

Interactive comment on “Spatial distribution and trends of different precipitation variability indices based on daily data in Northern Chile between 1966 and 2015” by Oliver Meseguer-Ruiz et al.

Anonymous Referee #1

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The main objective of the manuscript is to measure four different precipitation indices, their tendencies over Northern Chile and their statistical link to geographical variables. In my opinion, there is a strong need in literature for articles assessing observed local precipitation climate change at specific networks of stations, since many current studies focus on coarser spatial scales derived from regional or global models, which are prone to large bias, particularly in case of rainfall. Thus, the aim of this work is certainly of interest for the readers of HESS.

The topics presented are covered with a good amount of material, and the network employed is of particular interest due to the high altitudes of many stations and the scarcity

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of dataset covering arid regions. The manuscript is written in an understandable way, even if a revision from an native English speaker is recommended. Results are novel and interesting, exploiting a recently recovered large station network of particular geographical and climate relevance, and are well presented and explained. Therefore, I highly recommend the publication of the manuscript. Some steps of the analysis might not be easy to reproduce, given that three of the precipitation indices considered (Concentration Index, Entropy, Fractal dimension) are not straightforward to measure. However, even if their methodology could be further described, I think it is not in the scope of this paper, which already references the original articles describing these indices in detail.

In Section 2.1 ("Observed rainfall data"), authors describe the quality controls and homogenization employed. No station of the 161 employed was discarded, however, they specified that missing data were present for some stations. To better understand the degree of quality of the dataset, the authors could specify which was the maximum % of missing data measured in their stations during the study period.

In the Discussion Section, the authors compare their findings with those provided for other geographical areas already available in literature. In the case of the Concentration Index, the authors might also consider to include a comparison with the recently published work of Sangüesa et al. (2018)* for Southern Chile. It is interesting to notice that the range of annual values of the Concentration Index in Northern Chile [0.42-0.67] is quite smaller than the range observed in Europe at annual scale [0.51-0.72] in the paper of Cortesi et al. (2012)**, who employed exactly the same methodology to define the index, albeit with a slightly shorter period (1971-2010). At a first glance, such a range difference seems to be quite unlikely, due to the much more arid nature of Northern Chile compared to Europe, which should determine higher values of the Concentration Index. However, the lower values measured in Northern Chile might arise from a severely different gamma distribution of precipitation in desert climates; in fact, a lack of days with small or very small precipitation amount in the desert should

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determine an important change of the exponential curve of the Concentration Index, basically pushing the left part of the curve closer to the Equidistribution line, and explaining why in Northern Chile the values are lower than in Europe. I suggest the authors to introduce the comparison with Europe in the Discussion section, explaining why, in their opinion, the observed range in Northern Chile is smaller than the European one. To further improve the manuscript, the authors might want to include a similar comparison of the ranges of the values of the Entropy and Fractal dimension indices, particularly if important differences with the ranges measured in other continents are detected. Unfortunately I'm not proficient with these two indices, so I can't give any more suggestions to the authors.

The rest of the revision mainly addresses the readability of the text, asks a few simple questions and provide grammatical corrections.

* Sanguesa et al. (2018) Spatial and Temporal Analysis of Rainfall Concentration Using the Gini Index and PCI. *Water* 10(2), 112; <https://doi.org/10.3390/w10020112>

** Cortesi et al. (2012) Daily precipitation concentration across Europe 1971–2010. *Nat. Hazards Earth Syst. Sci.*, 12, 2799-2810, 2012; <https://doi.org/10.5194/nhess-12-2799-2012>

Page 1, line 11: replace sentence with this one: "Northern Chile is one of the most arid regions in the world, as it includes the Atacama Desert. At high latitudes, most of precipitation is observed only in a short period of the year, from December to March. This makes water availability one of the main concerns for policymakers".

Page 1, line 14: replace "and this makes that" with "for this reason,".

Page 1, line 18: replace the second "determined" in the sentence with a synonymous, e.g: "caused".

Page 1, line 24: replace the second "these" of the sentence with "this".

Page 2, line 1: the summer season mentioned is the Boreal or Austral one?

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Page 2, line 3: replace the sentence with "Such a configuration of the upper levels is known as Bolivian High (250 hPa). it activates the South American monsoon, (...). As a consequence, the dry or wet characterisation (...).

Page 2, line 19: replace "prior" with "main".

Page 2, line 22: correct the sentence: (...) they show a particular degree (...). Such patterns increase at high latitudes and in wet regions (...).

Page 2, line 25: add an "s" after "work".

Page 2, line 28: remove "or even smaller".

Page 2, line 29: replace "This exposes that" with "Thus,".

Page 2, line 40: replace "study" with "studied".

Page 3, line 4: replace "face characterization of precipitation" with "characterize precipitation".

Page 3, line 6: replace "this" with "the".

Page 3, line 20: replace "this" with "these studies".

Page 4, lines 1-5: redundant, can be removed.

Page 5, line 21: replace "are" with "is" or remove "every".

Page 8, line 10: take advantage of this line to introduce in the text between parenthesis the symbols used at page 9 for referring to variables elevation, curvature, orientation and distance to the Amazon basin (they are still not defined in the paper).

Page 8, line 22: replace "significance" with "robustness".

Page 8, line 18: I can't find neither Table 1 neither Table 2 in the manuscript. Were they included?

Page 9, line 17: replace "(17) to (20)" with "(16) to (19)".

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Page 12, line 10: replace "in" with "at".

Page 15, line 25: replace the first sentence with "In this work, the spatial distribution of specific irregularity indices applied to precipitation temporal behaviour has been presented, as it represent a good tool to carry on studies in arid and semiarid areas. In case of annual and monthly accumulated rainfall, the high degree of interannual variability determines a similar high degree of uncertainty of climate p projections. It is more interesting to consider (...) This allows to interpolate and measure (...).

Page 15, line 34: replace "very constricted" with "short".

Page 15, line 35: replace "C is increasing" with "C increases".

Page 16, line 1: expand the results: "The P11 index is mostly homogeneous in all the study region, with only a slight increase at the centre and south, (...)".

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