Manuscript reference number: hess-2016-597 - Response to RC2

We would like to thank the reviewer for his/her to-the-point comments. We provide here our response and modifications introduced to the manuscript to address the reviewer's comments and improve the general presentation of the study. Below, in black text font is the reviewer's comments, and in blue is our response.

The manuscript "Comparing Intensity–Duration–Frequency curves derived from CMORPH and radar rainfall estimates over the Eastern Mediterranean" represents a good contribution to the assessment of satellite-based rainfall estimations in areas where their impact could be potentially relevant. The authors have done a thorough analysis over a sufficient amount of time and thus the results are significant.
The manuscript certainly fits the journal scope and is suggested for publication after the following points are considered by the authors:
We would like to thank the reviewer for his/her positive review.

1) The reason why both versions (gauged and ungauged) of CMORPH are used is not sufficiently explained and detailed in the text.
Thank you for raising this important issue – also shared by reviewer 1. Our introduction failed to emphasize the importance of using both the gauge-adjusted and un-adjusted versions of the satellite product (CMORPH, is this case). The gauge adjustment is expected to improve satellite estimates on average at the cost of having this improved product with several days of latency, which does not allow the use in real time applications. Furthermore, we would like to mention that there are regions on earth where there are no ground based sensors to adjust the satellite precipitation datasets. Hence, the natural question by the reviewers: 'why are you using the non-adjusted product in an application that is based on historical data rather than real time estimates?' The answer lies in the different requirements of the applications that make use of IDF curves: hydrologic design needs optimal quantitative accuracy, so evaluating unadjusted data is important for demonstrating uses of satellite precipitation in ungauged areas; early warning systems need to correctly identify the frequency of near real-time estimates. We updated text in the introduction to better motivate our study: *"[…] early warning systems, e.g. for flash floods (Borga et al., 2011; Villarini et al., 2010; Borga et al., 2014), landslides/debris flows (Tiranti et al. 2014; Borga et al., 2014; Segoni et al., 2015) or heavy rain (Panziera et al. 2016), need to operate in real time and rely on short-latency remote sensed measurements. In these situations, calculating the frequency of near real-time estimates using IDF curves derived from gauge-adjusted data could provide misleading results. It is therefore useful to analyse the characteristics of IDF curves derived from non-adjusted rainfall data, which are expected to represent the frequencies of near real time estimates."*, and we recalled the concept in the conclusions, adding a new point: *"Comparison of HRC-IDF and CHRC-IDF against radar-IDF show consistent patterns of correlation and dispersion, and different biases. This means that gauge-adjustment influences the magnitude rather than the space-time organization of annual extremes and suggests that HRC-IDF can potentially be used to estimate the frequencies of CMORPH estimates in near real time early warning systems."*
In addition to this, it is interesting to note that the performance of gauge-adjustment on extremes is affected by the different measurement scales of remote sensing instruments and rain gauges. Moreover, the impact of gauge-adjustment over ungauged areas is rarely quantified, especially for extremes and potentially introduces non homogeneity in space due to different gauge density data.

2) Did the authors check how many of the gauges are used in the production of the gauge-adjusted version of CMORPH in the area? This could have an impact in the analysis, maybe small. However, a couple of words on the subject need to be included.

Thank you for the question. The gauge-adjusted CMORPH product is using limited gauge data from the region, which may be also used in the adjustment of the radar-rainfall dataset. From Fig. 1d in Chen et al. (2008), the number of CPC gauges in the study area should be around ~12. We have contacted the developers of the gauge-adjusted CMORPH product for more specific information, but we have not received a response on our inquiry yet. We will mention this aspect in section 2.3: "*The gauge-adjusted CMORPH product is using data from ~12 gauges in the region (Chen et al., 2008), which may also be used in the adjustment of the radar-rainfall dataset.*"

3) While it is true that gauges are not available over the sea (!) the authors should also spend a few words on the fact that normally satellite-based estimations are far better over the sea surface. This partially contradicts their results. Just pay attention to this important fact. See, for example: Kidd, C., and V. Levizzani, 2011: Status of satellite precipitation retrievals. Hydrol. Earth Syst. Sci., 15, 1109-1116 for a discussion on the various methods of rain estimation from satellite.
We would like to thank the reviewer for this suggestion. We think that our results and text do not contradict his/her point. The results show that the CC between satellite and radar IDF maps over the sea is low. The text associates this to the absence of rain gauges over the sea. Since (i) gauge-adjustment is a crucial part of the radar quantitative precipitation estimation and (ii) similar CC patterns for HRC and CHRC are observed over land, we think that satellite datasets are expected to provide more accurate information on the spatial distribution of IDFs over the sea. We believe there has been a slight misunderstanding on the interpretation of this sentence, so we revised text to improve its clarity, also included a reference to the suggested paper: "*As pointed out above, gauge adjustment is only weakly impacting the space-time organization of CMORPH extreme estimates, while it is a crucial step in radar quantitative precipitation estimation. This observation, together with the increased reliability of satellite based estimations over the sea (Kidd and Levizzani, 2011), suggests that spatial distribution of IDF values indicated by satellite products should be considered more accurate.*"

4) A fine combing of the English is suggested since many imperfections are detected throughout the text.
English language has been re-checked and improved, thank you.

Minor point: The caption of Fig. 4 does not match the real colors used in the figure. It appears that the authors have used two different version prior and after a change they did while writing.
The reviewer guessed correctly. We apologize for the inconvenient, that affected also Fig. 6. The captions have now been updated.

References

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