

Review of the article:

A climate suitability index for ecological habitats applied to terrestrial arthropods in the Mediterranean Region

General Comments:

This study presents a simple index to assess the climatic suitability of terrestrial arthropod populations in the Mediterranean and aims to fill the gap in our understanding of how climate change could affect their fundamental niches. The results highlight that the index is most reliable for species with significant volume of observations ($n_s > 1000$), and high resolution climate datasets. The authors claim that the proposed index is a proof of concept for its potential utility in guiding conservation strategies and mitigating the adverse effects of climate change on arthropod habitats.

The paper is consistent with the aims and scope of the journal. The manuscript is well written; clear, and easy to understand and addresses an interesting and not extensively explored topic. I have, however, some concerns with regard to the specific aims of the article and the methodological framework in use, which will be discussed below.

Specific Comments:

This study uses the index to assess the climatic suitability of terrestrial arthropod populations in the Mediterranean in the recent past (1980-2010 and 1995-2004) and does not provide any information about the future. Therefore, the following sentences are misleading and should be amended to accurately reflect the study.

line 19: "aiming to shed light on how climate change could affect their fundamental niches."

line 69: *"evaluate the effects of climate change on terrestrial arthropod habitats,.."*

line 77: *"a critical analysis given the anticipated direct impacts of climate change on countless species."*

Authors should emphasize that the study evaluates the performance of the metric in the recent past using hindcast RCM data, and if it is found to perform well, it could be used to assess the impact of climate change on terrestrial arthropod habitats. The time periods (1980-2010 and 1995-2004) should be clearly stated in the Data & Methods section.

Another concern is the temporal and spatial resolution. Authors should provide datasets with the same temporal and spatial resolution to be compared. This means that the Ens6 and EOBs datasets should also be examined in the period 1995-2004 in order to be compared with the WMD03 dataset. In the Data & Methods section, authors should explain how they get climate datasets to the same spatial resolution so that they can be compared and how the Ens6 has been calculated?

The article does not discuss the ideal geographical-climatic conditions for terrestrial arthropods in the Mediterranean in the present and how they might expand in the future. Where do we see most populations and where are their numbers expected to increase due to climate change?

What were the criteria for selecting the climate indices used in the study? Have you also checked if RCMs perform well in the representation of the selected indices? I would suggest a state-of-the-art literature review on this topic in the introduction section.

How do you explain that $p_{0.1}$ increases for $n > 4000$ (see Figure 7)?

How do you explain that in Fig.3 a-c the EIs product is almost everywhere close to 1?

Technical corrections

1 Introduction

#1: line 30: Please add references that relate to the Mediterranean basin.

#2: line 38: I suggest you to move this citation list (Doblas-Reyes et al., 2021; Gutiérrez et al., 2021; Ranasinghe et al., 2021) at the end of the sentence.

#3: line 60: Please change the “Coppola, Nogherotto, et al., 2021” to “Coppola et al., 2021” throughout the text

#4: line 63: Please add references that relate to the Mediterranean basin.

#5: line 67: Please add references.

#6: line 71: what does this mean “or experiments”?

2 Data & Methods

#7: line 118: n_s should be consistent throughout the text

#8: line 144: please change “by the ECMWF-ERAINT” to “by the European Centre for Medium-Range Weather Forecasts ERA-Interim reanalysis (ECMWF-ERAINT)”

#9: line 154: please change “using the RegCM5” to “using the fifth generation regional climate modeling system, RegCM5”

#10: line 155: please change *“driven by the ECMWF-ERA5 reanalysis”* to *“driven by the fifth generation ECMWF reanalysis for the global climate and weather, ERA5”*

#11: line 181: please indicate in the methods section that the EOBs is considered as the reference dataset

#12: line 181: Please explain how the data sets were combined.

#13: line 204: Please change *“this describes”* to *“they represent”*

#14: line 244: *“..but is almost consistently better than the Ens6.”* How is it better than Ens6? Can you elaborate on that?

Figures

The resolution of the figures should be increased and the titles should be larger. Please add latitude and longitude to the maps.