

*Review for revised manuscript “Hourly Precipitation Patterns and Extremization over Italy using convection-permitting reanalysis data”*

**General comments:**

The manuscript has been improved, with the authors appropriately addressing the reviewers' comments. The use of more precise terminology (e.g., "hourly precipitation patterns" instead of "events", "spatial extent" instead of "size"), a more instinctive choice of acronyms, and several redaction adjustments enhance the readability of the paper and improve the reader's understanding, particularly regarding the methodological aspects.

The contextualization of the analysis has also been strengthened. The authors now acknowledge the limitations associated with the 4-km resolution, integrate the non-extreme precipitation analysis more smoothly (through revisions to the title, abstract, and introduction), and clarify the overall purpose of the study.

Most of my previous concerns have been satisfactorily answered and incorporated. However, I reiterate that the metric N still presents a caveat. Although the authors have partially addressed this issue, it requires either further verification or more cautious phrasing in the conclusions regarding changes in extreme precipitation events (HPEs), as detailed in the specific comments.

For this reason, I recommend **minor revision** before publication.

**Specific comments:**

1. **Regarding the N metric:** My initial concern was that N could reflect both the hourly spatial density of precipitation structures and their frequency. The authors addressed this by adding, in the supplementary material (Fig. S1), an analysis of the frequency of wet hours, which reproduces the behaviour of N. These satisfactorily address the issue, but only for hourly precipitation structures, not for HPEs and not for HPE changes derived from N.

I leave to the authors the choice to either (i) extend the wet-hour analysis to HPEs and to changes in HPEs, or (ii) explicitly state the limitations of using N to interpret HPEs behaviour (See point 2).

In addition, in the sentence at I.204–206 ("Alternative metrics to N, such as the frequency of wet hours..."), it should be clarified what this alternative metric is intended to test. I also do not agree that N is more "tangible" than the wet-hour metric, but this may be personal.

2. **Regarding interpretation of changes in N:** In L.384–386, the authors write: “*This suggests that changes over time are more likely associated with the frequency of HPEs rather than their intensity or spatial extent. It may also reflect the lower noise sensitivity of N compared to other indicators.*”

This is an important statement, but in my view the methodology is not sufficient to conclude that frequency changes dominate over intensity changes in HPEs. As discussed in point 1, an increase in N could indeed reflect (i) more hours containing extremes, but it could also arise from (ii) an increase in number of structures within the  $0.5 \times 0.5$  window during the same hour.

The point about noise sensitivity is relevant and should be explicitly incorporated into the interpretation in that same phrase: N is less affected by noise, which makes statistical significance easier to achieve compared to peak-int and mean-int. However, both peak-int and mean-int also show increases in the selected regions (though not significant), and there are high chances that an intensification is responsible for the increase in the number of extremes.

For these reasons, this interpretation should be rewritten with clearer limitations, as a deeper investigation would be needed to affirm that frequency is primarily affected compared to intensity in my opinion.

#### Technical comments:

1. L. 248-249 “*Before focusing on the extremes, an analysis of the overall patterns of HPSSs across the dataset is presented, providing the necessary context for the interpretation of subsequent results on extremes*”. It is not straightforward that the non-extreme precipitation context is “necessary” for extreme precipitation analysis. Please clarify or rephrase.
2. L.307-308 Regarding Figure 8 “*In autumn, slightly higher intensities, ranging from 4 to 5 mm/h, cover most of the country, while lower values persist **only** in the Prealpine and Alpine regions.*” Change “only” to “mostly”, as values under 4 mm/h are not exclusive to the Prealpine and Alpine regions.
3. At several points the manuscript refers to ‘bias’ and ‘inconsistencies’ in the dataset. Please clarify that these refer to findings from previous work, since the dataset is not evaluated in this study. (i) L.320-323 “*However, while MeanInt and PeakInt seasonal maps appropriately reflect higher values during the autumn and summer seasons, they also display certain inconsistencies. In particular, some areas exhibit an overrepresentation of convective activity during summer, which may not fully align with observed patterns. This issue will be examined in greater detail in the Discussion section 4.*” Please clarify what is meant by “inconsistencies”. My

understanding is that these refer to inconsistencies in the sense of biases relative to observations. If this is the case, please specify which observational dataset they are compared to and cite the corresponding references. If it is not the case, give more precision on what you mean by inconsistencies. (ii) + I.402-403 “*Then, as described in Section 2.1, a precipitation overestimation bias is present in summer. These localized wet biases are likely due to overly active explicit convection in the model, as shown in Figure 8.*” Precise what is shown in Figure 8, as it is not a bias map. Rephrase the sentence 402-403 so that it is more explicit that you are referring to bibliography here.

4. Discussion I.413-414: “*In principle, such biases could have masked decreasing trends in those areas; however, the overall spatial pattern suggests that this scenario is highly unlikely.*” I do not understand how the overall spatial pattern suggests this scenario unlikely. Also be careful as you are mixing bias on annual precipitation percentages with percentages of trends in HPEs. Are they comparable? What if the bias in annual precipitation specifically comes from a misrepresentation of extremes?