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Interactive comment on "Characteristics and process controls of statistical flood moments in Europe – a data based analysis" *by* David Lun et al.

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The paper provides a comprehencive analysis of a datset of annual maximum floods covering all Europe and aims to dicuss how process controls can exolain the spatial pattenrs of mean annual floods and the coeficient of variation (CV) of floods. The paper comes in a line of papers anaysing floods at a European scale (Blöschl et al, 2017; Hall and Blöschl, 2018; Blöschl et al., 2019 and Blöschl et al., 2020). Whereas the previous papers have investigated trnds in time, this paper has a clear focus on the spatial pattenrns. This provides therefore new knowledge and is complentary to the previous papers. The paper is well written and could in my opinion be published after

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some minor revisions.

Lines 38:48: This is because a large basin is less likely to be fully covered by a thunderstorm than a small basin which tends to reduce the variance of extreme catchment-average precipitation and thus the MAF (Viglione et al., 2010a, b).

I would suggest to add one sentence discussion that there is a transition form convective thunderstorms to long duration stratisform precipitation as catchment size increases (see e.g. Figure 13 in Merz and Blöchl, 2003). This phenomena is also well studied in literature on area reduction factors for extreme precipitation.

Section 2.1 Data: Some more sentences could be added about the data. 1: Are the data from natural catchments not influenced by river regulations ? Do all flood data represent floods caused by rain and/or snow melt, or are there other types of floods like ice jam floods in this dataset ?

Figure 1: You could discuss more if and how your choice of regions influenced the results. I guess that if the aim as to have the best possible predictions of mean annual flood in ungauged basins, you would investigate more in detail how Europe should be divided into sub-regions.

Line 143: Please specify units of Qi and catchment area.

Equation 5: Since you use multi-letter symbols for variables, it is difficult to see where the multiplication sign is located. Either you should use only single-letter symbols, possibly combined with subscripts, or use the multiplication symbol to make the equation easier to read.

Lines 167-169: What is the equation for calculating the radius ?

Line 180-181 Could you be more specific on which variables were log-transformed and why ?

Line 206-207: Probably better to use past tense here.

Table 1: The regional cv is listed in the table, but not commented in the text. I suggest that you add some comments in the text.

Line 255: ‘however’ could be removed here.

154: is k the same as the radius defined on lines 167-169 (‘The length of the vector from the origin is a measure of the variability of the date of occurrence, ranging from 0 (uniformly distributed across the year) to 1 (all events on the same day).’ ? Then maybe k could be defined in the method section.

Kemter et al (2020) is missing in the reference list.

Line 313: ’which may mask causal relationship’. Do you think that also spurious correlations might be a challenge?

Figure 5: Maybe one extra point to add: The sign of the correlations listed in Figure 5 might depend on the domain you investigate, and the sign might change between sub-regions of Europe. E.g in the scandinvian countries, it is a negative correlation between elevation and LUF.

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