

We thank the reviewer for his/her helpful comments, which in our opinion helped to improve the clarity of the manuscript. Below our detailed response (black) to the comments raised by the reviewer (blue) including changes made in the manuscript (red).

Best wishes,

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1. Near line 20: “number of compound events”: the numbers are not fully meaningful without first defining what an “event” is, i.e., is an event counted as a day, a 3-day period, or a continuous period ≥ 3 days? (Note: Examples will always help. Suppose the event thresholds are met for all days from January 1st to 3rd, i.e., each of the 3-day window centered on Jan 1, Jan 2, and Jan 3 satisfies the event threshold), is this period counted as one event, or 3 events?)

An event is considered to be one day only. To illustrate this on an example and to address the second comment of the reviewer we included the following explanation to the end of Sect. 3.5 - “Definition of compound events”:

“The compound event is then considered to have occurred on the day in the centre of the three-day period over which the precipitation sum and the water level maximum was derived. The day before and after this are not considered compound events unless they are located in the middle of a three-day period that fulfills the above defined requirements.

For instance, suppose that the precipitation (P) summed over day₁, day₂ and day₃ exceeds the 95th percentile of the three-day precipitation sum of the full

time series ($p_{95\%}^P$), i.e. $\sum_{n=1}^3 P(\text{day}_n) > p_{95\%}^P$. If the maximum total water level ($H_{max}^{d1,d2,d3}$)

during the same three-day period exceeds the 95th percentile of the total water level (H) of the full time series ($p_{95\%}^H$), i.e. $H_{max}^{d1,d2,d3} = \max(H(\text{day}_1), H(\text{day}_2), H(\text{day}_3)) > p_{95\%}^H$,

then day₂ is considered to be a “compound event”. Day₁ and day₃ are not defined as compound events, unless they themselves fulfill the definition of compound events,

i.e. for day₁: $\sum_{n=0}^2 P(\text{day}_n) > p_{95\%}^P \wedge \max(H(\text{day}_0), H(\text{day}_1), H(\text{day}_2)) > p_{95\%}^H$ and for

day₃: $\sum_{n=2}^4 P(\text{day}_n) > p_{95\%}^P \wedge \max(H(\text{day}_2), H(\text{day}_3), H(\text{day}_4)) > p_{95\%}^H$.

Each of the three days is then counted as a single compound event. As a result, should all three days (day₁, day₂ and day₃) fulfill the requirement of compound events then they are considered as three separate events. Accordingly, the day before the compound event on day₁ would be day₀, the day before CE on day₂ would be day₁ etc.”

2. Near line 20: “within +/-1 days of the event”: Now I sort of understand what “centred” meant in the earlier sentence. In the example I gave above, does it mean the

resulting value of $a+b+c$ is assigned to day 2, and the 3-day period centered on day-2 is considered AR-related if an AR occurred on one or more days of day 1, 2, or 3? Please use the answer to make clarifications in the data section in terms of how a CE is defined, how an “event” is counted (e.g., if a CE lasted 6 continuous days, is it counted as one event, 2 events, or 6 events?), when a CE is considered to be AR-related or not AR-related, what “day of event” means, etc. Without clear and unambiguous definitions of terms, the statistics presented are hard to make sense of. (Note: Please directly address each point in the above comment if possible, and use examples where they might help the explanation. Among these, the two key questions are how the events are counted, and when a CE (defined using a 3-day window but assigned to the middle day) and an AR (which presumably is based on 6-hourly time steps) are considered to be associated with each other. I understand some of the answers would seem too obvious to the authors, but the hope here is that the description should be unambiguous enough for an ordinary reader to understand the statistics and/or re-produce the analysis procedures.)

Please refer to our answer to the reviewer’s previous comment.

3. Table 1 and where applicable in the text: “on day of event”, “one day before or after event”: given that the precipitation is a 3-day total, and CEs are defined using a 3-day window, descriptions like these are quite ambiguous. For example, if a CE occurred during the period of January 1-3, then common sense is that “one day before event” is December 31, and “one day after event” is “January 4”. But that doesn’t seem to be what the authors intended in indicate here. Again, an unambiguous definition of terms is needed to avoid potential confusions of this kind, as also suggested earlier. (Note: The authors did address this comment. But now that I understand better how an event is defined, a new question arises: how is “one day before event” and “one day after event” dealt with in cases where multiple events occur consecutively? Let’s use the earlier example again, i.e., assume the event thresholds are met for all days from January 1st to 3rd, i.e., each of the 3-day window centered on Jan 1, Jan 2, and Jan 3 satisfies the event threshold. Then, from the perspective of the Jan 2 event, Jan 1 and Jan 3 would be considered “one day before event” and “one day after event”. But that leads to a paradox, because both Jan 1 and Jan 3 are themselves “day of event”. Similarly, although Jan 2 is a “day of event”, it is also “one day before event” because it precedes the Jan 3 event, and is also “one day after event” because it follows the Jan 1 event. In other words, all of your statistics for “day of event”, “day before event”, and “day after event” are, inadvertently, a mixture of “day of event”, “day before event”, and “day after event”. This issue complicates the physical interpretation of the statistics and should be remedied/mitigated.)

The reviewer raises a valid point with this concern and highlights that the manuscript wasn’t clear enough in the explanation of the used terminology. When referring to “CEs

with an AR over the Netherlands”, we intended to refer to the set of compound events that coincides with the presence of an AR only on the day of the event itself. There is no AR present on the day before or after the event. Hence, if we take the example from our previous answer, if day_2 is considered to be a CE and classified as a ‘CE with an AR over the Netherlands’, neither day_1 nor day_3 have an AR over the Netherlands at any of their six timesteps. Therefore, our statistical analysis is limited to the comparison of (i) CEs with ARs over the Netherlands (on the same day as the event itself and without ARs on the day before and/or after) and (ii) CEs without an AR over the Netherlands on the day of the event (regardless of the presence of an AR on the days before and/or after the day of the CE). Neither of the two sets includes CEs where an AR is present on the day before or after the event day. We included a clarification of this into the manuscript.

In the second paragraph of Sect. 4.1 - “Climatology”:

“... To allow a thorough investigation of the impact of ARs on CEs in this study, we differentiate three types of CEs, namely those events that co-occur with an AR over the Netherlands, either on the day of the event (hereafter CEs with AR; Fig. 4b) or one day before and/or after (hereafter CEs with AR \pm 1day; Fig. 4c), and those that occur in the absence of an AR in the three days around the event (hereafter CEs without AR; Fig. 4d). To illustrate the difference between these types of event, remember the example used in Sect. 3.5. Assume day_2 is a CE. If no AR is detected at any of the timesteps throughout day_1, day_2 and day_3, day_2 is considered a "CE without AR". Should there be no ARs over the Netherlands on day_2 but on either day_1 and/or day_3, i.e. the day before and/or after the CE, then day_2 is considered to be a "CE with AR \pm 1day". Only if there is an AR over the Netherlands during one of the timesteps of day_2 itself, day_2 is considered a "CE with AR". Since the latter two types of CEs, i.e. CEs with AR and CEs with AR \pm 1day, show very similar atmospheric climatological anomalies ...”

At the end of the caption of Table 1:

“... For an explanation of terminologies and a definition of the different types of compound events please refer to the text.”