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Interactive comment on "Towards the Development of a Pan-European Stochastic Precipitation Dataset" *by* Lisa-Ann Kautz et al.

Anonymous Referee #4

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General Comments This manuscript is concerned with the simulation of precipitation capable of generating floods in Europe, which can create major losses to life and property. The authors rightly point out that precipitation records are often limited in length and spatial extent, which prevents them from being useful to drive hydrological models to simulate flooding responses to extreme rainfall. They argue that an appropriate strategy is to downscale coarse climate output from global climate models, which represents spatial fields of climate over historical time, nudged by re-analyzing these data with local observation information. They further suggest that to overcome the limitations of climate models in capturing the effects of extreme rainfall that occurs during convective storms, bias correction should be employed. The authors then set out a goal of determining the most appropriate bias correction method for such an applica-

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Discussion paper

tion and to then assess the relationships between historical precipitation events and flooding over parts of Europe. They use ECMWF re-analysis global GCM output for the historical period and then dynamically downscale these modeled data via an RCM to obtain precipitation fields of 25 km resolution. Then they apply bias correction to overcome artifacts such as ‘the drizzle effect’.

I believe this work is a solid and competent approach to the problem of attributing climate phenomena to flooding. I’m not very familiar with the extensive literature on downscaling climate model output and bias correction to explore its influence on hydrology, so I cannot evaluate the details of such an approach. More to the point, I am not terribly enthusiastic about this approach because of its limited utility in understanding the processes by which weather events translate into flooding. My biggest concern is that you are always left scratching your head about which method works where and for what circumstances. And furthermore, this uncertainty changes between events of different types and with different antecedent conditions (a point made briefly on p.12, Line 7). This may yield nonlinear errors in the representation of precipitation over the region (note differences in accuracy for the Danube v. Vistula rivers in the 2009 event), which are compounded when routing this into runoff and streamflow. These factors make it challenging to imagine that we can ever make considerable intellectual progress in attributing flooding to specific precipitation events in a generalizable way. Nevertheless, I can see the attractiveness of such methods, given the proliferation of global climate model re-analysis output. Overall, it seems that work is on solid footing and should ultimately be published, following a revision that addresses reviewers’ comments. I would like to see some intellectual realism injected here. How worth it is it to take a downscaling approach and what do we learn from doing it?

Specific Comments There are some issues with English language in the manuscript that require further editing. For example, the first line of the abstract mismatches the verb with the subject of the sentences. Precipitation is not plural. Another example occurs on page 2, line 1, where the word ‘presented’ should be replaced with ‘represented'. p.2, Line 7: There are various other methods and models for simulating fields of precipitation that should be included here. Please consult these references: (Paschalis et al., 2013; Peleg and Morin, 2014; Peleg et al., 2017; Singer et al., 2018). These models all have a similar goalâĂŤnamely to simulate high resolution rainfall series. However, p.2, Line 8-11: This sentence is not clear enough. I suppose you mean that the project generated multiple realizations of past climate and that's how you obtain 5800 years of data for a 60-y period? p.4, Line 4-5: I worry about the general ability of this method to capture orography, which can be a substantial contributor to runoff during extreme events. p.4, Line 25: Please define these terms and justify your choice of statistical-dynamical downscaling. p.6: I am very dubious about the attempts to deal with the drizzle effect. This is a major weakness in this and other studies that rely on coarse data for fine-scale problems. p.7, Line 6: The use of Pearson suggests that the data are normally distributed? Is this really the case? p.15, Line 6: 'unphysical' is not a word. p.16: I find the discussion very limited. It should be expanded to discuss the issues presented here more philosophically rather than simply recapitulating the findings. p.16-17: This study does not well acknowledge the numerous other ways of obtaining spatial fields of precipitation for driving hydrological models. I would like to see at least some discussion of pros and cons of each class of model.

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