egusphere-2022-1451
Viticulture extension in response to global climate change drivers – lessons from the past and future projections

Replies to comments of Reviewer #2

General comments

The manuscript provides a valuable complementary approach to other climate change impact studies on grapevine extension areas under different climatic conditions and contributing to their robustness. The study is well supported with figures and tables on various modelling setups and outputs. Some parts of the paper need improvements, especially the descriptions of the applied methods, processing steps and limitations of the approach/results (see details below).

We are grateful for this positive general evaluation.

Specific comments:

-At the begin of method you may define "emulator" and "Bayesian framework" and how these are applied in your study. Fig.1. needs an overhaul, e.g. the meaning of the shapes are not explained, and it should contain more details on processing steps in a straightforward way. Include also the validation steps with tree rings. The accompanying description should be improved as well and make details more clear. Rewrite e.g. the "Calibration of the emulator", in context to Fig.1. You should also include the inputs and outputs into that scheme to make the process more clear.

The terms mentioned by the Reviewer are important and deserve to be defined in the head of the method. We will give more information in the caption of Fig. 1 and will add the validation step in the figure. Concerning the last sentence of the comment, we do not understand as the inputs and outputs are already included.

-p5: Orbital parameters…this abstract needs better description/sentences.

We will add a few words on the physical meaning of these parameters

-p11: Please outline in the description of BIOME its limitations e.g. how far weather/climate extremes are considered for impact on vegetation/grapevine and what are the relevant uncertainties? E.g. the MTCO for predicting frost resistance has quite high uncertainty when not calibrated for regional climates e.g. continental vs. Mediterranean, which is also visible in your results, where there is obviously a strong bias for continental climates (see below). Grapevine cultivars have a wide range of winter frost resistance: some cultivars can survive -30°C during winter dormancy, frost resistance is influenced also by fertilization and other grapevine management options (also relevant for the VI index description at p19). These limitations should especially also better be reflected in the results desriptions/limitiation and in the discussion.

BIOME simulates a mean vegetation state based on an average climate. The extremes are not really taken into account. It is certainly a limitation which will be more clearly discussed. The

example of frost resistance is another good example of limitation of the approach. Indeed, the difficulty to simulate continental grapevine has several explanations. As proposed by the Reviewer, the absence of distinction between varieties is certainly one explanation (we have no idea of the cultivars used by the Roman farmers). The fact that VI is calculated using a mean climate is another one. We will improve the discussion thanks to theis comment.

-A further limitation of BIOME and your study is that it does not consider climate related biotic damage risks (you only mention it later as a limitation in your study).

It is true and will be mentioned earlier

-Fig 10a vs. 10b shows that there is a strong bias in the continental areas according to predicted wine growth areas. Under the future scenarios this bias occurs compared to other climate change impact studies for wine production areas. As described in p25 that's based on the overestimation of low temperature limit (VI Index, MTCO), which was not calibrated for the continental region. Therefore these areas should be marked in the graphs better with an additional pattern maybe, and elaborated better in the description and discussion too.

Reviewer is right, our explanation based on microclimates is not fully adequate and we will clearly state that the VI does not work with continental climate because the condition on MTCO is too strong.