**Hydrology and
Earth System
Sciences
Discussions**

Interactive comment on "Introducing a rainfall compound distribution model based on weather patterns sub-sampling" *by* F. Garavaglia et al.

Anonymous Referee #2

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General comments:

The paper analyses the possibilities of stratifying rainfall samples according to seasonality and weather patterns (WP), based on the idea that rainfall generation processes can be different for different WPs and seasons. A heterogeneous or mixed distribution function is developed that is composed of distribution fuctions describing the sub-samples. The idea is not new and there are, for example in the area of flood frequency analysis, a number of papers that argued similarly and that applied this idea. Although the idea is not new, I recommend publishing the paper after revision. The paper could support the strand that additional insight into flood-generating mechanisms (here: rainfall mechanisms) is useful for frequency analysis. However, in that respect I would like to see a more in-depth discussion on the underlying mechanisms and on the

justification of the seasonal and WP stratification. Further, a more thorough discussion on the advantages and limitations of this approach seems necessary, for example, the discussion on the robustness of the method compared to a standard frequency approach builds on one example only.

Specific comments:

Page 317, line 3: How representative are these 54 rainfall gauges for France? It would be interesting to see the spatial distribution of the 54 gauges, eg in relation to the French topography, and to have a statement on the representativeness of French rainfall by these gauges. 54 stations seems a small number given the considerable spatial extent and variation in terms of rainfall for France. If the points in the left diagram of Fig. 1 are the rainfall stations considered, then the spatial distribution is strongly biased towards SE France. I am not familiar with the French climatology, however, I doubt that this distribution of stations gives an adequate picture of the country-wide rainfall.

Page 317, line 5: What does this statement exactly mean? Is a certain day identified as rainy day, if at least one gauge measured 5 mm?

Page 317, line 16: I do not completely understand why steps 3 and 4 are necessary. I suppose that the result of step 2 is the classification of rainy days into seven clusters, i.e. in this step each rainy day is already assigned to one cluster. If this is true, why then step 3 and 4 with an additional assignment?

Page 318, line 3: What does it mean: '. . .ratio of the mean WP to global mean precipitation . . .'. Please give an unambiguous definition.

Page 318, line 20: I recommend to rename this section. Instead of Discussion something like 'Suitability of the proposed weather pattern classification'.

Page 320, Line 19: I am not completely convinced that the independence criterion is sufficient. If I understand the criterion correctly, it allows 2 days to be considered as independent, even if they are only separated by a rainfall day inbetween with smaller

rainfall than these two days. Since circulations patterns apply over a few days, this criterion might be too weak. Please expand this issue.

Page 321, Line 26: You say that seaonal divisions may vary considerable from year to year. Should this interannual variability be taken into account? And if yes, how could it be taken into account?

Page 322, Line 1: I do not understand this sentence: Why are the lowest quantiles between May and August? Please explain: What means '. . .Season-at-risk. . .' in Fig. 3. Similarly, give a definition of WP-at-risk (used at other locations in the manuscript).

Page 322, section 3.3: This section is partly a repetition to text/arguments earlier in the manuscript. I recommend to concentrate the literature review on homogeneity of samples and on underlying processes in one section (early in the manuscript). Then sections 3.2 and 3.3 should be combined.

Page 324, Line 21-23: Please elaborate these two sentences. What exactly do you mean with '. . .provides a new view. . .'. What is the interpretation of the MRL plots? Does the comparison of the plots in Fig. 5 suggest that seasonal stratification within one weather pattern is superior to a non-stratified approach? If such conclusions can be drawn from these MRL plots, would it be interesting to see more comparisons (or on which criteria have you selected the examples in Fig. 5 and 6)? The MRL plots are central to the argumentation of the paper and the selection of examples and the conclusions drawn are not convincingly demonstrated. What exactly do you mean with '. . .parsimonious effect . . .'?

Page 327: The robustness of the MEWP is demonstrated by one example only (using the autumn sample). It is necessary to see other examples, in order to understand if the robustness of MEWP is consistently higher compared to the standard GP approach.

Technical issues:

Page 320, Line 18; Please displace ' . . .time space. . .' by '. . .time period. . .'

Page 320, Line 19: Please delete '. . .begin to. . .'

Page 321, Line 13: Sentence ('. . .among which variation . . .') seems incomplete

Page 321, line 26: Why an 's' in '. . .Lyons. . .'. (Similar at other locations in the manuscript.)

Page 322, line 8: '. . .A discrimination. . .': Use capital letter

Page 324, Line 10: Move '. . .respectively. . .' to the end of the sentence: '. . .within the autumn season, respectively. . .'. And in general: several parts of the manuscript need an improved language.

Page 326, Line 3: use 'autumn' instead of 'fall' as it is done at other locations in the manuscript

Page 329, line 5: '. . .A comprehensive. . .': Use capital letter

Page 338, Fig. 2: Figure is rather small; country borders are hard to recognize. Please give explanation of grey rectangle and the arrow in the figure caption (in addition to the explanation in the text).

Page 340, Fig. 4: Please explain: What means '. . .WPs-at-risk. . .'?

Page 340, 341: I recommend to combine Fig. 5 and 6 in one figure.

Page 342: Figure is too small, can hardly be recognized.