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Hydrology and Earth System Sciences
Discussions

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 #1 for his/her valuable and constructive comments. We have considered the comments of Reviewer 1, 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 #1 Received and published: 22 February 2016

The author analyzed two sets of reanalysis data (ERA-Interim & ERA-Interim/Land), with regards to hydro-climatic variables. The author found that the two reanalysis data

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have similar patterns over the Turkey, in terms of changes in air temperature. However, for other hydrological variables, the two reanalysis do not have consistent performance. Such kind of assessment of reanalysis products is very much welcomed by the communities. This may help different end-users to understand that the choice of certain reanalysis data is important, as different reanalysis data can lead to different findings and lead to different decision makings. Nevertheless, few concerns arose after reading the manuscript. I suggested a major revision before the further process of this manuscript.

Major concerns: 1. It seems the author used annual value of different hydro-climatic variables to assess the trend and magnitude. On the other hand, certain variable can show strong seasonal behaviors, for example, precipitation. Perhaps, it would be much more useful to investigate precipitation at monthly scale or seasonal scale. Other than that, at different temporal scales, the hydro-climatic variables may have different errors. How these errors addressed before the analysis over the Turkey is not clear.

Reply of the Author (1): As suggested by the Rerefee #1, the spatio-temporal trends in precipitation were also analyzed at seasonal scale (for both ERA-Interim and Interim/Land datasets) and the results will be 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 by Interim-Land for a) Winter, b) Spring, c) Summer and d) Autumn.

With respect to addressing different errors related to the variables, there are dedicated studies which focus on the verification, error analysis o ECMWF Reanalysis datasets (e.g. Szczypta etal2011, Balsamo etal2015) and suitability of them for trend analysis (Dee etal2011). Here, the main objective of this paper is to investigate and inter-compare the spatiotemporal trends in several hydro-climate variables based on two end-products of ECMWF. In this regard, rather than characterizing/addressing the possible errors related to ECMWF's reanalysis datasets, here we try to focus to the inter-comparison of the spatio-temporal trends by two products of ECMWF and where possible validate them with ground data.

2. For air temperature, the author used only 11 in-situ stations to compare with reanalysis products, while for precipitation, only 8 in-situ stations used. However, in the text, the author indicated that there are at least 249 stations. I am wondering if it is possible to get those data and interpolate these in-situ observation to get the gridded product of air temperature and precipitation.

Reply of the Author (2): Previously, the stations temperature data was only available for an in-land 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 (attached Fig.5) presents an overlaid comparison of the significance and magnitude of the temperature trends by the ERA-Interim and meteo-stations.

Figure5. 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-Interim 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.

With respect to precipitation in-situ data, Figure 5 (in the manuscript) was limited with 8 stations due to the readability. Thanks to the availability of yearly precipitation data for 81 provinces freely (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 (attached Fig. 6) accordingly.

Figure6. The presence of the significant totalP trends by (a) ERA-I vs gauges, (b) I-L vs gauges. The magnitudes of 32-years totalP trends by (c) ERA-I vs gauges, (d) I-L vs 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.

The revised figures and the related explanation/discussion will be added in the revised manuscript.

3. For some other variables, you may not have in-situ observation. However, you do can find satellite observation products, for example, for SWE and ET. For runoff, you may find data from GRDC. Without the third independent dataset, it is hard to get the real value of either set of reanalysis data in terms of representing the long-term changes.

Reply of the Author (3): Thanks to the availability of several snow-gauge data that has been used in Gokmen et al. (2013), Fig 6 was revised as shown below. The comparison with the SWE stations data reveal that, despite the differences in terms of SWE magnitudes, SWE trends from Interim/Land dataset is quite similar to the in-situ data: both indicate no significant trends during the study period. Although station#6 (and Interim/Land) shows some increasing trend, the time-series is too short for trend detection. For the same locations, ERA-Interim dataset shows significant decreasing trends of SWE.

Figure7. The presence of the significant SWE trends by (a) ERA-Interim, (b) Interim/Land. The magnitudes of 32-years total SWE trends by (c) ERA-Interim, (d) Interim/Land.

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Figure8 The plots 1-6 indicate the comparison of the yearly SWE from the snow-gauges with the corresponding grids from ERA-Interim and Interim/Land. The locations of the stations are shown in figures 7a-b.

With respect to ET, a comparison with other independent satellite-based ET datasets could not be carried out because the temporal coverage of freely available datasets do not match with the study period of this study (e.g. MOD16 from MODIS is available year 2000 onwards, LSA-SAF ET from MSG-SEVIRI is available starting 2007). On the other hand, a detailed evaluation of the global terrestrial ET datasets (including ERA-Interim) can be found in Miralles et al., 2016.

With respect to Runoff, I carried out a correlation analysis between Runoff and total Precipitation for both ERA-Interim and Interim/Land datasets. As shown in the below Figure, for both datasets, there is highly significant positive correlation between Runoff and Precipitation. From such high correlations we can deduce that the validations of total P with in-situ data can be assumed valid for Runoff data as well.

Figure9. The correlation between total Precipitation and Runoff for (a) ERA-Interim, (b) Interim/Land

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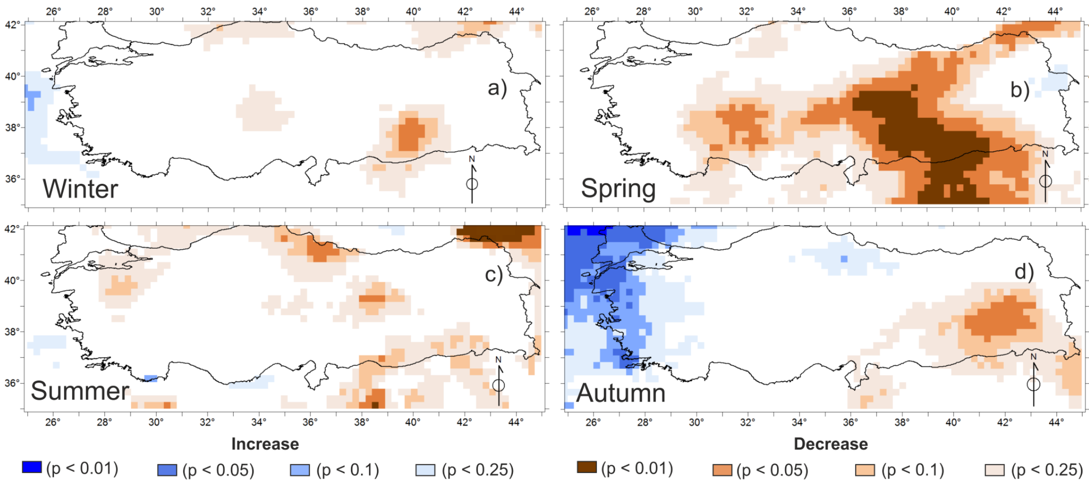

Fig. 1. The presence and the direction of Total Precipitation trends by ERA-Interim for a) Winter, b) Spring, c) Summer and d) Autumn

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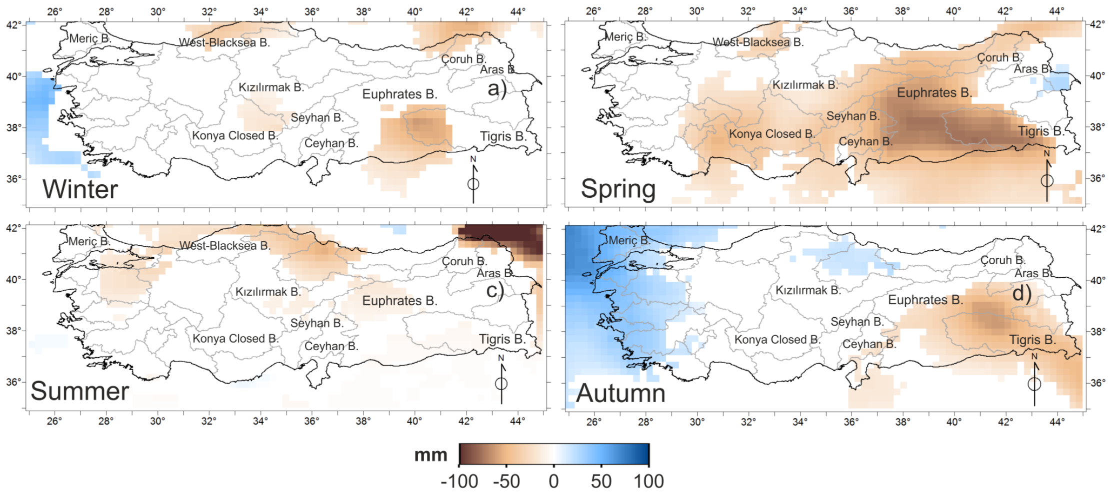

Fig. 2. The magnitudes of the Total Precipitation trends (32-years total) by ERA-Interim for a) Winter, b) Spring, c) Summer and d) Autumn

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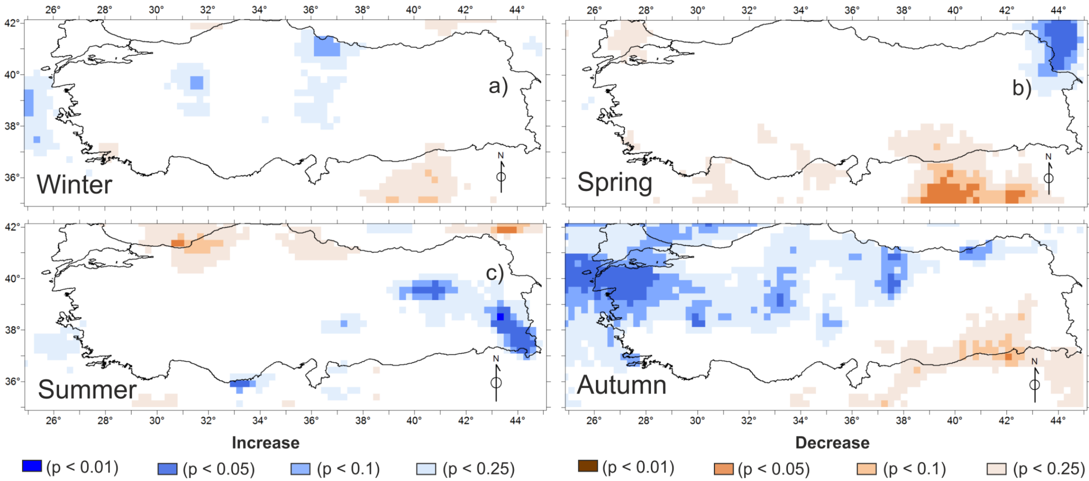

Fig. 3. The presence and the direction of Total Precipitation trends by InterimLand for a) Winter, b) Spring, c) Summer and d) Autumn

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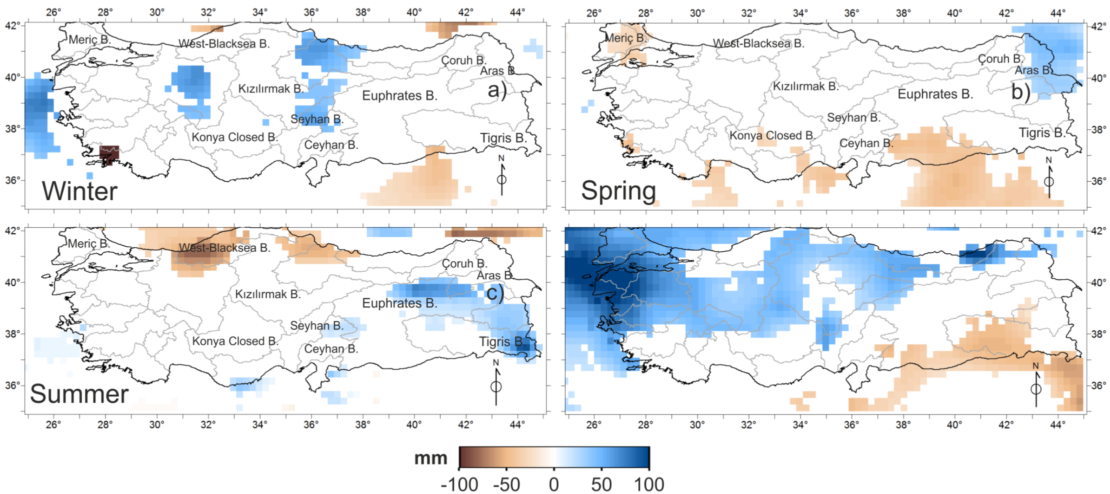

Fig. 4. The magnitudes of the Total Precipitation trends by Interim-Land for a) Winter, b) Spring, c) Summer and d) Autumn

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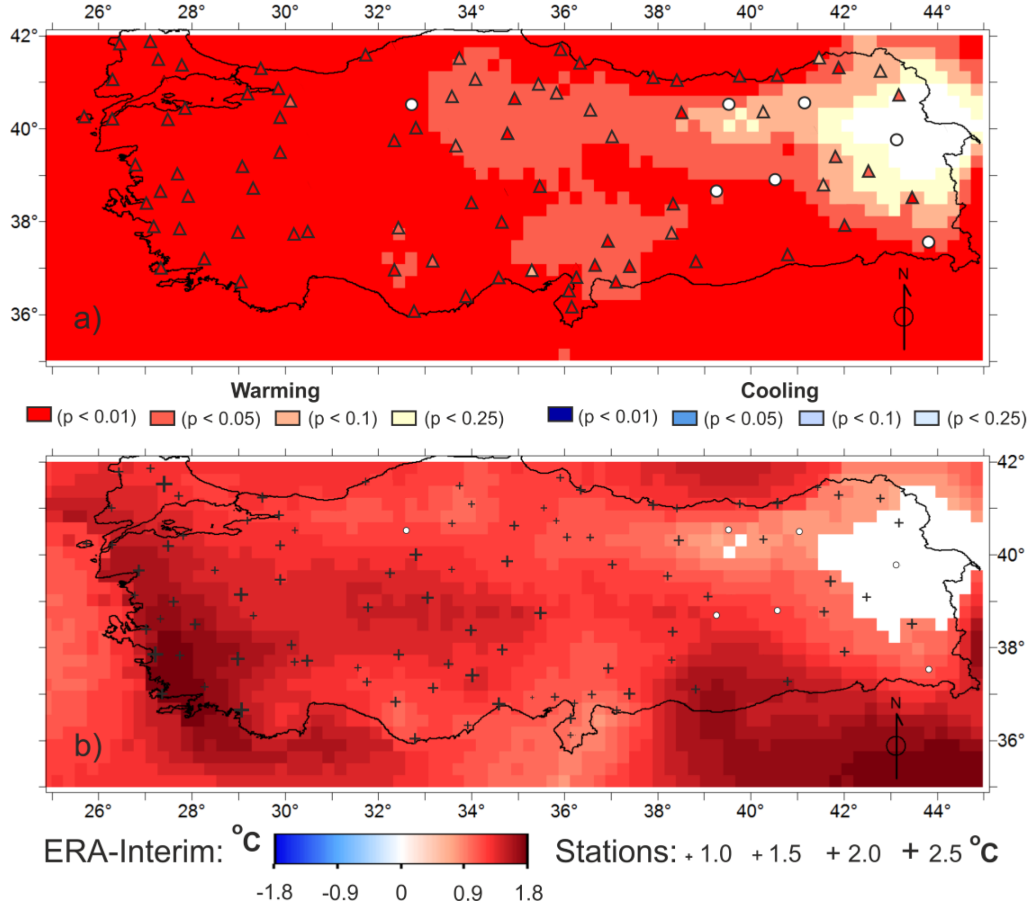

Fig. 5. The comparison of the (a) presence of the significant Air Temperature trends and (b) the magnitudes of 32-years total Air Temperature trends between the ERA-Interim dataset and the meteo-stations

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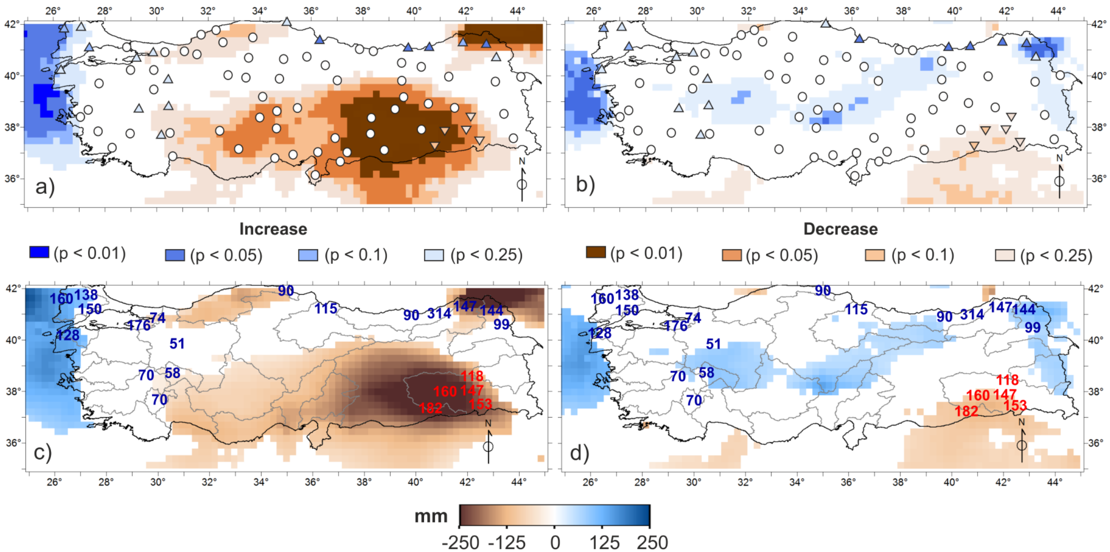

Fig. 6. The presence of the significant totalP trends by (a) ERA-I vs gauges, (b) I-L vs gauges. The magnitudes of 32-years totalP trends by (c) ERA-I vs gauges, (d) I-L vs gauges

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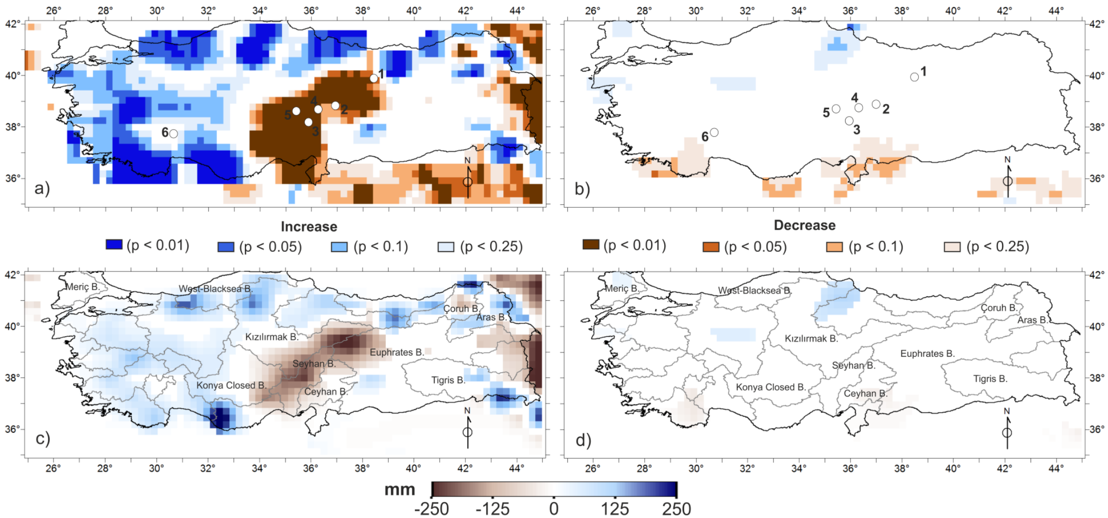

Fig. 7. The presence of the significant SWE trends by (a) ERA-Interim, (b) InterimLand. The magnitudes of 32-years total SWE trends by (c) ERA-Interim, (d) InterimLand

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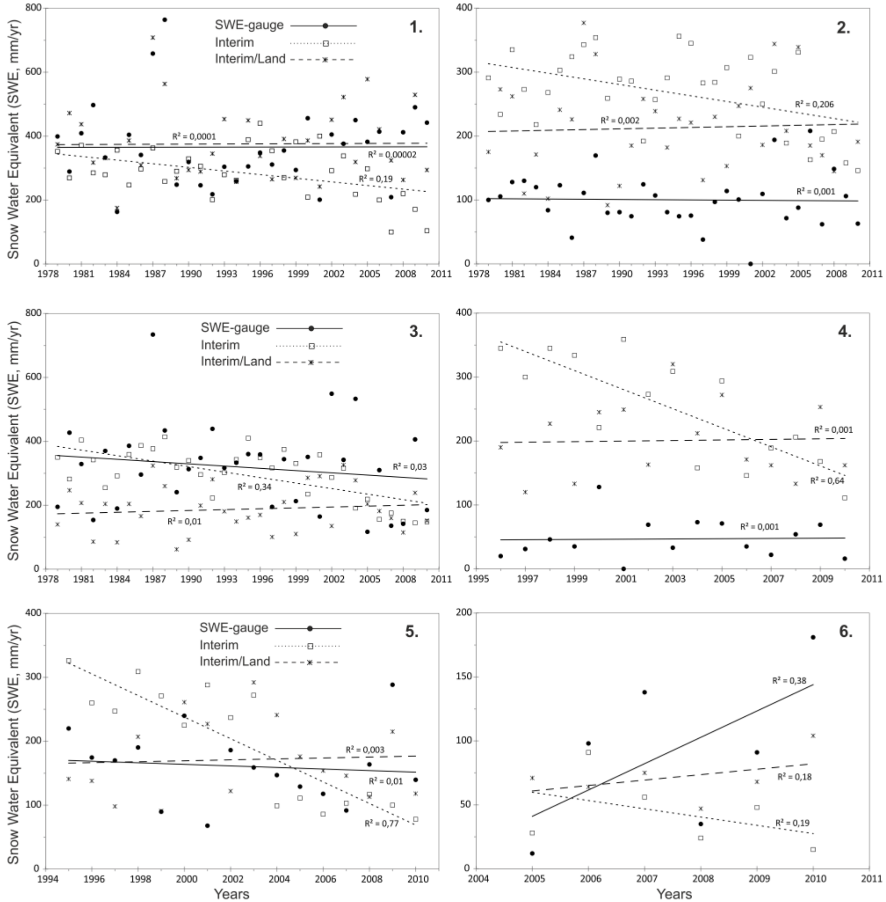

Fig. 8. The plots 1-6 indicate the comparison of the yearly SWE from the snow-gauges with the corresponding grids from ERA-Interim and InterimLand

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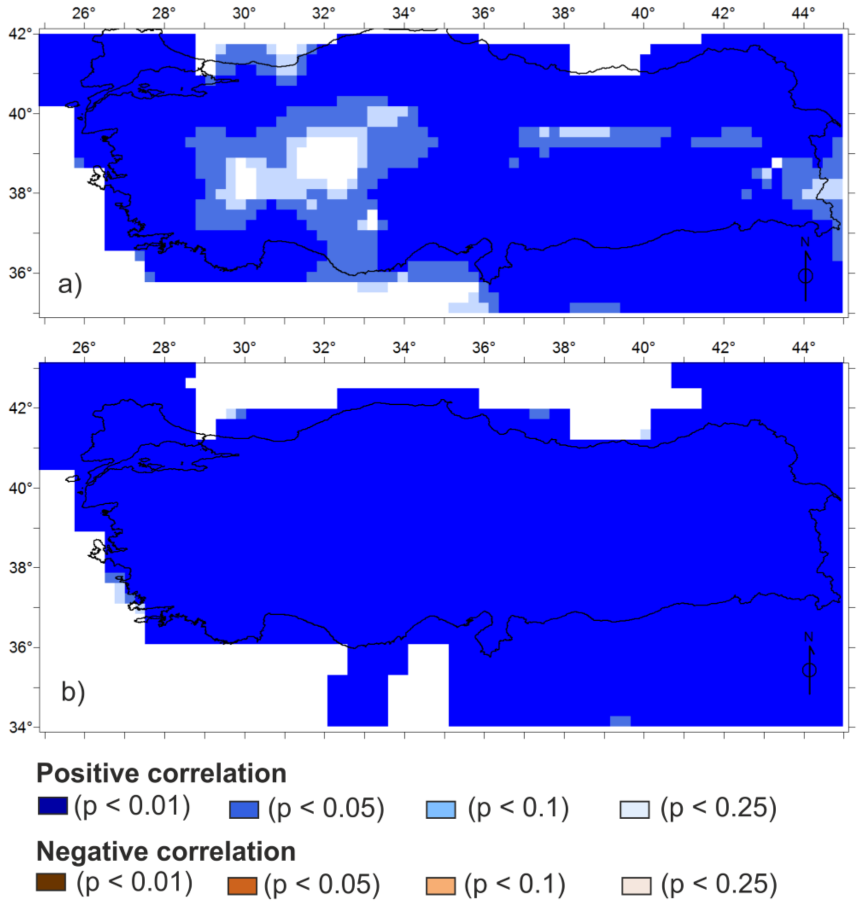

Fig. 9. The correlation between total Precipitation and Runoff for (a) ERA-Interim, (b) Interim-Land

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