Response to reviewer's comments

Dear authors,
Reviewer #2 gave some suggestions on technical corrections. Please have a look and make corresponding corrections. Thanks for your great efforts to revise the manuscript.
Best regards,
Editor
Thank you for handling our revised manuscript. We provide below here a point-by-point response to the residual comments from reviewer #2. Reviewer's comments are in black font, our reply in blue. We addressed all the reviewer's comments.

The revised manuscript entitled "Coastal and orographic effects on extreme precipitation revealed by weather radar observations" has been improved. Most of the comments and questions were fully responded in detail. This study is high-quality for the publication in HESS. Nevertheless, several remaining and new questions still exist and are listed as follows:
We would like to thank the reviewer for the time taken to read our manuscript and for the comments.

(1) I don't think a statement of FSE and/or a citation of it would take much space in the text, since this definition, which was used throughout the result, is basic and important for the method.
We included the equation for FSE, as follows (lines 147-148): *"(FSE, that is the root mean square error normalized over the average rain gauge amount, computed as:* $FSE = \frac{\sqrt{1/N \sum_i (r_i - g_i)^2}}{1/N \sum_i g_i}$*, where* $g_{i=1\dots N}$ *are the rain gauge observations and* $r_{i=1\dots N}$ *the radar estimates for the corresponding pixel, as in Marra and Morin, 2015)"*

(2) Please mind the line numbers in your reply should refer to the revised manuscript.
We are sorry for this inconvenience.

(3) The word of "framework" was used in Method Section for many times, for examples, in Lines 168, 169 and 228. However, sometimes the so-called "framework" was just a statistical distribution or a simple utility.
Thank you for pointing this out. Indeed, we found few instances in which the term was misused. We replaced it with 'method' in line 169, and removed the term in lines 183 and 250.

(4) Some subscripts of the variables were italic, while some are not (see Lines 235 and 245). Please correct them throughout the manuscript.
Thank you for pointing this out, we corrected where relevant.

(5) In supplement, the color change trend in FSE legend of Fig. S1a (dark colors denote large values) is inconsistent with that in BIAS legend of Fig. S1b (light colors denote large values). Furthermore, this trend in FSE legend of Fig. S3 changes again.
It should be noted that the quantities in Fig S1a, S3 have different properties than the ones in Fig. S1b. Fig. S1a and S3 (which have consistent colormap) show FSE (i.e. standard errors), for which low values are good and high values are not. Conversely, Fig. S1b shows multiplicative Bias, for which the perfect score is in the middle and both low and high values are not good; here, we use a diverging colormap, with colors typically used to identify dry/wet, and hence facilitate the reading.
What the reviewer comments is not actually correct, since both the colormaps become darker for worse performance. By chance, underestimation biases in Fig. S1b are more frequent than overestimation biases, so that it may look like lower values in Fig. S1b are darker, but darkness-wise the colormap is perfectly symmetric.

(6) The scale parameter in Fig. S4a, d, g has a unit of mm/h. Why a distribution parameter has precipitation intensity unit. Please clarify its physical meaning.
This comes from the definition of scale parameter: a parameter s is a scale parameter for F when the distribution of $\frac{x}{s}$ does not depend on s, i.e. when $F(x, s) = F(\frac{1}{x}, 1)$. Following this general definition, a scale parameter always has the units of the variable at hand.

(7) In Fig. 5a, for the shape parameter as a function of terrain elevation for durations of 10 minutes, the weather radar data derived a slightly decreasing regression line (in solid black), whereas the rain gauge data derived a slightly increasing one (in dashed grey). It can be observed from the first two dots at 10' in Fig. 5 also. What results in this discrepancy, the radar errors or the bias correct uncertainty?
Technically, there is no discrepancy: as shown in Fig. 5e, the slope of the shape-elevation regression from rain gauges in Fig. 5a is not significant, meaning that although it visually seems positive, we cannot claim it is different from zero. Given the adjustment we provide to the radar data, radar-estimated parameters corresponding to the rain gauge locations are the same as the rain gauge parameters. If one uses radar estimates in place of rain gauges and samples only the rain gauge locations (as gauges do), would get the same values and regression line.
Any difference in these regressions is thus to be associate to the fact that radar and gauges sample the area differently. Since rain gauges are small in number, the slopes derived from rain gauges are strongly dependent on the abundance of stations and on their location. The apparent mismatch between radar and gauges in Fig. 5a is due to exactly this problem, and highlights the added value of our results.
Rain gauges in high elevations are few and are systematically located west of the Jordan rift valley (there is no sub-hourly rain gauge data available for the Jordanian Plateau) while the weather radar allows us to sample the whole region.

(8) Thanks for the authors' reply to my Comment 4 about the storm definition. For the radar pixels on the sea (I mean the regions where there are no rain gauges, see the Fig. S2), what station data or which rain gauges were referred when the storm events of radar precipitation were extracted?
As mentioned in our response and in the manuscript, storms are defined at the regional scale as consecutive wet days (section 3.1 point 1). This also holds for the pixels in regions where no gauges are available (either the sea or the Jordanian Plateau). Given the small range we analyze (140 km from the radar) and the climatology of the region (well defined storms separated by relatively long dry periods), this definition is deemed sufficient to also cover the ungauged areas. It should be recalled that, in case no rain is observed in a pixel during a storm, that storm is not considered as a storm for the statistics of that particular pixel.

(9) The Section 6 Summary and Conclusion should be more concise and without citations, since detailed analysis has been provided in the Section 5 Discussion.
Thanks for the suggestion. We shortened the section removing some text and some references. Since our discussion is rather detailed, however, we prefer to keep the main messages in the conclusions, in order to have them delivered to readers with less time available.

(10) In Line 618, I believe the authors made a mistake by writing "standard errors in the order of ~22%," when revising the manuscript. Please recheck all the updated numerical values after every revision.
Good call, this was a leftover from the previous version. We updated it to 26%.