Interactive comment on "Spatial characteristics of severe storms in Hong Kong" *by* L. Gao and L. M. Zhang

Anonymous Referee #2

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General comments: The premise of the study is that the spatial structure of very extreme events might be different from that observed in more 'ordinary heavy rainfall. However, no 'ordinary heavy rainfall' events were included in the analysis, so I cannot see how this hypothesis might reasonably be investigated. A more complete analysis would need to include samples of several events to enable a comparison. At present, the manuscript reports the results achieved by applying a set of standard statistical techniques to a limited number of events (three). However, it is not possible to put these result into any kind of context with, say, more ordinary events or extreme events from a different location. As such, the experimental design used in the study is not sufficient rigorous to draw the desired conclusions and consequently the results presented in the manuscript are, in my opinion, of limited interest to an international audience.

The study hypothesise that elevation and 'varying meteorological conditions' – whatever they are - are important factors (page 6987, line 24 & Page 6989, line 23), but neither elevation nor other meteorological variables are considered as a covariate when developing the trend-surface in 3.2. But if these variables control rainfall amounts, then they should be included in Eq.4 rather than geographical location.

In many places, the description of the procedures and statistical aspects of the analysis are not sufficiently precisely formulated.

Specific comments Page 6983, line 1-3: 'For a particular region…' A reference is needed for this statement.

Page 6983, line 7: '(presence of zero values): what values are being referred to here?

Page 6987, line 1: '…related to monsoons other than typhoons.' Do you mean that the three events were observed during the monsoon, and that no events occurred as a result of typhoons?

Page 6987, line 6: Explain better how the maximum rolling rainfall values are defined. Does it matter if the rolling rainfall values (say 4hour) at different locations are not based on the same 4hour period? Fig. 3: Maybe add map outline behind gauge locations?

Page 6988, line 2-3: '…which are the most important characteristics of a storm event': what characteristics are being referred to here?

Page 6988, line 1-6: It is not clear to me what will be achieved by this three step procedure other than a description of model parameters for three storms?

Page 6988, line 17: What does it mean that N is a function of z, i.e. $N(z)$? Do you consider subsets of station pairs located a certain distance from reach-other? If yes, how do you determine the number of intervals? Eq. (1): In my copy it looks like some symbols are in bold (vectors) and some are not (scalars). Check that the notation is consistent.

Page 6988, line 20: Define the meaning of stationarity in this context.

Page 6988 ,line 21: what is the 'spatial data' being referred to here? Spatial data in general, or rainfall specifically? Eq.(2): Why use exp(-3*h/a) rather than just exp(-h/a), absorbing the '3' into the constant?

Page 6989, line 5: Why not consider the nugget? The semivariogram in Figure 5b looks like it could use a nugget?

Page 6989, line 7: I don't understand the importance of the sentence starting 'The rainfall data are assumed. . .'?

Page 6913, 13: 'which suggest better stronger spatial connectivity. . .' Table 2: Why is the sill larger for 2h than for 12h, 24h and 24h for the 2008 storm, when the opposite is true for the other storm? Presumably the numerical values of rainfall accumulations over longer durations are larger, so the variability (and thus) sill should also be larger? Please chack.

Page 6989, line 17-18: The text suggests Figure 5 contains data from three storms, but I think it only shows one storm (2008) for two different duration? Figure 4: I can't find a reference to this figure anywhere? And also, the y-axis label is missing.

Page 6990, line 12-16: This analysis appears to be based purely on a visual assessment of the plots. I think a more formal statistical analysis would be required here to make statements about similarity of difference between these sample estimates. Also, it is not known how robust these estimates are, and to what extend differences are due to particularly small or large observations in a short record. Later in line 20-21 the authors comment that this analysis is not sufficiently robust. But this is a critical observation, and should have initiated a revision of the methodology to be more robust.

Page 6991, line 6: I don't understand the reference to a shift of coordinate system. Eq.(7): Previously 'z' has been used as a reference to rainfall amounts. From Eq. 3 I think the de-trended rainfall (or residuals) is denoted 'epsilon'?

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Page 6993, line 14-15: Is it not the residuals that are strongly correlated rather than the actual rainfall amounts?

Page 6993, line 19: 'Same procedure' as what?

Page 6993, line 20: How is the ellipse fitting done?

Page 6998, conclusion bullet 4: What does 'best spatial continuity' mean? Do you mean 'strongest spatial correlation'? Also, what does the term 'as time goes by' refers to?

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