

The authors have addressed each comment, and most parts of the manuscript have been appropriately revised. I believe that the manuscript can be accepted after addressing the following minor comments.

We again thank the reviewer for the helpful suggestions.

Regarding Eqs. 3-5:

It would be better to clearly indicate what each subscript represents, for example, "...distances in the windward (W) and leeward (L)..."

We updated our manuscript to implement the suggested changes.

Regarding the response "That is a very interesting topic. As a matter of fact, it is very hard to fully represent climate...":

I understand that averaging smooths out the variations, but would it not be possible to examine the differences in a statistical tabular form or probability distribution, for example by classification according to orography? As a reader, I would personally like to know what kinds of climatic differences led to the differences in the simulation results. If it is possible to address this, please do so (I will not insist on it if it is difficult). In any case, I understand the difficulty of visualization.

Due to the non-linear nature of the processes and the complex interplay between all aspects of the simulated ecosystem, we believe it is very difficult to quantify exactly how much a certain climate forcing contributes to the change in a given output. Some broad conclusions can be derived from general tendencies, which we already do in the discussion section. However, we agree with the reviewer that a broad view of the dominant changes in the forcings introduced by CHELSA will help to better support our arguments in the discussion. To this end, we produced plots of the distribution of changes in the three main variables (averaged over the period 2011-2014), binned into elevation differential categories (that is, the difference between the elevation of a downscaled gridcell and the mean elevation of the corresponding low-resolution gridcell):

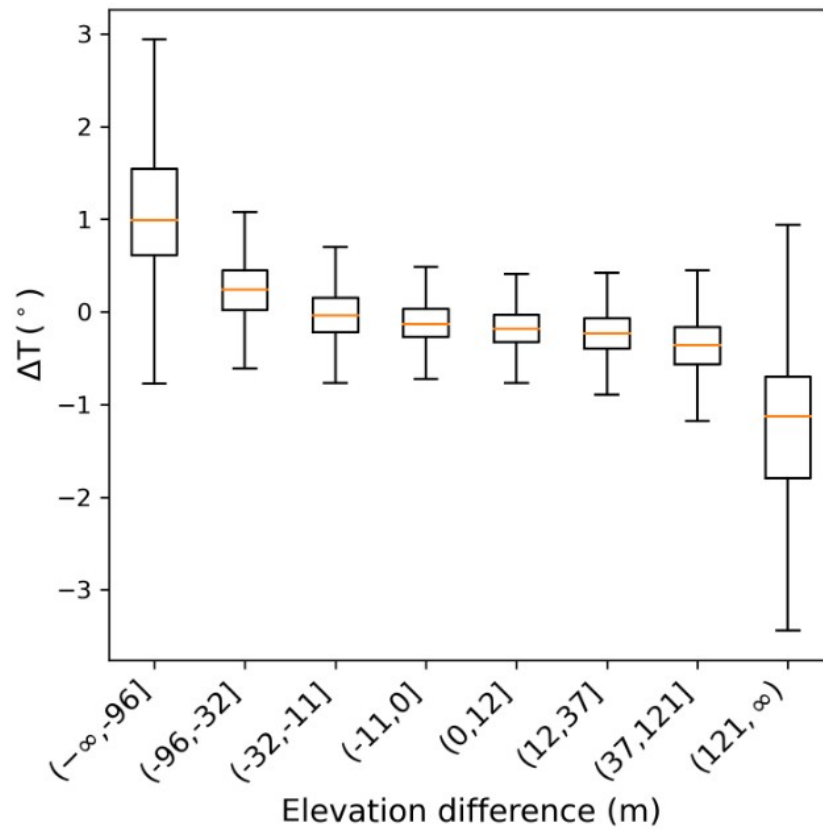


Figure 1. Distribution of the difference in mean air temperature between the downscaled and the original datasets. Positive values indicate a temperature increase after downscaling. The data was binned in octiles of elevation difference, calculated with respect to the average elevation of the low-resolution gridcell that contains the data point. The x -axis labels indicate limits of the bins. Water points are excluded. The distributions were derived from temperature averages over the 2011-2014 period.

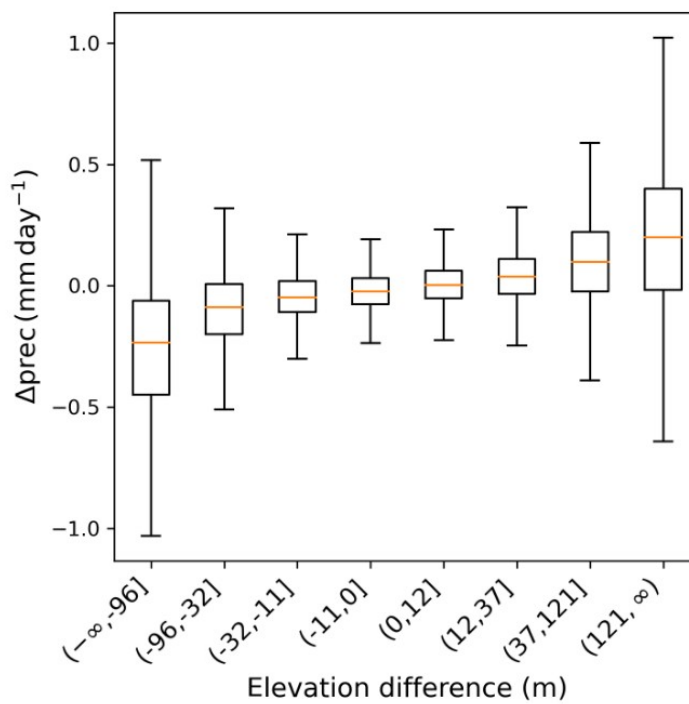


Figure 2. As in Fig. 1, but for average precipitation.

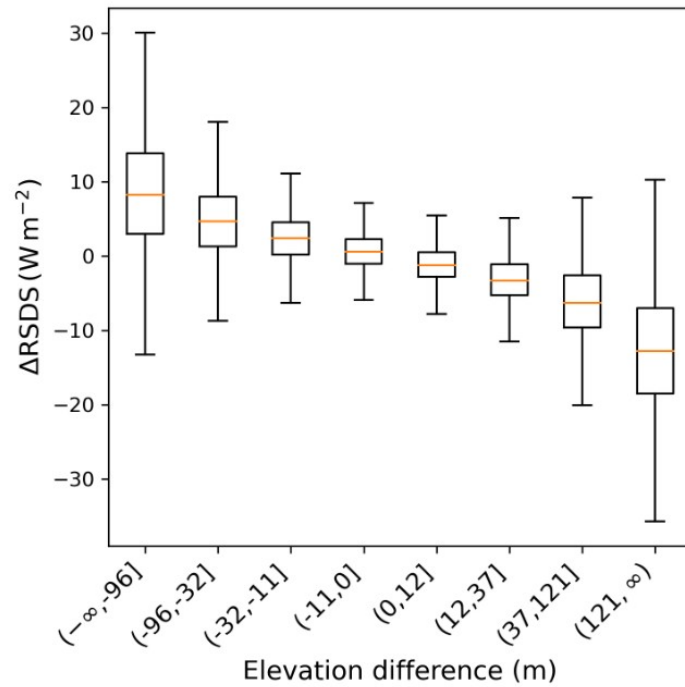


Figure 3. As in Fig. 1, but for average RSDS.

We added these figures and the following accompanying text to the discussion section of the manuscript:

“One possible mechanism underpinning the difference in modeled GPP between high- and low-resolution simulations in areas with high elevation variability is the non-linear relationship between the mean gridcell temperature and the duration of the growing season, which is dynamically calculated by LPJ-GUESS. The linear relationship between temperature and elevation (Eqs. 1 and 2) implies that air temperatures in higher parts of resolved mountainous areas are lower than the average value in the corresponding low-resolution gridcell (Fig. 6), causing a shorter growing season. The lower parts will, in turn, experience a longer growing season. The shorter growing season in high areas leads to reduced productivity and vegetation cover. Because of the non-linear response of the model to climate forcings, this is not fully compensated by the additional productivity in the lower, warmer parts. A similar argument can be made for the photosynthetic rate, which is temperature-dependent. On the other hand, rainfall redistribution in the high-resolution grid may provide a counteracting effect. CHELSA tends to concentrate the total amount of rainfall towards high-elevation areas to account for the influence of orography on precipitation (Fig. 7), which may reduce water availability for plant growth in the lower areas. The radiation downscaling algorithm is more involved, and includes the effects of orographical features as well as those of the position of the Sun (Sect. 2.1.3). Nonetheless, there is a clear pattern in Fig. 8 showing that higher parts of mountains receive less solar radiation per square meter than the corresponding low-resolution value, while the lower parts— more. This suggests that the increased cloud cover resulting from orographic precipitation leads to a decrease in

average radiation in areas of higher elevation difference. This effect contributes to the reduction of vegetation in places with high elevations. ”

Regarding the response “In this study, we have not investigated whether using downscaled climate data improves...”:

I understand your clarification in the response. However, I believe it would be helpful to briefly state this point in the manuscript itself as a future study. Readers who are interested in the performance of the products publicly available in the authors’ repository will also look for descriptions of comparisons with observations. In fact, I did so myself.

We modified the text as follows:

*“The high-resolution simulations were performed on a grid that captures coastlines and water bodies more precisely, and are driven by climate that is generally closer to the observed regional climate (see validation sections in Karger et al., 2021, 2023). This motivates us to interpret these differences as systematic biases incurred when running LPJ-GUESS on a coarse grid. **We defer evaluating the simulation results against observational data to future studies. However, we note here that if the model output on low resolution was closer to observations, that would suggest that the model needs recalibration or revision.**”*

Since geographical features and climate effects are not related to intrinsic properties of LPJ-GUESS, we infer that predictions by other DGVMs are likely to be affected in a similar manner. We note, however, that gridcells in LPJ-GUESS are independent from each other (there is no lateral information flow) and completely unaware of gridcell size. By contrast, other models may include processes, such as lateral matter transport, which are sensitive to the coarseness of the grid. This introduces an additional dependence of the output on resolution, on top of the effects discussed in this study.”

My previous comment contained some mistakes (e.g., Fig. 8 -> Fig. 4). I apologize for the confusion.

No worries!