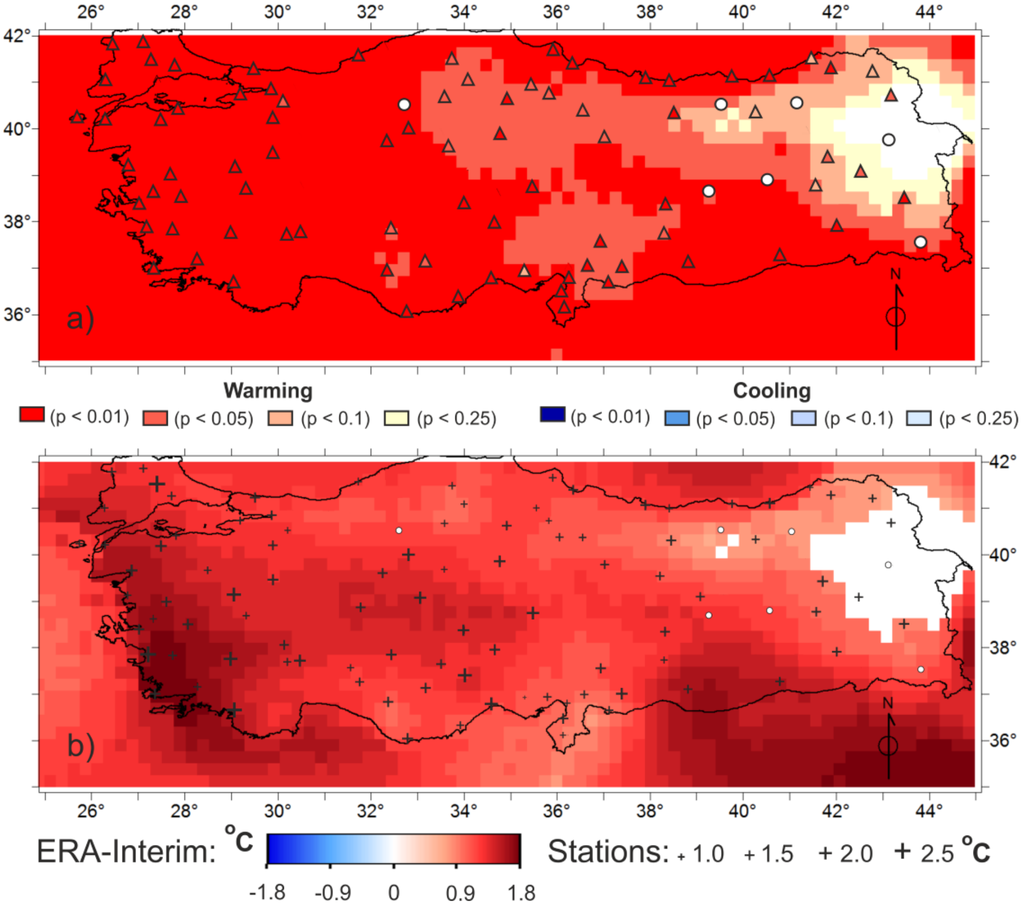


**Fig. 7.** Fig7 The comparison of the (a) presence of the significant Air Temperature trends and (b) the magnitudes of 32-years total Air Temperature trends between the ERA-I dataset and the meteo-stations



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