

We thank Referee #1 for his/her valuable comments and suggestions, which helped to improve the manuscript and to remove ambiguities/misunderstandings. Below are point-to-point responses to each comment.

## GENERAL COMMENTS

The study uses spectrally nudged high-resolution regional climate model simulations to quantify the sensitivity of summer 2019 European heatwave to the thermodynamic effects of global warming. The simulations indicate that, under unchanged atmospheric circulation, the daily maximum temperatures experienced under the heatwaves increase by about 2 K for each 1 K of global mean temperature change, and locally up to 3 K to the east of the heatwave centre. This contrasts with the simulated temperatures earlier in the summer, which only increase at the same rate with the global mean temperature. These features, together with the increased diurnal temperature range during the heatwave periods, suggest a role for reduced soil moisture in the amplified temperature response.

Overall, the manuscript is interesting and well-written. I only have a few minor comments and remarks on it.

We thank Referee #1 for the positive assessment of our manuscript

## DETAILED COMMENTS (substance and presentation)

1. The focus of the study should be introduced earlier. Perhaps write on L7: ... we employ an event-based storyline approach to study the 2019 summer heatwaves over Central Europe. The approach comprises three steps ....

Reply: We agree with the reviewer's suggestion, and we moved the information about the focus of the study into the suggested place:

"To isolate the more certain thermodynamic response from the less certain dynamical response to anthropogenic climate change, we employ an event-based storyline approach and focus the present study on the 2019 summer heatwaves over Central Europe. Our approach comprises three steps:"

2. "the scaling of the global mean temperature" is obscure: the global mean temperature always scales one-to-one with itself.

Reply: We agree with the reviewer that this statement could be misleading. We have modified the third research question as follows:

(3) What is the local to regional extreme temperature scaling in response to global warming for an event like the 2019 heat wave?

3. Equation (2) suggests a linear increase with height.

Reply: thank you for pointing this out. There was a mistake in the formula, which will be corrected

$$\alpha_{nudge} = B_0 \left( \frac{z - z_{start}}{z_{top} - z_{start}} \right)^2$$

4. L148-149. The ensemble spread in E-OBS characterizes the observational uncertainty in individual daily temperature fields. The observational uncertainty in (e.g.) summer mean values is expected to be considerably smaller, due to cancellation of errors whose sign varies from day to day. For this reason, comparison with the E-OBS ensemble spread understates the significance of the model-to-observation biases on longer than daily time scales.

Reply: We agree with this comment. In the revised manuscript, the method of significance estimation will be changed to the student t-test.

5. L237-238. The difference in warming rates might also relate to the difference in season (early vs. late summer), not only the extremeness of temperature.

Reply: We are grateful for pointing this out. We admit that we did not put enough focus on this aspect. It may indeed be helpful to have a month-by-month perspective. This aspect has already been discussed in Sanchez-Benitez et al. (2022) and illustrated by their Fig. S9 and Fig. 6. There, they find a gradual increase of global warming amplification from early to late summer, which indeed plays a role in the magnitude of warming rates obtained in our experiment. The increased probability of large heatwaves in late summer was also found by Hundhausen et al. (2023) and illustrated in their Fig. 9. We will add this information to the discussion section at L314.

6. L274-277. Is the mean scaling similar for all summer months, or does it increase from early to late summer following the decrease in average soil moisture?

Reply: We agree that accounting for the intraseasonal cycle of regional warming amplification would be more meaningful. As discussed in the point above, there is evidence that the mean scaling is not similar for all summer months. In the revised manuscript, we will compute mean scaling for June, July, and August separately.

7. Same as comment 2.

Reply: see reply to comment 2

8. L339-341. Is this seasonal evolution of the diurnal temperature range change specific to summer 2019, or does it also occur in the other simulated years?

Reply: We observe an increase in the diurnal temperature range in all summers during the driest periods in Central Europe. We will add a sentence on this in the manuscript.

#### DETAILED COMMENTS (wording and typos)

1. aimed at estimating the effect of human-induced ...

2. L34-35. contributions to
3. computationally efficient
4. L70 and later. spectrally nudged
5. and 8-20 km in the Arctic
6. Caption of Figure 3, L3. give / report the RMSD to E-OBS
7. Analogously to
8. the GER-3 simulation
9. L221-222. the longitude-latitude area
10. to the east of it?

Reply: We thank you for these suggestions, and we will implement all of them in the revised manuscript