EGUsphere, author comment AC1
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Reply on RC1

Iason Markantonis et al.

Author comment on "Investigation of the extreme wet–cold compound events changes between 2025–2049 and 1980–2004 using regional simulations in Greece" by Iason Markantonis et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-48-AC1, 2022

This manuscript investigated historical and future wet-cold compound events (WCCEs) over Greece with observation data, reanalysis data and EUROCORDEX models. All models agreed that for the historical period, more events by the fixed threshold approach were found over mountainous regions while the percentile approach yielded more WCCEs over the eastern parts of the country and Crete. Furthermore, the projected changes in the number of WCCEs were investigated under RCP 4.5 and RCP 8.5. WCCEs obtained with percentile thresholds, were distributed mostly in Eastern Greece and Crete while their changes differed significantly among models.

This manuscript present too many elementary analysis about historical extremes for observations, reanalysis data and RCMs with different methods (24 figures) without giving a unified conclusion. On the other hand, the subject of this manuscript is compound extremes under climate change, but the discussion about changes in future compound extremes are too simple, with only spatial distribution of extremes. In my opinion, the historical results with obs, reanalysis and RCMS present the historical compound extremes and evaluate performance of RCMs in simulating compound extremes. Then changes in future compound extremes will be discussed in detail. I suggest the authors refine historical compound extremes analysis and reduce or combine some figures, give more discussion about future extremes. Additionally, many grammar errors should be corrected. Thus, major revision is needed.

Answer: The authors would like to thank the reviewer for the valuable feedback to improve the manuscript. The figures about past period are reduced and greater analysis about the future period is provided.

List of specific (major and minor) comments:

- *Abstract: Abstract mainly introduce data and methods used in this study without presenting the main results and conclusions. TX-RR, TN-RR, RCP should be given the fullname.*

Answer: Results presented briefly, fullnames written in new version.

- *P1, L27: Please give full name of IPCC SREX.*

Answer: Full name is provided in revised version.

- *P1, L35: "using projection data from and .": Not a complete sentence. Please confirm.*

Answer: Sentence is properly corrected in revised version.

- *Introduction: Recently, there are plenty of studies about compound extremes, and please reorganize Introduction to show the most recent progress about compound extremes, especially for the study area.*

Answer: Thank you for the comment. The introduction has been re-organized. The investigation of compound extreme events is focused on wet-cold compound events. The few latest compound event studies referring to wet-cold compound events are discussed in the introduction.

- *P2, L66: This study adopted EUROCORDEX under RCP 4.5 and 8.5. Why not considering CORDEX-CMIP6 under SSPs scenarios?*

Answer: We wanted to adopt models with the finest available resolution, because of the complex topography of Greece. EUROCORDEX at 0.11°. Future works of the authors will consider SSPs scenarios and regional downscaled simulations from CIMP6 global models.

- *P2, L71: Is there citation about HNMS observations?*

Answer: HNMS does not provide a specific citation, only the site of the national service is available which has been added in the paper.

- *Figure 1: The quality of the figure is too poor to see the details and the the fonts are too small. Please revise the figure and other related figure with higher resolutions and larger fonts.*

Answer: *Figure 1 is replaced by a new version with clearer details and fonts.*

- *L85: Give full name of ECMWF.*

Answer: Corrected in script.

- *L94: Please give the reason that such five models are adopted.*

Answer: This is answered in the manuscript. These models have the finest available spatial resolution, daily resolution for the periods we examine and also adopted and validated in Cardoso et al., 2019.

- *Section 3.1, L132-138: It seems that the definitions of TN5p, TX5p, R95p, R20 are same as those in ETCCDI? If so, please cite it.*

Answer: Thank you for the comment ETCCDI has been added in the script. Also now the study focuse only in fixed thresholds.

- *Section 4: In my opinion, this section mainly showed the historical results with obs, reanalysis and RCMS and evaluate performance of RCMs in simulating compound extremes in order to investigate future compound extremes with RCMs in Section 5.*

This section presents too many elementary analysis with too many figures, and some figures are mentioned with few words. Please consider combine similar figures, such as Figs 3-5, 6-8, 9-11 and so on. Additionally, I think compound extremes by observations and reanalysis data are used to evaluate the performance of RCMs in simulating extremes, so Section 5.1 should be mentioned together with observation in Section 4, as well as historical extremes by RCMs. And more deep discussion is also needed.

Answer: : The authors took into consideration this valuable comment and required changes have been applied in the paper by changing section and the context in sections 4,5 and 6.

- *L195: "4.3 HNMS" should be "4.1 HNMS…", L209: "4.4…" should be "4.2…"*

Answer: Section numbers changed accordingly in revised paper.

- *The captions of all figure should be given in more detailed description, such as the meaning of black points in Fig. 6, etc.*

Answer: Box-plots black points are discussed in methodology in revised version. Also, more detailed captions for all figures are provided.

- *L258: Please confirm section number: "4.5.1 Empirical approach" and L280: "4.5.2 Copula".*

Answer: Section numbers changed in revised version.

- *Since the manuscript mainly focused on compound extreme under climate change, changes in future compound extremes should be given in more detailed discussion. In current version, only spatial distribution of future compound extremes is discussed. Consider giving more discussion about changes in future compound extremes, such as their statistics, multi-model ensemble mean as well as their possible mechanisms, and so on.*

Answer: Mechanisms and further statistical analysis of compound extremes changes will be analyzed in future studies. Ensemble mean is added in the paper as suggested and used as the basis for the future changes of wet-cold compound events.