Response to reviewers:

We thank the reviewers and editor for their thorough and constructive comments. We have revised the manuscript accordingly and below we provide responses to each reviewer comment (RC 1, RC 2) with quoted reviewer text in black followed by our reply in blue, we have included manuscript line references where possible.

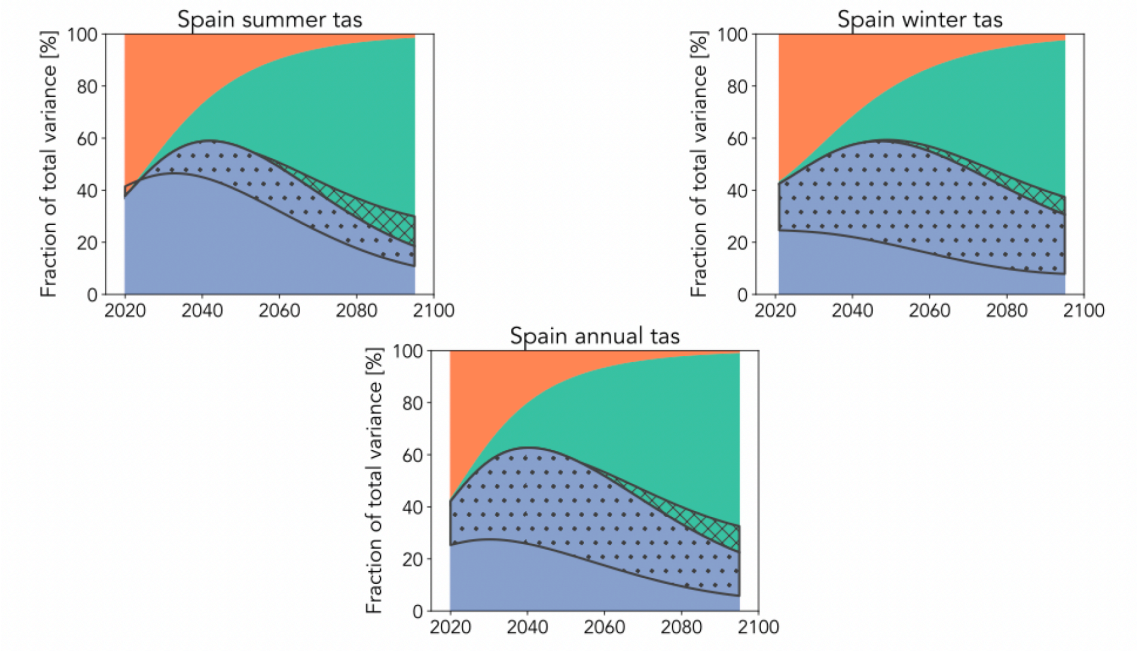
RC 2:

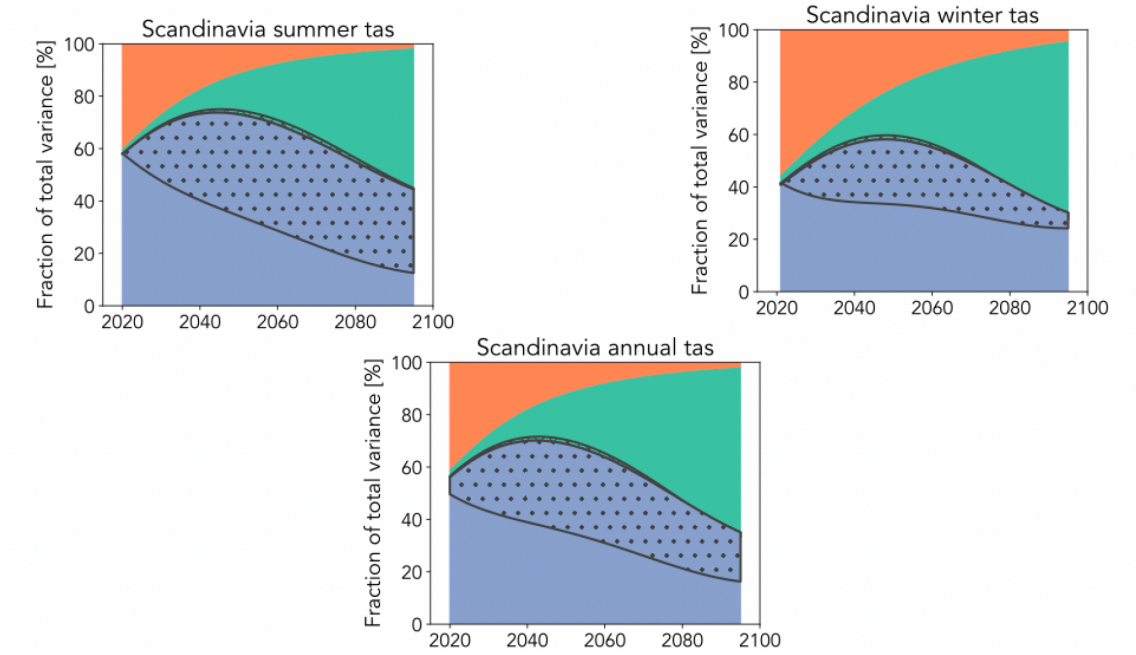
- ‘In Figure 1, panel f, the split between scenario and model and regional and global is somewhat unclear due to the overlap of the hatching, perhaps the scenario hatching could be changed to a different colour or design to make the transition clearer.’

  - This was also noted by RC1.
    - Changed the hatching of the global model uncertainty contribution in Figure 1f.

- ‘The paper mentions the different contributions to uncertain with different variables and regions, it would be really interesting to see this, perhaps as an additional panel in Figure 1 or in supplementary material which could be references.’

  - The format of ESD Ideas papers limits the length and number of figures in the manuscript (about 1000 words, one figure or table, innovative animations may be included as a supplement). We include additional figures here, for your reference, and will wait for the editor’s response on whether it is allowed to have these as supplementary material.
    - Created HS09 figures + MGW partitioning (similar to Figure 1f) for different regions and seasons to compare.





- ‘The only major comment I have on this work is that more discussion/ analysis of the MGW method is needed here to understand the uncertainty in this/ potential issues. Ideally, the authors could explore/ discuss alternative methods to understand the differences in global projections. However, this would be a significant additional demand and delay publication, so if this is not possible the authors should certainly discuss the limitations of the MGW method. In particular, if different models reach a given temperature level at different times, we would expect different regional patterns due to the differing inertia of the atmosphere, oceans, etc. Therefore a good chunk of the “regional uncertainty” could be due to this inertia effect rather than true differences in regional uncertainty between the models. This should be discussed and ideally the fraction of explained uncertainty in the analysis due to this should be analysed.’

  - We appreciate the suggestion and have considered this point. We agree that a more detailed assessment of the MGW method’s limitations and its contribution to regional uncertainty would be valuable. Performing the additional comparative analyses with alternative methods and quantifying the fraction of regional uncertainty attributable to timing/inertia effects would, however, require substantial new experiments and time beyond the scope of this revision. Instead, we expanded the manuscript discussion and revised the limitations paragraph.

    Lines 44-45: changed ’Finally, applying MGW to regional climate projections breaks path-dependency, limiting the current extension to processes such as sea level rise or ice sheet melt.’ to ‘MGW, however, does not apply to peak-and-decline projections, and when applied to regional climate projections it breaks path dependency, thus making it ill-suited to warming driven processes such as sea level rise or ice sheet melt.’