The reviews are all thoughtfully and carefully done and are therefore very valuable; the authors will revise the paper according to the detailed comments at the time of the final submission. This response is to react to the most important points at this stage, so that the discussion remains targeted on the core message of the paper.

The response to the reviewers will be in the order in which they were published and we will quote the appropriate sections, followed by our step-wise responses.

Reviewer # 1

"… the model is described and applied in a bivariate framework, even though it can be extended to many dimensions (> 2)."

This is de facto a description of a multivariate model and many of the evaluations are multivariate by nature. For example Figure 18 compares statistics of the 32 stations, and the entropy treatment is based on sets of three stations. However, in the sense of parameterisation, this is indeed a mainly 2-D approach because the model interdependency parameters (except m, k and alfa) are estimated using pairs of stations via the correlation matrix of the underlying background normal process.

Most of the reviewer's discussion, expanding on his view of the modelling, is related to the bivariate case, whereas our interest lies in the high dimensional multivariate situation. In the extension of the HK05 model suggested in the reviewer's equations 1 to 3, one would need 2^n binary probabilities (see discussion in Srikanthan and Pegram, 2009) which for the case of n >> 2 (n = 32 for our case) is not possible to determine from the observations, hence the reliance on the hidden covariance model driving the copulas. The advantage of the V-copula in this case is that it offers a higher flexibility in fitting the distribution in the upper right corner - which can alternatively be modelled as a separate copula as done in HK05.

" … the partitioned copula model implicitly describes the rainfall as a continuous process where the intermittency arises when the rainfall amount is smaller than the measurement resolution of the instrument. In this sense, the zero values assume the same meaning of the other tied values resulting from the instrument rounding-off. Since the two models imply two very different ways of considering the rainfall structure, in my opinion, these issues should be discussed in depth by the authors."

To respond to this carefully thought out comment, we use this opportunity to elaborate further on the advantages of our approach based on the V-transformed copula, which is not a model of rainfall "as a continuous process". In fact the V-transform explicitly models the distinction between two rainfall modelling/generating processes. The V-transformation separates the positive (wet) rainfall values into two distinct component distributions (the left and right arms of the V as shown in Figure 5 of the paper) which are separated by a small zone corresponding to no precipitation (dry). These lower and upper arms of the V-transform can be interpreted as describing advective/stratiform and convective precipitation respectively. The attached Figure 1 shows the conditional distributions corresponding to the two components - (the parameters are m=1.5, k=2, alpha=2). One can see that the blue distribution corresponding to the high non-linear transformed values on the right arm of the v-transform produces much higher precipitation values than the red distribution derived from the left arm, which is in fact a segment of the (untransformed) normal distribution. A special analysis (not detailed here) of the correlations within sets of precipitation values generated from the two arms of the V-copula transform, shows that the correlation between the series is different for the two different generating mechanisms. For the above defined parameters with P[0] = 0.5 one has a correlation of 0.81 for the precipitation amounts corresponding to the lower arm of the V-transformation and 0.48 for the upper arm. Thus the lower arm represents the advective (or stratiform) processes better than the upper arm, which corresponds to scattered occasionally very intense (or convective) precipitation.

Instead of the individual distributions H,F,G (given in Eq. 1 in the review) we use conditionals corresponding to higher precipitation amounts, as these are of higher practical relevance. In the revised version we intend to add some remarks on the form that the Hs take.

The approach presented in Serinaldi (2009) is very interesting. However, we would not choose to use that treatment, as the multivariate extension using the Gumbel copula to n dimensions does not model the processes reasonably. This is because, instead of maintaining strong interdependence, the dependence structure deteriorates with increasing dimensions (Druet-Marie and Kotz, 2001). By contrast, meta-elliptical copulas do not suffer from this problem.

" … the unconditional probabilities in Figs. 14 to 17 do not provide an effective illustration of the model performance in the multivariate sense, as they only describe the marginal behavior, so that similar results can be easily obtained by simulating from univariate mixed distributions at each site without introducing spatial and temporal dependences."

The comment suggesting that these figures can be derived "from univariate mixed distributions" is incorrect. The figures quoted use the unconditional cumulative frequency distributions for comparison purposes, to illustrate the difference between the conditional and unconditional distributions, and demonstrate how well the suggested model reproduces these differences. Indeed, the lower (dashed lines) offer good evidence of the model's ability to capture a particular aspect of dependence, i.e. the behaviour of one station's rainfall, conditioned on another station being reasonably wet (> 10 mm in a day). This could not be modelled by a univariate distribution, which is implicitly independent of a correct spatial dependence structure.

Reviewer # 2

"(6) Is the scale of the ordinate of fig. 5 appropriate? In my opinion, the area below these curves must be equal to one. Moreover, one of them appears to be greater than the other one (although it is impossible to distinguish which is which because no legend is provided)."

The reviewer seems to have been 'put off' by two things: the logarithmic scale of the densities and the truncation of the normal density at the origin. Attached in Figure 2 is a 2-part representation of the densities over a wide range of ordinates, to linear and logarithmic scales, where it will be seen that the areas balance and integrate to 1 as they should. We thank the reviewer for drawing attention to the figure (and numerous other inconsistencies in translating a Word document to Latex!) because there is a detail missing in the original paper; the V-copula transform density is asymptotic at the origin, which is now corrected.

"(9) At the moment there is no analysis of uncertainty of the parameters k, [alpha], and m."
The uncertainty analysis of the model parameters is definitely an interesting and important subject but it is not in the central focus of the paper.

Further discussion of the results will be added to the revised version of the paper.

Reviewer 3
"(1) I don't agree with the definition … and use of the term clustering in the paper."
"Clustering" was used in the sense of multivariate joint occurrence. We intend to change the wording.

" (3) In par. 3.1. at page 4496 l. 9, it is said that when m > 3, s rapidly approaches Gaussianity (and the transformation dose not depend anymore on a and k). In the application the parameter m is for almost of the months greater than 2 which means, however, that the right arm of the v-copula (which a and k refers to) is used only for very low probable values."
This is a very perceptive comment by the reviewer. The high values of m indicate that the scattered rain has relatively low probability. This is realistic for the region where most of the precipitation is related to large scale frontal systems.

"(4) … the copula model is shown to be better than the covariance model at smaller distances with respect to capturing the C1887 wet-dry occurrences. However in both models the dependence with the distance is not explicit. Can you explain the reason of this difference?"
The difference between the entropies corresponding to the wet/dry states depends on the distance because the correlations (even if not explicitly) themselves are related to the distance. The V-copulas differ more from the Gaussian if the correlations are higher. This suggests that the corresponding entropies can differ more.

" (5) The entropy-based method is very interesting. However i think it has some limitation in an anisotropic field as the rainfall. As a matter of fact the spatial structure of the rainfall is often very heavily influenced by the orography and other hydrometeorological constraints"
Orographic effects influence precipitation strongly. The entropies themselves are calculated in the copula space (using quantiles) thus systematic differences and anisotropies are filtered out. Figures 21-23 show that the dependence of the entropy on the square root of the area is relatively smooth. This smoothness suggests that the effect of possible anisotropies on the triples is not at all strong.

Drouet-Mari, D. and S. Kotz, (2001). *Correlation and Dependence*, Imperial College Press, London.

Srikanthan, R., Pegram, G.G.S., (2009). A Nested Multisite Daily Rainfall Stochastic Generation Model, *Journal of Hydrology*, Vol 371 pp 142–153. DOI: 10.1016/j.jhydrol.2009.03.025

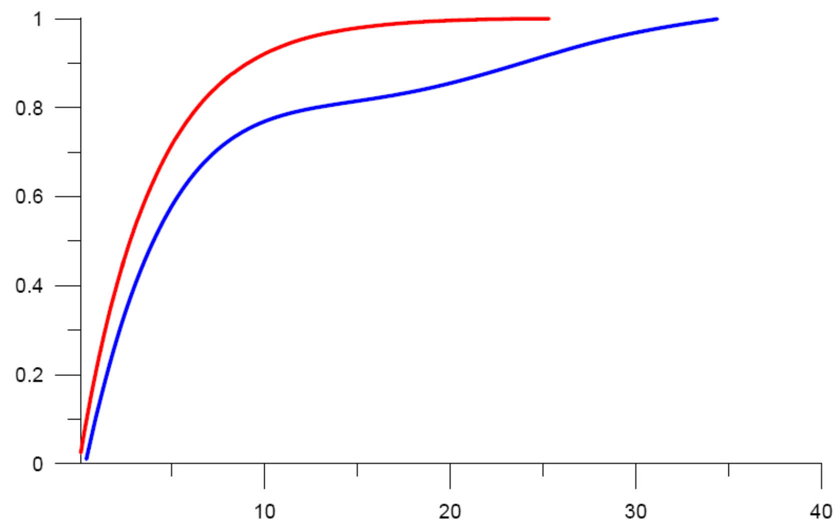

Figure 1. The figure shows the conditional distributions corresponding to the two different parts - (parameters are m=1.5, k=2, alpha=2). One can see that the blue distribution, corresponding to the high non-linear transformed values on the right arm of the v-transform, produces much higher precipitation values than the red distribution derived from the left arm, which is in fact a segment of the (untransformed) normal distribution.

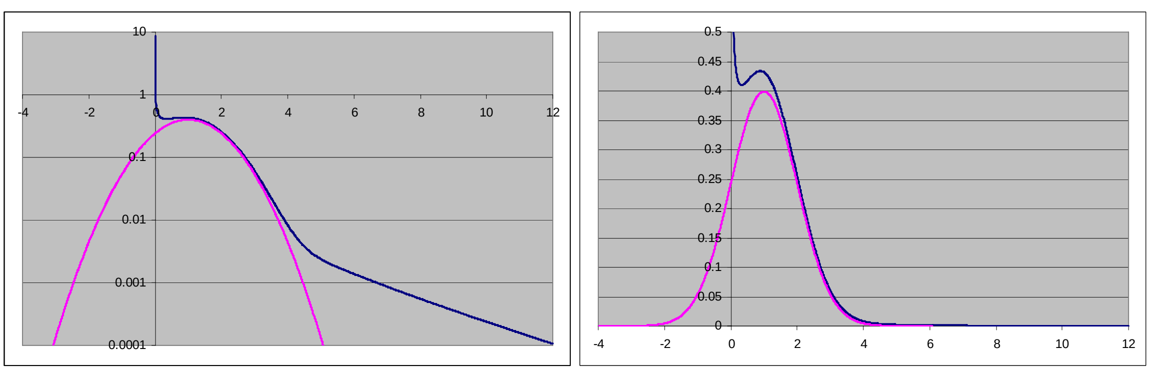

Figure 2. This is a reworked version of the original Figure 5 in the paper. The pink curve is the Normal density centred on 1 and the blue curve is the V-copula density with parameters m = 1and k = alpha = 2. Both curves integrate to unity in the linear plot on the right. The plot on the left illustrates the long tail of the V-copula density function. The blue curve is always above the pink curve. This figure helps to explain the differences in the cumulative distributions illustrated in Figure 1 above. As m gets bigger, the Normal density moves to the right and the blue curve drapes more closely over the pink one.