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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "The Climatology, precipitation types and atmospheric conditions of extreme precipitation events in western Turkey" *by* Bulent Oktay Akkoyunlu et al.

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This paper attempts to investigate the precipitation types (using radar outputs and circulation weather types) of extreme precipitation events (EPEs) over western Turkey for the period 2006-2015. This work grouped weather types by origin sea effect, cyclonic effect and convective effect based on Lamb Weather Classification and helping with radar data. The final objective is a descriptive analysis of the EPEs patterns in terms of spatio-temporal and environmental point of view. Although I find the angle really interesting and worthy of research I think that this paper should go through to a major revision process before being published as there are strong issues related to

the methodology and some unclear sections that needs major revisions. Overall, this work has potential to develop a good article but is not mature for the publication in an international journal at this stage. The way in which it is written is hard to read. There are many redundancies in terms of writing style, paper structure and most importantly big sentences with complex meaning. I would recommend to get this paper edited by a professional editor/corrector. My main concerns are Introduction and title:

-Talking about climatology for a period of 10 years is not correct. I recommend you another title including the period without climatology.

According to your comments, we changed title as: "Atmospheric conditions during extreme precipitation events in western Turkey for the period 2006-2015"

- You need references or justify better why you are choosing percentile 90th to talk about extreme events.

We added some references using 90th percentile and we rearranged related part as follows: "For this reason, similar to the previous studies (Jones, 2000; Zhang et al., 2001; Piccarreta et al., 2013; Krichak et al., 2014), we chosen a methodology. . ."

- In the abstract you have identified precipitation types by using radar information and LWT but in the title you are budding between precipitation types and atmospheric conditions.

You are right. Therefore, we changed title as "Atmospheric conditions during extreme precipitation events in western Turkey for the period 2006-2015"

-From line 20 the abstract is confused. I recommend you to rewrite the highlights of the abstract. I suggest extensively to revise the Abstract to better summarize the paper. Some information is missing in the current version.

According to your comments we rearranged related parts as follows: "While convective EPEs are seen more common in the southern portions, cyclonic and sea effect originated EPs are mainly affect the southwest and northeastern parts of Marmara.

Among these three precipitation types, convective CTs produce more intense daily precipitation (66.1 mm in average) in the Marmara region due to the interaction between high-pressure center over Balkan Peninsula and low-pressure center over eastern Mediterranean. Based on the hourly observations, convective types of EP show two peak values during afternoon and evening times of the day and are linked to diurnal heating. . .”

-I suggest to the authors thoroughly review previous studies and summarize their limitations, based on which the specific objective of this paper should be explicitly presented. Without this information, readers cannot evaluate the novelty of the contribution of the paper. You need to add more references in the first paragraph. The lack of flow and structuring of ideas makes it weak. E.g. you do not reference to studies that use radar to characterize precipitation types.

According to your suggestions, we developed and added more references to the first part, and later, we emphasized the importance of this paper at the last part.

Data and Methodology

-I recommend you to do a new section/subsection of study area (if you are not from the region it can be confused) highlighting the orography, regions, and some useful and generic information.

Thanks the reviewer for the valuable knowledge. Instead of new subsection, we added properties of Marmara and Aegean to the end of the Section 2.1 as follows: “From these two regions, Marmara has different climatic characteristics in itself. While inland areas have temperate continental climate, milder climate of places on the Black Sea coast resembles more of an oceanic climate, typical to other areas of Turkish Black Sea coast. The coasts in Marmara and Aegean parts have Mediterranean (Med) climate and this region is second smallest Turkish region in size after Southeastern Anatolia. Only south and east parts of the region are more mountainous. In terms of Aegean, this region has a Med climate with mean annual precipitation changing from 450 to 1200

mm yr-1 (Asikoglu and Benzeden 2014). Although climatic behavior of the Aegean is similar to the Med climate, it is shown obvious differences in landscape. Unlike the more parallel mountains found along the Med, Aegean mountains often cut directly into the sea.”

-It is not clear how you use the radar data. You are talking about radar in the methodology but you don’t mention the radar analysis in the results.

Thanks a lot for your alert. We used radar data in the study and as an example for convective activity, we added new Figure and sentences to the end of the section 3.3.

-Lamb Weather Type is not an objective classification. Jenkinson and Collision (based on LWT) is the objective classification. For this study you have to apply Jenkinson and Collision (and show the equations and grid points used) or use a new methodology based on ACP/Cluster analysis. Using a subjective methodology is not very rigorous.

Thanks for your alert. In this study, we used objective version of LWT and in accordance with your suggestions, we added new figure (Fig. 1a) and we rearranged this part together with explaining the usage of LWT and its equations in the section 2.3.

-Why do you use mean daily pressure data? Is it possible that sub-daily changes in the circulation may distort the pattern when averaged? You are working with hourly resolution and convective weather types are difficult to reflect in a “daily mean synoptic scale”.

It is known that daily mean sea level pressure is extracted from the averages of 6-hourly sea level pressure data. In the study, hourly precipitation dataset is firstly converted to the daily totals and then we focused convective types, which are dominated in the particular day.

-In Section 2.4: there is a lack of examples or studies that use percentiles to establish thresholds of extreme precipitation, is not enough the example of Karl et al., 1996. In this section the methodology is unclear and needs more scientific rigor.

You are right. In this section, we added extra references to define fixed thresholds. Then we added references indicating percentile based precipitation thresholds and we explained why we chosen 10% of largest daily precipitation amounts due to the large differences in topography and irregularity in precipitation distribution.

Results:

-I suggest to create a discussion chapter. You are talking about discussion but there are few references. I recommend you to move the discussion paragraphs and extend this new section (after the results)

In this study, we developed results section by adding new references and we discussed our results with the precious ones.

-When the results are read, the methodology becomes clearer, which is why the major revisions focus on section 2, which will influence changes in section 3. However, this section is rather structured. Convection is not a synoptic process. You have to take it into account and not confuse it, as shown throughout the article.

We rearranged the results and methodology section in accordance with your suggestions. Also, we tried to explain convective instability under some particular synoptic processes by using radar outputs and equations

-I suggest a new table summarizing all kind of weather types for all EPEs. All kind of weather types that you comment are part of the sample?

Thanks the reviewer. We emphasized the most important CTs that cause cyclonic, sea effect and convective precipitation in the manuscript. Therefore, to not cause confusion, we did not add all CTs for all EPEs.

-You talk about radar in the methodology but is unclear that use radar data for the final results. You can support with the radar data when you talk about convection.

You are right. We supported convectivity with radar by given an example related to 28

September 2015.

-In section 3.1 I don't understand why you talk about a case of study. You are describing the climatology of EPEs (general results, not specific case).

We given this section, because when we defined threshold values of extreme precipitation for each station, it can be shown that although some stations take less daily precipitation when compared with others, their daily precipitation values exceed their threshold limits (Triangles in Fig. 4).

-In the figures 3, 5, 6a-c-e and 7a. Which kind of interpolation do you use? I recommend you kriging interpolation for this kind of area and data. We used krigging interpolation for this figures.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-29/nhess-2018-29-AC2-supplement.pdf

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-29, 2018.

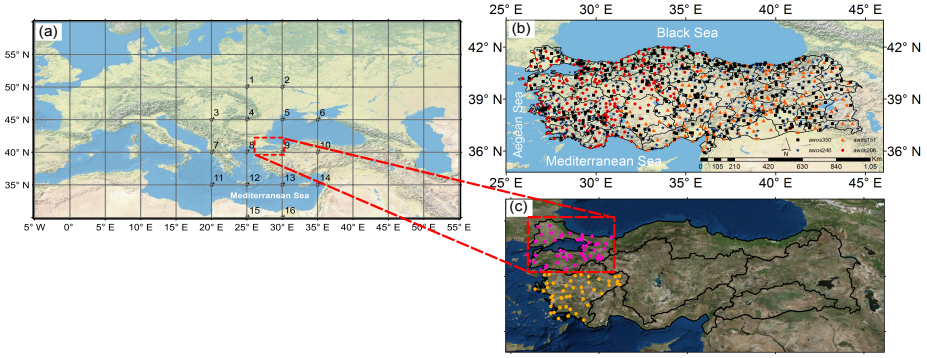

Figure 1. (a) The 16 MSLP grid points used in the Lamb Weather Type analysis. The dashed rectangle covers the Marmara Region. **(b)** The distribution of totally 953 automatic weather observing systems (AWOS) over Turkey depending on the four projects (AWOS 206, 151, 246 and 350) and **(c)** the locations of the 51 (pink points) and 47 (light brown points) AWOS stations, at Marmara and Aegean regions. Hourly precipitation data of these 97 stations were provided by the Turkish State Meteorological Service (TSMS) for the period of 2006-2015.

Fig. 1.

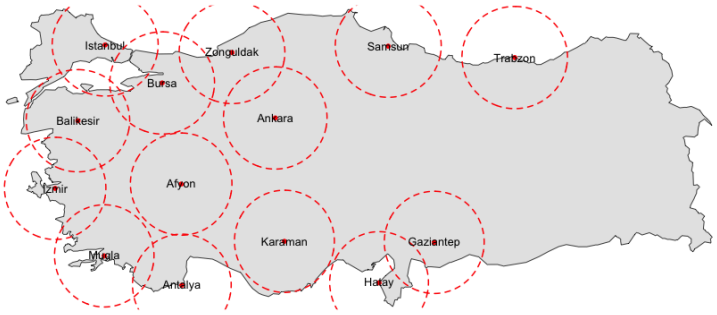

Figure 2. The distribution of 14 radar network over Turkey. Precipitation products of six radars (Istanbul, Bursa, Balikesir, Izmir, Mugla, and Afyon), which were taken from TSMS were evaluated manually to describe the characteristics of the precipitation types.

Fig. 2.

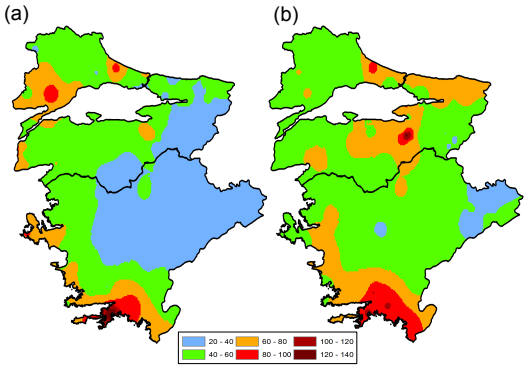

Figure 3. (a) Maps show the threshold values (in mm) of the stations during 2006-2015 when precipitation exceeded the 90th percentile generating an EPE. **(b)** the contribution of total EPs of a station to its annual mean precipitation (mm).

Fig. 3.

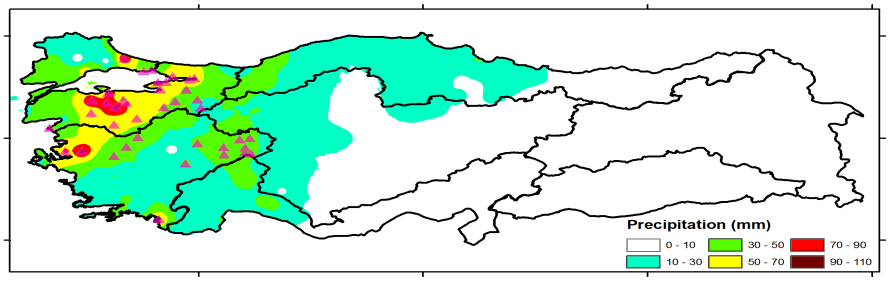

Figure 4. Daily total precipitation amounts over Turkey on October 28, 2010 (mm, in shaded) and the stations exceeding their 90th percentile threshold (triangle).

Fig. 4.

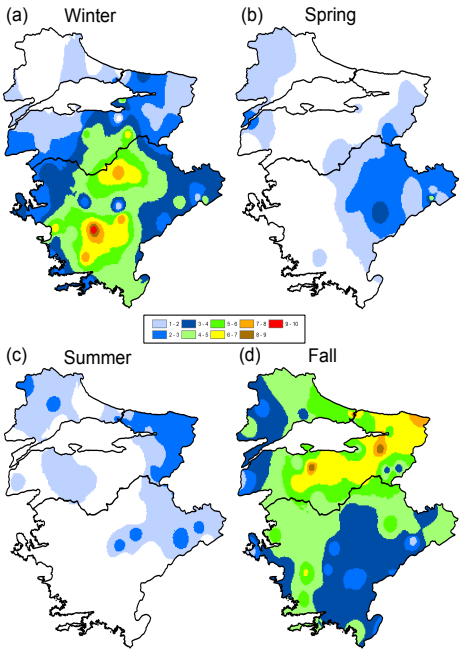

Figure 5. Seasonal distribution of the counts of the days for the stations when precipitation exceeded their 90th percentile during an EPE case for **(a)** winter, **(b)** spring, **(c)** summer, and **(d)** autumn seasons.

Fig. 5.

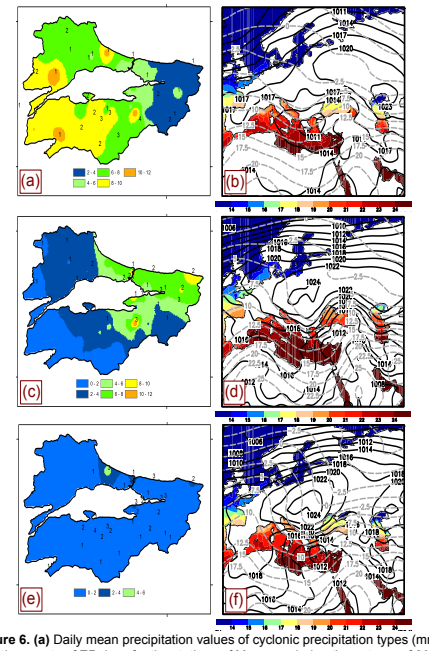

Figure 6. (a) Daily mean precipitation values of cyclonic precipitation types (mm, shaded) and the counts of EP days for the stations of Marmara during the autumn of 2006-2015. **(b)** Composites of the daily mean sea level pressure (MSLP, solid lines), sea surface temperature (SST, colored), and air temperature at 850-hPa (dashed lines) for the average of 18 extreme precipitation days over Marmara. **(c)** same as **(a)** but for the sea-effect (NE) precipitation types. **(d)** same as **(b)** but for the 14 extreme precipitation days. **(e)** same as **(a)** but for the convective (E) precipitation types. **(f)** same as **(b)** but for the 11 extreme precipitation days.

Fig. 6.

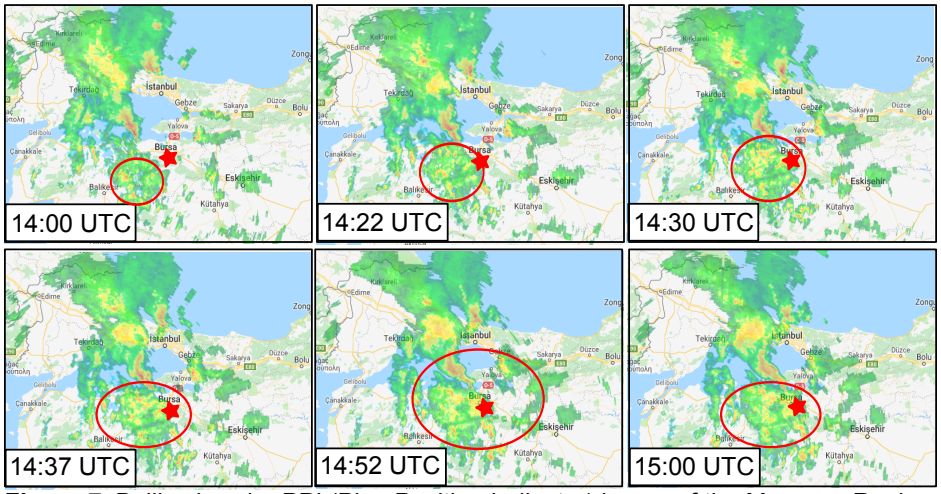

Figure 7. Balikesir radar PPI (Plan Position Indicator) image of the Marmara Region on 28 September 2015. Red star marks the Mt. Uludag.

Fig. 7.

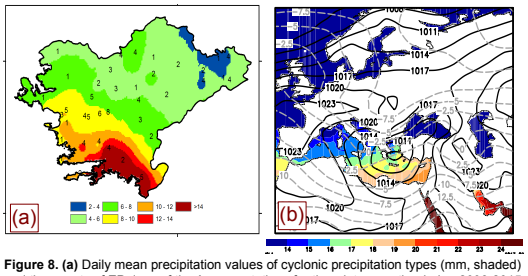

Figure 8. (a) Daily mean precipitation values of cyclonic precipitation types (mm, shaded) and the counts of EP days of the Aegean stations for the winter months during 2006-2015. **(b)** Composites of the daily mean sea level pressure (MSLP, solid lines), sea surface temperature (SST, shaded), and air temperature at 850-hPa (dashed lines) for the average of 35 extreme precipitation days over Aegean.

Fig. 8.

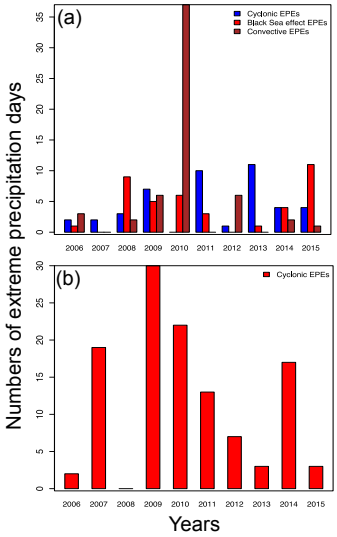

Figure 9. Annual distribution of the total counts of EPEs as well as precipitation characteristics for **(a)** Marmara in autumn and **(b)** Aegean in winter months.

Fig. 9.

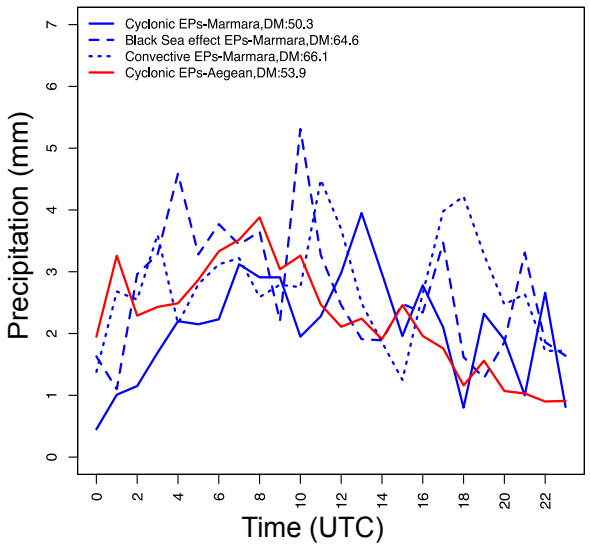

Figure 10. Average hourly precipitation amounts (mm) of EP days according to cyclonic, Black-Sea affected and convective types in Marmara for autumn and cyclonic EPs for Aegean in winter. DM indicates the daily mean precipitation amounts (mm) associated with the count of days ended-up with extreme precipitation.

Fig. 10.