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

Anonymous Referee #1

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*** General comments *** In the paper the authors analyzed spatial variation of severe storms in Hong Kong. It is concluded that such spatial characteristics are due to the orographic effect (the local terrain) and meteorology factors (monsoon rainfalls instead of typhoons). My major concern is whether the interpretations and results will be robust and meaningful given the fact that rainfall data of only three severe storms were used in the entire study. Orographic effect of rainfall spatial distribution is a climatological phenomenon and should be dealt with using enough number of storm events. The concept of climatological variogram modeling (as opposed to event-specific variogram modeling) has been addressed in many studies including the following: - Bastin G, Lorent B, Duque C, Gevers M. 1984. Optimal estimation of the average areal rainfall and optimal selection of raingauge locations. Water Resources Research 20(4): 463–470. -

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Lebel T, Bastin G, Obled C, Creutin JD. 1987. On the accuracy of areal rainfall estimation: a case study. Water Resources Research 23(11): 2123–2134. - Cheng, K.S., C. Wei, Y.B. Cheng, and H.C. Yeh, 2003. Effect of Spatial Variation Characteristics on Contouring of Design Storm Depth. Hydrological Processes, 17(9):1755-1769.

The other concern is that the authors firstly established event-specific variograms of 4h, 12h, 24h, and 36h maximum rainfalls for individual storms and then 2nd order polynomial trend surface were fitted to spatial rainfall data. The major axes of trend surface mapping were then determined by results of anisotropic variogram modeling. The rainfall random fields were assumed stationary (or homogeneous) in space and exponential variogram model with an asymptotic sill was adopted. If the rainfall random fields are stationary, there is no need for trend surface mapping since the trend surface represents "expected value of the precipitation distributed over the rainfall domain" (as stated by the authors). Such a methodological problem needs to clearly explained.

Specific comments 1. As described in the general comments, I would suggest using more events for characterizing rainfall spatial variation. If rainfalls of more events are used, the climatological trend surface mapping should be conducted, instead of trend surface mapping for individual events. After all, trend surface is the "expected value" surface. 2. I also suggest the variogram modeling be conducted for residuals of the trend surface mapping. Such residuals can then be assumed stationary and isotropic since the trend surface mapping has taken care of the anisotropic variation. 3. The variogram parameters in Table 2 seem unreasonable. Usually the range of longer duration (24h or 36h) rainfall fields are larger than the range of short duration (1h or 12 h) rainfall fields due to the longer duration of rainfall accumulation. In particular, the sill of 4h rainfalls is significantly larger than rainfalls of other durations for the 5–7 June 2008 storm. This is not possible since the sill represents variance of the random field and rainfalls of longer duration have larger expected values and variances than rainfalls of short durations. The very close sill values for 12h to 36h rainfalls are also not reasonable, as can be seen in sill values of other storms. 4. Anisotropic variogram modeling of the residuals of trend surface mapping is not reasonable as explained in comment #2. It can also be seen clearly from Eq. (3). Results of anisotropic variogram modeling shown in Figures 12 to 14 imply the residuals (epsilon) in Eq. (3) are anisotropic.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 6981, 2015.

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