

Interactive comment on “Monitoring and quantifying future climate projections of dryness and wetness extremes: SPI bias” by F. Sienz et al.

Anonymous Referee #1

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General comments

The manuscript aim is to proof that Gamma distribution not always is the best choice to represent precipitation. The Authors address this point testing Gamma distribution versus other four distributions (Weibull, Burr type III, exponentiated Weibull and generalised Gamma) over different dataset and applying Akaike Information Criterion to find the best distributions among those considered. The Authors' thesis is confirmed by the results. Moreover, the Authors put into evidence as a misrepresentation in precipitation distribution affects the identification of (extreme) dry / wet period using SPI, based on the inverse transformation of precipitation probability into dryness / wetness classes.

Specific comments

C5522

Introduction (general comment) It will be easier to understand the introduction if a brief description of SPI index is inserted. Otherwise the link between precipitation distribution and SPI calculation is undefined until section 2.1.

Page 10637 Line 5 - I will suggest the Authors to insert a brief comparison between SPI and other drought index based only on precipitation data like deciles (Gibbs, W. M., and J. V. Maher. 1967) or rainfall anomaly index (Rooy, 1965). In this way, the Authors could point out a second reason SPI index is widely used, i.e. the possibility to directly compare SPI values estimated over different regions.

page 10638 Line 11 - The Authors wrote “leading to underestimation respectively overestimation of extreme dryness and wetness” that is the opposite of what stated in the Abstract and after in the text. If it is not a typing error, please clarify this point.

Section 3 Precipitation distribution and SPI (general comment) Reading Section 3, I understood that Authors fitted each distribution over monthly sub-datasets, i.e. each distribution is characterised by 12 parameter sets, and that they do not try to investigate the case studies data using a unique parameter set for each distribution considered. The use of a single parameter set associated to a given precipitation amount always the same SPI classes, while the use of monthly parameter sets associates different SPI class to the same precipitation amount. In climates characterised by strong seasonality such variability can lead to a very different classification of the same precipitation amount, e.g. a precipitation could be classified as extremely wet in a dry month and as extremely dry during a wet month. I think the Author should address this point, a possible way is to investigate the advantage in terms of accuracy having 12 different distributions instead of just one in regions climatically different.

Page 10646 Lines 17-18 and following. The Authors presents a one to one comparison between GD and WD, BD, EWD and GGD for ease of interpretation. By doing so they have to compute AICD for each couple considered and this causes the different behaviour of GD curve in the different panels of Figure 6. After that they provide a

C5523

complete comparison between all the distributions where AICD curves assume once again different values. Since Figure 7(a) includes Figure 6 I will suggest to (a) eliminate Figure 6 and discuss, in the manuscript, the different behaviour of GD versus the other distributions in light of Figure 7 maybe also adding GGD distribution that now is omitted and (b) to insert a new panel in Figure 7 where show the results from the synthetic dataset.

Page 10646 Lines 23-27 The text is not clear here: it seems that dotted black lines are representative of WD, BD, EWD and GGD results, while red dotted line are representative of GD data. Since dotted lines are not clearly defined in Figure 6, text and figure seems to contradict each other.

Page 10649 As for the previous Section I will suggest to merge Figure 9 and 10 by adding a panel to Figure 10 to presents the results of the synthetic dataset and adding the results for GGD distribution, that is now omitted and discuss the different performances of the distributions in light of this new Figure.

Page 10650 Line 11 The Authors say "The GD yields a rapid increase in the number of times the AIC minimum is reached, if longer SPI time scales are considered". Does this tendency refer to a one to one comparison between GD and the other distributions or does it refer to the overall behaviour of the distributions?

Page 10650 Line 21 Figure 16 is introduced before Figure 14 and 15 please verify it and eventually move Figure 16 in the correct position in the manuscript.

Figures 12 and 13 would it be possible to provide the results of the direct comparison among all the distributions considered?

Technical corrections

Page 10643 Line 4, change "England and Wales" in "England Wales"

Page 10651 Line 21 I think that Authors means "the lower bound is below -2" instead of "the lower bound is higher than -2"

C5524

Figures 6 and 9 If the Authors decide to keep them I suggest to change the dotted lines with more legible marks.

Figure 8 Please substitute this figure with the right one, now there is the same figure of Figure 9.

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