Interactive comment

Title: Characterizing the space-time structure of rainfall in the Sahel with a view to estimating IDAF curves
Published for comments: 23 July 2014

Reviewer blind comments to author
This paper presents a global model to define intensity duration area frequency curves, based on simple scaling in space and time in combination with dynamic scaling to relate space and time. The model is applied to a network of rain gauges in the Sahel region with 22 year time series of rainfall data. Hypotheses underlying the model are verified and discussed in a thorough way. Some improvements could still be made to improve consistency and clarity of the paper, that I suggest could be made in a minor review of the paper.

- Variable symbols are not used consistently in equations throughout the manuscript and explanations of several variables are missing, especially: ς (eq 2); σ is both scale and shape parameter ? (in eq 2); η (in eq 4); q, k(q) (eq 6); λ (in l1 p 8415 is explained for eq 4, but eq 4 does not have a λ?); η seems to be used in a different sense in eq 13 to 17 compared to eq 4.
- On page 8411 various references to papers working on IDF and IDAF curves have been mentioned; it would be good to include reference to recent studies using radar-rainfall data for space-time analysis of rainfall (e.g. mention Overeem et al. (2009) here[1])
- On page 8418, the initial rainfall dataset is discussed. It is stated that all years where more than 25% of data were missing were excluded from analysis. Please clarify if this 25% includes 0 rainfall data or refers to >0 mm rainfall data points (if so, what was the applied threshold)? If 25% data includes 0 rainfall, a lot of relevant (significant) rainfall data points could still be missed. Could the authors elaborate a bit more on this, especially given the rather exceptional rainfall regime of the region.
- On page 8419, spatial aggregation of the rainfall fields: please clarify how rainfall data were spatially aggregated – were data simply averaged, were any spatial weights applied? Later, in line 15-16 it is stated that " only rain gauges having at least 1 other rain gauge present in at least seven of the eight sectors are retained". This could hardly be true for smaller spatial aggregations (rain gauge density is too low at these scales to meet this requirement) – please explain
- Page 8420: lowest temporal resolution used is 1 hour, while original data have 5 min resolution. Why were smaller temporal resolutions (15 min, 30 min) not considered?
- On page 8422, it is stated that "methods takes advantage of limiting sampling effects by increasing sample size". This is not entirely true: the same number of samples are aggregated over a range time windows to obtain datasets of different temporal resolutions; this does not increase sample size.
- On page 8422, l 20-21: it is stated that "the obtained IDF and IDAF curves do not display either any coherent spatial pattern or any trend over the domain". It would be helpful to illustrate this in a figure and to verify this statement in a more formal way: checking statistical differences in parameters of the IDF/IDAF distributions across the spatial domain.
- On page 8423: please report and discuss values of the parameters obtained, especially the dynamical scaling
- Discussion: The authors state that rain gauge networks continue to have an important value for space-time rainfall information in generating long time series of rainfall. Such networks

[1] Overeem, Aart, T. A. Buishand, and Iwan Holleman. "Extreme rainfall analysis and estimation of depth-duration-frequency curves using weather radar." *Water resources research* 45.10 (2009).

however have the disadvantage of uncertainty introduced by spatial interpolation that for instance radars do not have. Can the authors please discuss the influence of uncertainty introduced by interpolation of rain gauge data on IDAF curves and how this compares to resolutions that could be obtained from radar information. And also to what extent a region like the Sahel would benefit from higher resolution data (either obtained from radar or denser rain gauge networks).

Comments on figures:
Figures are small and sometimes difficult to read. Figures 4 to 8 are quite dense and would benefit from more explanation in the figure captions. Overall, more information in figure captions is needed to properly understand what is shown; preferably, figures should be clear, independent of the text.
In figure 2 and 4, the first moment seem to be decreasing with increasing duration, which could be a boundary effect. Please explain.