Anonymous Referee #2

This paper calculates a series of precipitation indices in Northern Chile and analyse their spatial distribution and trends over 1996-2015 period. There is some nice discussion on the different precipitation indices and their relationship with topography and climatic characteristics of the study region, which they relate with previous findings. However, the authors have not clearly elaborated how these analyses contribute to the objectives of the study (stated in the introduction). The manuscript cannot be read fluidly, and there are some logic sequences in the argument that are hard to follow. I think the topic can be of interest for HESS audience, however, the manuscript would require some major improvements. Below I provide some general comments, followed by a series of specific questions and recommendations.
The authors would like to thank the reviewer for his work regarding the comments on this manuscript and his nice words. The authors appreciate the comments regarding the language. We hope that after the comments made by the reviewers, it will be better understood.

General comments:
The authors generate a series of indices for each meteorological station, and then spatially distribute these indices based on interpolations techniques. Have the authors considered to use a gridded precipitation product instead, and then calculate the indices for each cell? I think is more physically robust since we have more information about the spatial distribution of precipitation phenomena (e.g., regional models, geostatistical interpolation). Can the authors elaborate on this?
The reviewer rises one key topic worked here. In this case, we decided to work only with observed data as a part of the goal of the manuscript and then just see how geographical factors influence on it. We totally agree on the idea of the interest to work with interpolated precipitation data, but for daily data resolution, we bet to work only with meteorological stations in this case.

There is a new platform with climate projections for the region that I think should be explored as part of the literature review of this work (http://simulaciones.cr2.cl).
We totally agree that there is a great work done by the CR2 team according to climate change projections. It has been mentioned in the introduction.

Tables are placed at the end of the manuscript, while Figures are placed within the text. Please maintain consistency.
The guidelines for the manuscript preparation of HESS says that Tables "should appear on separate sheets after the references and should be numbered sequentially with Arabic numerals", but it's not the case for the Figures, that's why we placed them as they appear.

Tables: commas should not be used for decimals.
Table 2 has been modified accordingly.

The complete manuscript should be revised since there are plenty of grammatical errors that do not permit a fluid reading.
The grammatical mistakes have been corrected, we hope that now it will be easy to read.

Specific comments:
Abstract: "precipitation is recorded in a very constricted season every year". Is it that the recording is constricted or that the events are very rare? Please clarify.
We meant that the season was very short. It has been clarified in the text.

"Accumulated rainfall presents very high differences from one year to another, and this makes that climate projections have a very low degree of confidence in this area. So to this region it is more interesting to study the irregularity of precipitation itself instead of the accumulated rainfall values." The logic sequence of these sentences is not clear, please elaborate the point.
It has been modified in order to make it clearer.

"These results will help to improve climate projections for these region and to inform the development of water management policies." It is not clear how climate projections and water management policies can use such results. Can the authors clarify? Also, there is a typo in 'these region'.
The last sentence has been expanded in order to do it more understandable. The typo has been corrected.

P2L5-8: can the authors elaborate on the logic of these sentences?

The text has been corrected to clarify the meaning of these sentences.

P2L20: This sentence requires further discussion. There are studies aiming at differentiating these two effects (e.g., Boisier et al., 2016).
The authors agree that the original sentence was not correct, while we were referring to precipitation projections in tropical regions. It has been clarified.

P2L21: there is literature available analysing projected changes in the region, which I think is more suitable than the cited work.
New references have been added:
- Baez-Villanueva, O. M., Zambrano-Bigiarini, M., Ribbe, L., Nauditt, A., Giraldo-Osorio, J. D., and Thinh, N. X.: Temporal and spatial evaluation of satellite rainfall estimates over different regions in Latin-America, Atmos. Res., 213, 34-50, https://doi.org/10.1016/j.atmosres.2018.05.011, 2018.
- Cabré, M. F., Solman, S., and Núñez M.: Regional climate change scenarios over southern South America for future climate (2080-2099) using the MM5 Model. Mean, interannual variability and uncertainties, Atmosfera, 29(1). 35-60, https://doi.org/10.20937/ATM.2016.29.01.04, 2016.
- Kitoh, A., Kusunoki, S., and Nakaegawa, T.: Climate change projections over South America in the late 21st century with the 20 and 60 km mesh Meteorological Research Institute atmospheric general circulation model (MRI-AGCM), J. Geophys. Res., 116, D06105, https://doi.org/10.1029/2010JD014920, 2011.
- Williams, C. J. R.: Climate Change in Chile: An Analysis of State-of-the-Art Observations, Satellite-Derived Estimates and Climate Model Simulations, J. Earth Sci. Clim. Change, 8, 5, https://doi.org/10.4172/2157-7617.1000400, 2017.

P2L21: should say 'even though'
It has been corrected.

P4L2-3: is not clear how the confidence of future projections may be more accurate by a better understanding on the temporal behaviour of precipitation. Can the author elaborate this point?
It has been clarified.

P4L3-5: the last sentence is not clear. Please re-phrase.
It has been rephrased.

P5L2: "..." should not be used in scientific writing. Please re-phrase and correct typo ("do not varies")
It has been corrected.

P5L9: please provide references to support the statement: "an area where climate projections are not able to determine a clear trend for precipitation".
We added the reference "IPCC, 2013".

P5L11: is not clear how the determination of indices trends can be used to discriminate natural variability from anthropic forcing. Please elaborate and provide references.
While it is not the goal of the work developed here, we have rephrased the sentence. We added "This can be determined by comparing the behaviour of these precipitation variability indices with the behaviour of temperatures, linking their influence on the hydrological cycle."

P5L14-15: please correct grammatical errors.
They have been corrected.

Sect. 2.1: There is a missing citation for the meteorological stations (institution, where were the records obtained from, etc.). Also, general statistics on the record lengths (mean, min, max) could be provided, as well as the percentage of missing records. In addition, the elevation of meteorological stations should be provided (to have an idea of the representation of altiplanic zone).
The institutions that provide the data and the link from they were obtained have been added: "The data are obtained from the database provided by the by the Chilean Water Directorate (DGA) and Chilean Meteorological Directorate (DMC) and available online (http:// http://www.cr2.cl/bases-de-datos/)."
The mean annual amounts can be seen in Fig. 2, and some further detail of the meteorological stations has been added as an Annex.

Given the convective nature of precipitation events in this area, we expect to see many "outliers", so I wonder if the quality control applied here is correct.
Can the authors explain how they fill missing data? They mention "undoing the normalisation of the reference series", but is not clear how the procedure is done, and under what assumptions. How much missing data is allowed?
Section 2.1 has been rewritten, defining the values of missing data and doing a better explanation of the filling method applied in this case:
Daily rainfall records from 161 stations across the study area for the period 1st January 1966 to 31st December 2015 are used, with a varied number of missing data (a quarter of the series had less than 19.8% of missing data, half of them had less than 46%, and the other quarter had more than 73.5%). The data are obtained from the database provided by the by the Chilean Water Directorate (DGA) and Chilean Meteorological Directorate (DMC) and available online (http:// http://www.cr2.cl/bases-de-datos/). Further information of the meteorological stations can be found in the supplementary material (Annex A).
The quality control was developed using the R package Climatol version 3.0 (Guijarro, 2016), which uses normal ratio values (every data is divided by the mean of its series) of the closest precipitation data to build reference series for all the stations. In this way, every precipitation data P_{ik} of series i is "normalized" by $\widehat{p_{ik}} = P_{ik}/\widehat{P_i}$, and then all data (whether existing or missing) is estimated as:

$$\widehat{p_{ik}} = \frac{\sum_{j=1}^{j=n} w_{ij} p_{jk}}{\sum_{j=1}^{j=n} w_{ij}} \quad (1)$$

in which $\widehat{p_{ik}}$ is the estimated precipitation from the nearest n data in time step k, weighted by w_{ij}. Averages $\overline{P_i}$ are computed initially with the available data, but new averages are obtained after filling all missing data with their estimates, repeating the process until no average differs more than 0.05 mm from its value at the previous iteration. Differences between observed and reference series (in normalized form) are then used to test their quality by outlier detection, and also to check their homogeneity through the SNHT test (Alexandersson, 1986), using up to n = 10 reference data in order to smooth any possible inhomogeneities in the nearby stations. The detection of significant shifts in the mean was done on the monthly aggregates of the series, since the much higher variability of the daily series makes that detection far more difficult, especially in such arid climates as in the studied area.

The rest of sect. 2.1 is hard to understand, please improve the methodological description. Probably providing equations may be useful.
Please, check previous response.

Sect. 2.3: There is a finer topographical resolution available (e.g., SRTM at 30-m), which I think is more suitable for this region (characterised by high elevation, but also low slopes in some sub-areas). Especially if this is the data used to calculate the gauge elevation.
The reviewer is totally right, but the authors decided to work with a wider resolution because the results won't change significantly and the computing times are consequently lower. Moreover, the elevation considered for the calculation were the elevations provided by DGA and DMC.

Please correct the last sentence of the section.
The sentence has been corrected.

Sect. 3.1: It is not clear how the regression coefficients are obtained. Please clarify.
We have added, in section 3.1, the way the regression coefficients are obtained:
"The multivariate regression models are linear, and the coefficients are obtained by mean of the minimum mean square error method".

Please correct the number of the equations.
The text has been corrected.

Conclusions: Please correct grammatical errors.
The text has been corrected.

P15L26: please elaborate the statement "the high degree of irregularity shown between years make climate projections have a very high degree of uncertainty:
The sentence has been rephrased.

P16L8: can the authors provide examples on how the generated information can be used to water management policies?

We added the sentence: “Depending on the water availability, the development of economic activities can be adjusted so water supply may be guaranteed for the whole community.”

References: Boisier, J. P., R. Rondanelli, R. D. Garreaud, and F. Muñoz (2016), Anthropogenic and natural contributions to the Southeast Pacific precipitation decline and recent megadrought in central Chile, Geophys. Res. Lett., 43, 413–421, doi: 10.1002/2015GL067265.