In their paper, the Authors discussed non-stationarity of rainfall in time (e.g. differentiating between rainfall types in time), suggested an approach to automatically divide the rainfall into different types and discussed the importance of extracting the rainfall statistics by their type when applying the statistics in sub-daily stochastic rainfall models. The question of the need to account for non-stationarity in sub-daily stochastic rainfall models is interesting and relevant for the readers of HESS. My comments are mostly minor, except for one major issue that I encourage the Authors to address: in the case study the Authors present their results based on only 10 realizations. Likely, more than 10 realizations are needed in order to quantify the natural (stochastic) variability in rainfall and to statistically identify the mean signal of the rainfall. For example, looking at Figure 6, it is quite clear that with 10 realizations the variability in rainfall is quite high and the discussion of the results (i.e. the differences in cumulative rainfall amounts between rainfall types H1, H2 and H3) could be biased to the fact that only part of the natural variability is presented. This issue can be easily resolved with increasing the number of realizations simulated per rainfall type. Other than that, I found the paper interesting, well written and structured. The method suggested by the Authors is sound and I believe the hydrological community, especially the researchers using weather generators, will benefit from the paper. Please find my recommendations for some text editing along with some minor comments to address below.

[page line]

[2 26] ". 'space' is used in this paragraph with two different meanings. First, in relation to the domain ("the question of stationarity in space is not addressed here because we focus on regional to local areas", and then in relation to the structure of rainfall within the domain ("The proposed framework relies on the classification of radar images based on their space-time features"). I found it to be a bit confusing.

[3 18] "…small enough to ensure spatial stationarity". The study area is characterized with a complex terrain, as seen from the figure illustrating the domain. What are the height differences and how do you know for sure that stationarity is preserved in space? To check spatial stationarity one must have a very long (>30 years) observation set. I suggest using one of MeteoSwiss gridded product (e.g. HiresD) which is freely available to check if the assumption of spatial stationarity is valid.

[3 20] The Alps mask and bias rainfall estimates from the weather radar over some areas in Switzerland. How good are the rainfall estimates from the Swiss weather radar system for this region?

[Figure 1] Please also add a scale bar in plot (a). I suggest adding an arrow indicating the advection direction and speed (i.e. using arrow length) in plot (c).

[5 2] "This change in the space-time features is very rapid and takes place in less than 30 min". Very interesting. If the changes are so rapid, why not using the weather radar data from MeteoSwiss at 5-min resolution? Results should be more robust. I guess data at 5-min resolution was not available for this study, but this is a point (of using higher temporal resolution data) you might want to later discuss.

[5 16] "Quantile 80% of rain intensities". Why 80%? Why not 95% or even 99% to explicitly account for extreme rainfall intensities? Please give the reason for choosing the 80th quantile.

[5 18] "…and applied here in the context of rain fields occurring at mid-latitudes under a temperate climate". Does it matter for which climate it is applied for?

[5 19] "They are computed based on binary images representing rain masks". I suggest adding a reference here to Fig. 2.

[5 21] "clusters". It seems that sometimes 'clusters' are used and sometimes 'cells' are used to describe the same rainfall features. Please be consist.

[6 26] "…we adopt an approach based on a Gaussian Mixture Model classifier (GMM)". Why? Using GMM for clustering is one option, but other methods to cluster data are available. Please give the reason to favorite GMM on other methods. Also - I guess the build-in Matlab functions were used?

[8 4-5] A repetitive. Consider deleting.

[8 5] "In addition, it can be desired to avoid noisy successions of rain types". This sentence is not clear to me.

[Table 1] "Type 3" is missing.

[10 8] "…convective rains (Type 1), thunderstorm-related heavy showers (Type 2), and stratiform rains (Type 3)". Why not following the same types you are presenting in Figure 1? I was confused at first reading as I had in mind that the rainfall types presented in Figure 1 are the one that will be discussed and presented throughout the paper. And - I would interpret both types 1 and 2 as convective events, characterized with high intensity rainfall and associated with thunderstorm, but one is more correlated in space than the other. I found the names given to type 1 and 2 a bit misleading.

[11 2] "synthetic images". At 1-km and 10-min, right?

[11 3] "Results show that the proposed method can consistently detect the prescribed rain types and their temporal evolution, for all realizations". Please support this statement with some numbers. How good are the results? Looking at the figure, it seems close to 100% fit.

[12 2] "10 realizations". I recommend increasing the number of realizations (to 30, or even 50) to better account for the natural (stochastic) variability of climate. Examining the results in Figure 6 - the signal of under/overestimating will be clearer with more realizations plotted.

[Discussion and conclusion]. I am missing some discussion on the advantages and limitations of using GGM comparing to other cluster methods, the sensitivity of the results depending on the threshold (10% and 60 min) that you were using, discussing if the 6 rainfall types that were automatically chosen are really differ (physically and statistically) from each other - or if some rainfall types could have been consider as the same one to reduce the number of types, etc. The discussion part should be "thicken" and should be separated from the conclusion part.

[15 21-25] In this context, I would like to mention three of our previous studies (Peleg and Morin, 2012, 2014; Peleg et al., 2015) in which we follow the framework suggested here, i.e. we classified rainfall types based on climate variables taken from re-analysis data (rainfall statistics are therefore based on rainfall images from a weather radar that are linked to different synoptic conditions/systems), used the statistics to train a sub-hourly distributed rainfall generator to simulate rainfall at high-resolution (5-min and 250-m) for both present and future climates (linked to GCMs). I believe that some parts of the analysis presented in these papers (e.g. cluster analysis of rainfall types, extracting space-time statistics from radar images to train rainfall generators) is also relevant here.

Peleg, N., Morin, E., (2012) Convective rain cells: Radar-derived spatio-temporal characteristics and synoptic patterns over the Eastern Mediterranean. Journal of Geophysical Research, 117,D15116.

Peleg, N., Morin, E., (2014) Stochastic convective rain-field simulation using a high-resolution synoptically conditioned weather generator (HiReS-WG). Water Resources Research, 50(3), 2124-2139.

Peleg, N., Shamir, E., Georgakakos, KP., Morin, E., (2015) A framework for assessing hydrological regime sensitivity to climate change in a convective rainfall environment: A case study of two medium-sized eastern Mediterranean catchments, Israel. Hydrology and Earth System Sciences, 19, 567-581.