

The responses to the reviewer are below in blue.

The authors have addressed my concerns, and I personally appreciate how the study is now framed. I believe it makes a valuable contribution to the literature and helps readers understand where this methodology fits among other existing attribution approaches. I only have a few minor comments:

We thank the reviewer for the careful reading of our manuscript and for the constructive feedback provided throughout the reviewing process, which have help us improve both the positioning and the overall quality of the manuscript. We are pleased that the revised framing of the study is now clearer and better positions the methodology within the broader extreme event attribution literature.

We address the remaining minor comments below.

- Line 24: Consider rephrasing as: “while keeping the large-scale circulation fixed to that of the ERA5 event” (or similar wording).

We thank the reviewer for this suggestion. To improve clarity, we revised the sentence to explicitly state that the thermodynamic responses are isolated while preserving the observed large-scale circulation. We adopted this wording rather than repeating the reference to ERA5, which is already introduced in the preceding sentence.

The sentence now reads: Two climate scenarios are compared: Factual (present-day) and Counterfactual (~1950), isolating thermodynamic responses while preserving the observed large-scale circulation

- Line 25: how is extremeness evaluated? I would rephrase this as: “Long-term IFS-FESOM and ERA5 datasets provide a climatological reference for evaluating event extremeness based on maximum daily precipitation...”

We thank the reviewer for this suggestion. To improve clarity, we revised the sentence to explicitly indicate that event extremeness is evaluated using percentile-based thresholds of selected key variables. We chose this wording because the climatological assessment is based on multiple variables rather than solely on maximum daily precipitation.

The sentence now reads: Long-term IFS-FESOM and ERA5 datasets provide a climatological reference for event extremeness using percentile-based thresholds of selected key variables.

- Lines 55–60: Please explain that the probabilistic approach attributes a class of events, potentially combining events associated with different circulation drivers, and is therefore unconditional with respect to the specific event

We thank the reviewer for this suggestion. To clarify the scope of probabilistic attribution approaches, we have revised the text to indicate that they quantify changes in likelihood and intensity across a class of similarly defined events, irrespective of their specific circulation drivers.

The sentence now reads: Probabilistic attribution approaches, for example, are particularly valuable for quantifying changes in event likelihood and intensity across a class of similarly defined events, irrespective of their specific circulation drivers. However, their application to highly exceptional precipitation events can be constrained by limited sampling of comparable events and by sensitivity to the event definition.

- Lines 71–73: Circulation-based analogue approaches typically do not assess changes in likelihood. In fact, some authors consider them part of storyline approaches. While I would prefer to keep them separate as you already do, I suggest reframing these couple of sentences to explain that analogue approaches assess changes in event magnitude resulting from changes in the physical environment associated with the event (depending on the degree of dynamical constraint)

We thank the reviewer for this helpful suggestion. We agree that circulation-analogue approaches are conceptually closer to storyline approaches than to probabilistic attribution methods, as they also assess changes in event characteristics under constrained dynamical conditions rather than focusing primarily on changes in event likelihood. To clarify this distinction, we have revised the text accordingly.

The sentence now reads: In contrast to probabilistic approaches, these methods focus less on changes in the event likelihood and more on how present-day warming altered the physical environment associated with the event. Similar to circulation-analogue approaches, they assess changes in event characteristics under constrained dynamical conditions.

- Line 74: Please briefly explain the pseudo-global warming method for readers who may not be familiar with it. For example: “Using a pseudo-global warming approach, which consists of modifying temperature and humidity fields according to climate model projections in high-resolution regional simulations (e.g., Calvo-Sancho et al.)...” or similar

We thank the reviewer for this suggestion. To improve readability for readers unfamiliar with the pseudo-global-warming methodology, we have added a brief explanation indicating that the approach imposes thermodynamic climate-change signals on regional simulations, while keeping the discussion concise and focused on the findings of the cited studies.

The sentence now reads: Using a pseudo-global-warming storyline approach (in which thermodynamic climate-change signals are imposed on regional simulations) and high-resolution modelling, Calvo-Sancho et al. (2026) focused on the convective storm affecting Valencia on 29 October, examining how climate change modified local thermodynamic and convective processes

- Line 88: “remains insufficiently explored” → “remains unexplored,” as whether the topic has been explored sufficiently is subjective

Done

- Line 119: In the phrase “the event before and during the rainfall peak,” I think it is important to specify how far in advance the analysis extends, as this is a distinctive aspect of the study compared with previous work

We thank the reviewer for this suggestion. We agree that the original wording did not clearly indicate the temporal extent of the analysis prior to the rainfall peak. To clarify this point, we revised the sentence to explicitly state that the study examines the evolution of the synoptic-scale thermodynamic conditions several days before and during the rainfall peak. We believe this provides the necessary context while leaving the detailed analysis period to be described in the Methods section.

The sentence now reads: Our study complements previous statistically-derived and regional-to-local storyline attribution analyses by being the first to focus on the evolution of the synoptic-scale thermodynamic conditions associated with the event, several days before and during the rainfall peak, using global km-scale model simulations.

- Figures 1 and 2: Do these figures show the four-member mean of the factual simulations, or only the main simulation? I guess the main simulation but please clarify in the figure caption

We thank the reviewer for pointing this out. Figures 1 and 2 are based on the main Factual simulation rather than the ensemble mean. To avoid ambiguity, we have clarified this explicitly in the corresponding figure captions.

- Figure 3: What is meant by the “free run”? Does it refer to a simulation without spectral nudging? Please clarify, as I believe this is the first time the term is introduced in the manuscript

We thank the reviewer for pointing this out. In Section 2.3, we explicitly define the long-term simulation as “IFS-FESOM” and state that this terminology will be used throughout the manuscript. To remain consistent with that definition and avoid introducing an additional term, we have removed “free run” from the figure 3 caption and now refer to this experiment simply as “IFS-FESOM”.

- Why figure 4 has red colours for increase in TWVC and blue for decrease?

We thank the reviewer for this comment. The red-blue colour scale was chosen to visually distinguish the TCWV differences from the precipitation differences shown in panel c of Figure 4, thereby reducing potential confusion between variables. In addition, the use of warmer colours for positive TCWV anomalies was intended to provide a visual connection with the warmer thermodynamic conditions associated with increased atmospheric moisture. We believe that this colour scheme provides a clear and intuitive representation of the results and have therefore kept it in the figure.

- Figure 8: Are the orange arrows scaled according to the absolute values in the factual and counterfactual scenarios? If so, please clarify this in the caption or main text. If not, please consider scaling them accordingly

We thank the reviewer for this comment. The orange arrows are intended as a schematic representation of the main moisture transport pathways identified from the IVT and TCWV analysis and are not quantitatively scaled according to IVT magnitude. To avoid potential confusion, we have clarified this explicitly in the figure caption.