Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
https://doi.org/10.5194/hess-2021-395-RC1, 2021

Comment on hess-2021-395

Anonymous Referee #1

Referee comment on "Coastal and orographic effects on extreme precipitation revealed by weather radar observations" by Francesco Marra et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-395-RC1, 2021

Investigation of extreme hydro-meteorological events in complex terrain, for example, the coastal and orographic areas, attracts increasing attention especially under the climate change. However, the interaction effect of weather system and terrain on extreme precipitation remains unclear. The manuscript entitled "Coastal and orographic effects on extreme precipitation revealed by weather radar observations" provides deep insights into the understanding of the interaction effect of weather system and terrain features on local extreme precipitation using radar rainfall data. It was high-quality from the experiment design to the effect analysis and discussion, as well as the excellent language expression. Nevertheless, I would like to point out several key questions and suggestion for the authors.

- In Abstract, the expression of "we obtain estimates of the 1 in 100 years intensities" was obscure. Did it mean the precipitation intensities?
- In Line 146 of Page 6, please list the mathematic equation of FSE index with detailed explanation of variables and parameters.
- How was the SMEV model constructed and applied to different extreme precipitation data? In Section 3.1, I highly advice the authors to use the mathematic equations to express the SMEV model structure, exceedance probability, and return levels. Math language is more precise than the text description. In addition, please introduce the novelty of SMEV.
- Were the storm and ordinary events defined only based on rain gauge data, or separately defined using rain gauge and radar extreme precipitation estimates? Furthermore, the storm events were individually extracted using multiple extreme precipitation datasets with various durations, is it right? Why the parameter *n* is the same for all durations? Please the author make it clear.
- About parameter *n*, how to use it in SMEV model in the Steps 3 and 4 of Page 7? Also, if using mathematic formula, it is easy to clarify the unnecessary confusion. Meanwhile, please make it italic here and hereinafter.
- In Line 217 of Page 8, it's doubtful that the authors implemented the bias correction and spatial interpolation of radar extreme precipitation (steps 3 to 5) based on SMEV parameters rather than precipitation itself. For the multiple parameter optimization

problem, there exists “parameter equifinality” phenomenon. Namely, very different parameter sets may lead to similar result (referring to probability distribution in this study). Therefore, a numerical value nearby the optimal parameter may be an unavailable one. Maybe we cannot “correct” or “interpolate” the estimated parameters derived from SEVE model. This is very important to the whole study. Please ensure it testable, refer and list several typical previous studies with this usage.

- The expression of “intensity distribution” occurs frequently throughout the manuscript. I know it meaning “precipitation intensity distribution” (as Line 49). However, to be accurate, I suggest the authors use “precipitation intensity distribution (PID)” or “probability density function (PDF)” instead of “intensity distribution”.
- In Line 255, the GEV approach and its full name (generalized extreme value distribution) should be presented in Section 3 for the method.
- In Figure 3 (a-d), what does the proportion of the scale parameter represent? For the subplots (e-h) of shape parameter, there is no benchmark line in red, why?
- In Figure 5, only subplot (b) of 1 h duration displayed an increasing trend for the shape parameter with increasing elevation. However, the scatters and color shading in Fig. 5 (b) were very similar with those in Fig.5 (a). Please the authors recheck and discuss this inconsistency in trend.

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2021-395/hess-2021-395-RC1-supplement.pdf

Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
https://doi.org/10.5194/hess-2021-395-RC2, 2021

Comment on hess-2021-395

Anonymous Referee #2

Referee comment on "Coastal and orographic effects on extreme precipitation revealed by weather radar observations" by Francesco Marra et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-395-RC2, 2021

The authors study the effects of land-coast interactions and orography over a complex study area on extreme precipitation. The work reveals how short (radar) time series could be used to look at several features of a study area in depth. They use the return levels themselves as well as the underlying parameters to study these effects over different durations ranging between 10-minutes and 1-day.

This is a high-quality manuscript, that is well-structured, well-written, and contains a lot of detailed information while still conveying the main message. Therefore, this review only consists of some minor points and clarifications:

- Figure 1: The lines with the annual rainfall amounts are hard to distinguish from the underlying elevation in the mountainous areas. Perhaps the authors could change the colors, or add an extra panel containing the annual rainfall amounts. Also add some more information on the transects, as it only becomes clear much later on why these transects are included.
- L147-151: It would be helpful for the readers if the authors add some information on which ranges of the FSE are considered good, and how much this "large improvement over the previous radar archive available for the region" is.
- L151-L159: what are the implications of the issues of the radar that still remain? Which issues generally cause over or underestimation, or in which regions are the results likely over/underestimated?
- Section 3.1 point 1 (L181-L188): what are these 2 weather types? Are they two of the ones introduced in the study area? Why do they need to be separated by 1-day dry periods?
- Section 3.3: Make the part of using GEV for comparison more prominent, and provide the abbreviation in this section already. The abbreviation a few lines further now comes without an introduction.
- L258: change to: "only seven show FSE exceeding 50% of which two exceeding 75% (Fig. 2b; see Fig. S3 for more details on other durations)".
- Figure 3: add ticks on the x-axes for 3e-h. Would it work for such density plots to have 1 colorbar representative of all sub-panels for easier comparison?
- Section 4.4: why are these the longitudinal transects chosen over these 3 latitudes?

Consider introducing this in the method section, possibly around Figure 1 where they are just mentioned in the caption.

- Figures 6 and 7 are normalized, which does provide interesting information and helps the reader in understanding the differences along transects or orography. However, it would be interesting to also include some actual values, for instance of the T2 and T100 estimates, also over different durations.
- L372: Do you mean middle transect instead of northern?
- L372-L373: The patterns of the rift valley described aren't visible in 3f, consider adding: "for the northern two transects".
- Figure 9: Consider changing using a circular colormap as this one is hard to interpret.