

Interactive comment on “Spatiotemporal patterns of synchronous heavy rainfall events in East Asia during the Baiu season” by Frederik Wolf et al.

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Response to Anonymous Referee # 1

We gratefully appreciate the very interesting and helpful suggestions of the anonymous reviewer regarding the presentation of our study. First of all, we thank the reviewer for their general positive feedback.

In the following, we present a point-by-point response to the comments and remarks, with the comments of the reviewers shown in blue, italic font.

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- *ll. 88-89: This is NCEP/NCAR - Reanalysis v1 - Kalnay et al 1996*

In fact, most of our analyses are based on data from the NCEP/NCAR Reanalysis v1. However, in the discussion section, we also use 200 hPa relative vorticity, 200 hPa as well as 850 hPa winds, and 500 hPa geopotential height from the NCEP-DOE Reanalysis v2 for Figure 6, which is why both datasets are mentioned here. We will clarify this in our revised manuscript.

- *1. ll. 98-100: It is not clear to me the difference between the two parameters. Could you please clarify, maybe with a figure?*
- *2. l. 103: or you use a module here, or you have to mention before this formula that event m is preceding event l.*
- *3. ll. 104-105: I had to open Odenweller and Donner because this paragraph it is not very clear. Once comparison starts, I find some differences e.g. event coincidence rate can be precursor or trigger in the original paper. Formula (1) is trigger event coincidence rate. Please use the same symbols of the original paper (s”).*
- *4. l. 107: anticipate this sentence before the formula $0 < \dots < \Delta T$. please use original symbols of the paper you are citing (s”).*
- *5. ll. 112-113: since you are studying instantaneous non lagged event, why are you using tau in the above formulas?*
- *6. l. 121: please use original symbols of the paper you are citing (s”).*
- *7. l. 125: this is just a question: being tau equals zero throughout all the manuscript, does it make sense to write it everywhere? It can be yes or no, but please motivate it.*

We thank the reviewer for these comments pointing out that we need to further clarify our methodology. We will rewrite this section with a special focus on the

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raised points. Indeed, regarding comment #7, we agree that we can omit the second ECA parameter τ , thereby possibly relieving the necessity of adding another schematic illustration to clarify comment #1.

- *ll. 113-115: here 3 appears a magic number. Could you please provide a more physical explanation? I don't know (just guessing - it should be justified): e.g. transport of moisture from point a to b can be maximum three days.*

The reviewer is correct, we motivate our choice based on the related atmospheric processes. We will include an explicit explanation of the underlying rationale in our revised manuscript.

- *l. 199: maybe I missed it in the paper. What is ITCZ?*

Thank you for this comment. We have indeed missed introducing the abbreviation ITCZ for the inter-tropical convergence zone. We will add this information to the manuscript.

- *ll. 206-208: I know where is Honshu... I wonder if all the readers of this journal know it. Could you please indicate it (with a point) in your map or use any coordinate?...*

We thank the reviewer for this remark. We agree that a labelling of the islands and the Japanese Sea will be useful for following the discussions in our manuscript. Therefore, we will include a physical map of the region with indications of the main geographical features discussed in the manuscript.

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- *ll. 224: could you please identify somehow the double band in the figures? (maybe with two ellipses or anything you think may work better). This may help people with red-green colour blindness.*

We will highlight the corresponding structure in Fig. 1c and d of the revised manuscript.

ll. 233-235: I have a question (just to clarify). Did the northern high degree band disappear because of any physical phenomenon OR it is disappeared because the area that you take into account is too small?

It is likely that the northern band disappears since the link distance pattern changes completely due to the seasonal reorganization of the atmospheric circulation. Unfortunately, since the TRMM data set is limited to a latitude below 50°N we unfortunately cannot check the possible effect of a larger study area in the context of the present study. However, further exploring the mechanisms described in our work as represented in other more global data sets presents an interesting direction for future research.

- *l. 246: Another question. Why mid-June/mid July? are these months more important than the other that you are studying? Do you want to capture a transition? the two bands are more evident? could you please add a sentence where you specify it? thanks*

We agree that we have to more explicitly clarify this choice in our manuscript. There are in fact two reasons behind. First, we have observed that the double band is most prominent in this period. Second, the cross-degree peaks exactly

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for the 30-days window covering the period between mid-June to mid-July. We will add a corresponding note to the manuscript.

- *II. 294-296: is this approach similar to the one that was first used in one of the prof. Kurths paper? In case yes, I can't remember which one it was... could you please check?*

It is not clear to us which paper and specific approach the reviewer is pointing to here. There have been various papers from the mentioned group using event synchronization strength (rather than ECA) based functional network analyses in the context of monsoon dynamics over India, South America and also East Asia. Some of them have also looked at synoptic situations occurring with the emergence of synchronized rainfall (e.g., Boers et al., Nature Comm., 2014). However, we are not aware of any work that has explicitly studied the synchronicity of heavy rainfall events in two distinct regions with the statistical approach that we have taken here.

- *I. 308: I'm not sure that anti-synchrony is equal to "extraordinary low event coincidence rate". I would rather use "asynchronous". a- stands for without / anti- stands for against. So for me anti-synchrony would be a negative synchrony (that can be also high)*

Regarding this comment, we would like to clarify that we indeed did not mean "asynchronous" behavior (in the sense of absence of synchrony) but really some "negative synchrony" in the sense that during heavy rainfall in one of the regions, heavy rainfall would be suppressed in the other, i.e., would occur less frequently than expected just due to chance. (If phrased in terms of phase synchronization,

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this would correspond to anti-phase behavior. However, since we are arguing in terms of events here, such terminology does not easily apply.)

- *I. 319: this is very vague. Could you please specify what do you mean for particularly high activity? I mean in numbers.*

Here, we refer to the event coincidence analysis regarding the number of events in the two regions. We will rephrase this sentence specifying the quantiles of event coincidence rates.

The identified typo in I. 351 will be corrected in the revised manuscript, too.

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