Response to the comments of Prof. Geoff Pegram (Reviewer#2)

Reviewer comment (RC 2.1): What a pleasure to read a hydrometeorological article bringing innovation and appropriate explanation in estimating, through resampling using valuable tools, spatially and temporarily highly variable precipitation on O'ahu, ready to be used in other counties with variable topography. I have enjoyed the journey and am pleased to have reviewed it.
There is nothing much else to add, so I am returning my marked-up copy of the document. In addition, I am repeating a few of the less trivial remarks below my signature, which is my wont.
I recommend resubmission of a revised version in due course.

Authors' response (AR 2.1): We would like to thank Prof. Pegram for his thoughtful review, and we are glad to read that our approach, initially designed for tropical islands, could find applications in different regions with complex topography.

RC 2.2: L 71 A very useful introduction

AR 2.2: Thank you, we're glad that you agreed with our choice to focus our introduction on the adaptation of stochastic rainfall models to the climate at hand.

RC 2.3: L 89 storm (seasonal cyclones)

AR 2.3: Ok, we will add this clarification in the revised manuscript.

RC 2.4: L 101 Figure 1: Main features of rainfall observed over the island of O'ahu. Nice informative figure caption as are all of the others.

AR 2.4: Thank you.

RC 2.5: L 112 Figure 2: Overview of the structure of the stochastic rainfall model. Explain what you are doing more fully - also, how do you explain the almost perfect antithesis? What do the 'covariates' mean? What do you mean by: "will be discussed in detail later" in line 110 above? - Where? Aha - you refer to Fig. 2 (not Figure 2) in the following paragraphs –confusing.

AR 2.5: This is true that this figure occurs early in the paper (because it is an introductory figure), and therefore should have a more detailed caption. We expand and improve this caption in the revised manuscript. To answer the specific questions of Reviewer#2:

- This "almost perfect antithesis" is due to the nature of the covariates displayed here, specifically geopotential height at 950hPa (covariate 1) and temperature difference between 950hPa and 700hPa levels (covariate 2).
- Here "covariates" means atmospheric variables (e.g., pressure, temperature, humidity, wind) observed (or simulated) over the area of interest, and which are potential predictors for rainfall occurrence, intensity and spatial patterns.
- We will change this sentence line 110 to the following in order to avoid confusion: "Figure 2 summarizes the structure of the model, which will be discussed in detail in sections 2.2.2 to 2.2.4".

RC 2.6: 2.2.2 Meta-Gaussian representation. 'Meta' can be used as an acronym for "most effective tactics available", so how you define it in this context, as it is unusual and I had to hunt for it in the web?

AR 2.6: We agree, several terminologies co-exist in the literature (e.g., meta-Gaussian, trans-Gaussian, transformed-Gaussian), and meta-Gaussian may not be very frequent. We will define this term at the beginning of section 2.2.2 in the revised manuscript.

RC 2.7: L 142 Eq. (2) That's clever.

AR 2.7: Thank you.

RC 2.8: 286 Figure 3: Rain types identified for the island of O'ahu. Figure 3(a) is too crushed for a person to read the busy text in comfort. Please enlarge it and relocate 3(b) below. Your paper is short enough not to force the shrinkage.

AR 2.8: Thank you, we will re-design Figure 3 to make it easier to read.

RC 2.9: L 295 … (Fig. 3, rain types h–q)… Types h–q are labelled above by fading green captions an r-v are fading red - why? A distraction - please change them to monochrome black.

AR 2.9: Different colors have been used for labelling different rain types in order to allow for easy identification of rain type contributions in Figure 3b. But it is true that it can be distracting, and that it is redundant with the caption of Fig 3b. We will therefore follow this suggestion, and change these labels to monochrome black in the revised manuscript.

RC 2.10: L 321 Figure 4: Ability of the model to simulate site-specific rain statistics on O'ahu. I do not understand why you have a column (in (d)) of simulated values of near 125 mm/day and your simulated range is up to about 450 - same comment for the rest of the panels. (a), (b) & (c) are easy to follow ...

AR 2.10: This is because for the highest quantile (i.e., the 20-year maximum at the station of interest), the variability between the 50 realizations (i.e., independent simulations) becomes very large. For instance, in the first row of Fig. 4d, the observed 20-year maximum is 125mm/day and the simulated 20-year maximum varies between 125mm/day and 450mm/day depending on the realization, hence an overestimation of the 20-year maximum in this case. It should be noted that this large variability of simulated maximum is not seen as a negative result, but rather as an indication that this feature is poorly constrained in our model and should therefore be handled with care (see the discussion about the ability of our model to simulate extreme rainfalls, lines 370-376).

We will improve the caption of Figure 4d in the revised manuscript to make it easier to follow.

RC 2.11: L 334 covariates properly capture rain type occurrence in a tropical marine climate. That's pretty convincing.

AR 2.11: Thank you.

RC 2.12: L 355 Figure 5: Assessment of island-scale statistics simulation in O'ahu. Good work - the spread of mean and max daily rainfall are interesting - how do you account for the bias of the top-end in (d) with the max observed at 500mm? The text below does not comment on this.

AR 2.12: This bias means that our model overestimates the island-scale 20-year daily rain maximum, which is actually the main limitation of our model. This was discussed l 370-376 and restated in the conclusion lines 425-426. We will revise to make these points more clear.

RC 2.13: Comment on the Supplementary material: Figure SM2.4: Assessment of island-scale statistics simulation in Tahiti. This image is confirmation that the techniques were a success on Tahiti, transferred from your work on O'ahu. I suggest that you take a clip of the image [from (b) to (e)] to show us the value of your technique; the supplementary material is likely to be checked by few readers, so you need a teaser!

AR 2.13: Thank you for this suggestion. We will add a figure in section 3.4 to give an overview of the results obtained for the island of Tahiti.

RC 2.14: L 415 4.2 Concluding remarks. I think that this model will not be confined to tropical islands. I can see applications in my country, South Africa, where we have high coastal mountains in the East rising to 3000m flattening through dryer areas towards the North West. Check the figure from our work ; precip. max of 2000mm: "The gridded Mean Annual Precipitation averaged over each of the 1946 quaternary catchments in the region" in: Pegram GGS, Scott Sinclair and András Bárdossy (2016). New methods of infilling Southern African raingauge records enhanced by Annual, Monthly and Daily Precipitation estimates tagged with uncertainty. Water Research Commission, WRC Report No. 2241/1/15 ISBN.

AR 2.14: Thank you for sharing this insight and possible application. We are glad to read that our method can potentially be used in other areas with complex topography. It is true that orographic effects look impressive, in particular in Cape Town and Drakensberg areas. The main challenge we see to adapt the present framework to another climate (e.g., South Africa) is the selection of appropriate meteorological covariates to guide rain type occurrence.

RC 2.15: L 455 References. Please include doi's where available.

AR 2.15: Ok, we will add doi's every time this information is available.

RC 2.16: L 561 Scott, D. W. (2010), Scott's rule, WIREs Computational Statistics, 2, 497-502. doi:10.1002/wics.103. This find required a wild goose chase through the net but, eventually for your information, I found the original:- SCOTT, DAVID W. (1979). On optimal and data-based histograms. Biometrika, 66(3), 605–610. doi:10.1093/biomet/66.3.605

AR 2.16: Thanks a lot for this original reference. We will add it to the revised manuscript.