

Josep M Bonsoms  
Department of Geography (University of Barcelona)  
Montalegre 6-8, 3er floor (3007)  
08001 - Barcelona (Spain)  
Tel.: +34 655 36 49 42 / +34 934 037 849  
[josepbonsoms5@ub.edu](mailto:josepbonsoms5@ub.edu)

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Barcelona, 22<sup>th</sup> February 2023

Dear Dr. Helbig,

I am submitting the third version of the manuscript entitled “**Snow sensitivity to temperature and precipitation change during compound cold-hot and wet-dry compound seasons in the Pyrenees**”, co-authored by myself, Dr. López-Moreno and Dr. Alonso-González.

Thank you very much for the time you expended reading our manuscript. Thanks a lot for your careful review and for formulating positive and constructive comments.

A point-by-point answer to editor and reviewer 2 suggestions can be found in the following pages.

Yours sincerely,

A handwritten signature in black ink, appearing to be the initials 'JB'.

Josep Bonsoms, on behalf of the co-authors.

**Response to third review of “Snow sensitivity to temperature and precipitation change during compound cold-hot and wet-dry seasons in the Pyrenees”**

**by Josep Bonsoms<sup>1</sup>, Juan Ignacio López-Moreno<sup>2</sup> and Esteban Alonso<sup>3</sup>**

<sup>1</sup> Department of Geography, University of Barcelona, Barcelona, Spain.

<sup>2</sup> Instituto Pirenaico de Ecología (IPE-CSIC), Campus de Aula Dei, Zaragoza, Spain.

<sup>3</sup> Centre d'Etudes Spatiales de la Biosphère (CESBIO), Université de Toulouse, CNES/CNRS/IRD/UPS, Toulouse, France.

Corresponding author: J.I López-Moreno (nlopez@ipe.csic.es)

Response to Editor.

Reviewer comments are in black and responses in blue.

I would like to thank you again for your revisions and acknowledge your work on the revised manuscript!

The reviewer, I sent the manuscript back to, also thought the manuscript has improved a lot and has only two minor points with regards to more references or information.

I have the following minor, rather technical comments:

Thank you very much for your recommendations and suggestions.

Line 17-19: Where in the manuscript do you mention these exact numbers? Maybe I missed it, but I couldn't find them in the manuscript.

We have delated the exact numbers since it is not included in the manuscript (it is only shown at Figure 5 a).

We have changed:

When the temperature increased progressively at 1°C intervals, the largest seasonal HS decreases from the baseline were at +1°C (47% at low elevation, 48% at mid-elevation, and 25% at high elevation)

To:

“When the temperature increased progressively at 1°C intervals, the largest seasonal HS decreases from the baseline were at +1°C.”

With regards to Section 4.1 including Fig. 2 and 3:

It might help the understanding when you indicate the elevations in the figures, e.g. behind the naming "Ax" or briefly mention station details in the captions or when discussing the performances of A1 to A4?

We have followed your first suggestion and we have changed Fig 2 and 3 and included the elevation behind the naming.

There are some minor editing/language issues or typos:

- abstract Line 25: "Results suggests" -Remove "s"

Done

- Line 252 missing line break;

Done

- End of L. 292: "."

Done

- Line 325 "The maximum seasonal HS was during [...]" - Is there something missing (sensitivity?)

Yes, we have added: "... maximum seasonal HS **sensitivity to temperature and precipitation**".

Once these rather minor revisions have been addressed, I will do my best that the manuscript can be published very soon.

Best regards,

Nora Helbig

**Response to third review of “Snow sensitivity to temperature and precipitation change during compound cold-hot and wet-dry seasons in the Pyrenees”**

**by Josep Bonsoms<sup>1</sup>, Juan Ignacio López-Moreno<sup>2</sup> and Esteban Alonso<sup>3</sup>**

<sup>1</sup> Department of Geography, University of Barcelona, Barcelona, Spain.

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Response to Reviewer 2.

Reviewer comments are in black and responses in blue.

Dear Editor, Dear Authors,

I would like to acknowledge the work done on the manuscript. All my concerns have been satisfactorily addressed (either by incorporating my recommendations or by clear responses).

The additional text and figures improve the manuscript. I have only a few remaining minor points, which are listed below.

Best regards,

Adrien Michel

**Thank you very much for your recommendations and suggestions.**

I fully agree with the extended argumentation on the contradiction between nonlinearity and the use of a linear indicator (%/°C) to facilitate interpretation and comparison between massifs and with other studies. I appreciate the more detailed analysis between massifs, which 1) confirms the main results and 2) strengthens the analysis. I would only recommend adding some details on the PCA. It is not clear to me on which sets of variables the PCA is performed. The two

references given did not allow me to fully understand. Just one or two sentences explaining exactly on which data set the PCA is performed would be very helpful.

We have changed the description for:

Following previous studies, massifs were grouped into four sectors by applying a Principal Component Analysis (PCA) (i.e., López-Moreno et al., 2020b; Matiu et al., 2020, among others). We applied a PCA over HS data for each month, year, massif, and elevation. Massifs were grouped into four sectors depending on the maximum correlation to PC1 and PC2 scores (see Figures S2).

Finally, in the conclusion (l.628) you say: "[...] in this region, a 10% increase of precipitation, as suggested by many climate projections over the eastern regions of this range, could compensate for temperature increases on the order of about  $< 1^{\circ}\text{C}$ ." However, the only references I can find in the text are on line 96: "an increase (decrease) of precipitation by about 10% for the eastern (western) regions during winter and spring (Amblar-Francés et al., 2020)" and on line 479: "Snow sensitivity in the easternmost areas could decline during the winter because of a trend for an increase of about 10% in precipitation in this area (Amblar-Francés et al., 2020)". A single reference is not enough to state: "as suggested by many climate projections". You could add some references or rephrase this sentence.

Thank you for your suggestion. This work is the reference study about climate projections in the Pyrenees. It was published under the framework of the last climate change research project in the mountain range (CLIMPY). There are not more works about precipitation projections at high resolution and using CMIP6.

We have moderated our statement and we changed "as suggested by many climate projections" to "as suggested by the Spanish Meteorological Agency (AEMET) climate projections."