

Biogeosciences Discuss., author comment AC1
<https://doi.org/10.5194/bg-2022-74-AC1>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Reply on RC1

Morgan Sparey et al.

Author comment on "Bioclimatic change as a function of global warming from CMIP6 climate projections" by Morgan Sparey et al., Biogeosciences Discuss.,
<https://doi.org/10.5194/bg-2022-74-AC1>, 2022

We thank the reviewer for their comments. Our responses below are in bold.

One potential additional improvement to the manuscript would be to develop equations, like that in Equation 1 for the % land area changing climate type, for each streamlined classification climate type of Table 2. As warming increases from 0K to 4K some of the streamlined climate types will increase in % land area covered and others will decrease. An equation for each streamlined climate type could be very interesting / useful as some climate types will expand and reduce at different rates compared to the global land area change in Equation 1. Adding an extra column to Table 2 with the equation for each climate type would be very useful additional information. This would allow researchers interested in particular bioclimates to use these results for their research.

Many thanks for this suggestion, which is very helpful. We will include the additional analysis/equations, as suggested.

Specific comments

Line 53: change "data to to" to "data to"

Done.

Table 1: while the following differences from Peel et al (2007) are largely minor and most likely do not impact the end results significantly, it is important to note them. The Ds climate correction is likely to be the most important and should be corrected.

- Criteria for C climate: change from " $0\text{°C} \leq T_{\min} < 18\text{°C}$, $T_{\max} \geq 10\text{°C}$ " to " $0\text{°C} < T_{\min} < 18\text{°C}$, $T_{\max} \geq 10\text{°C}$ ".
- Criteria for Cs climate: change from " $P_{\text{wwet}} \geq 3 * P_{\text{sdry}}$, $P_{\text{sdry}} < 4$ " to " $P_{\text{wwet}} > 3 * P_{\text{sdry}}$, $P_{\text{sdry}} < 4$ ".
- Criteria for D climate: change from " $T_{\min} < 0\text{°C}$, $T_{\max} \geq 10\text{°C}$ " to " $T_{\min} \leq 0\text{°C}$, $T_{\max} \geq 10\text{°C}$ ".
- Criteria for Dw climate: change from " $P_{\text{swet}} \geq 10 * P_{\text{wdry}}$ " to " $P_{\text{swet}} > 10 * P_{\text{wdry}}$ ".
- Criteria for Ds climate: change from " $3 * P_{\text{sdry}} < P_{\text{wwet}}$ " to " $3 * P_{\text{sdry}} < P_{\text{wwet}}$, $P_{\text{sdry}} < 4$ ".
- Criteria for ET climate: change from " $0\text{°C} \leq T_{\max} < 10\text{°C}$ " to " $0\text{°C} < T_{\max} < 10\text{°C}$ ".

The correct (Peel et al., 2007) criteria were actually used in our analysis. These issues are all typos in Table 1, which have now been corrected.

Line 63: change "First, C and D climates follow a 0°C threshold instead of 3°C" to "First, C and D climates follow a 0°C threshold instead of -3°C".

Done.

Line 75: I know data can now be considered as singular or plural, but I recommend changing "model and observational data is smoothed" to "model and observational data are smoothed".

Done.

Line 85: what do you mean by "anomaly corrected fields"? Not all readers will understand this term or what it means, so more explanation is required.

By "anomaly corrected field" we mean climate model outputs that have been corrected to agree with the observational record over the overlapping period of 1901-1931. This is done by calculating anomalies relative to that period for each model and then adding these anomalies to the observational climatology. The following text has been added to clarify this: "Model outputs are *anomaly corrected* to agree with the observational over the period 1901-1931. This is done by calculating anomalies relative to that period for each model and then adding these anomalies to the observational climatology."

Table 2: In Table 1 all second letters were capital (for example CFa rather than Cfa). However, in Table 2 a mixture of second letter capitalisation is used (see Subtropical). Please be consistent.

As suggested, second letters in Table 2 have now all been capitalised.

Figure 3: It would be better to increase the size of these four maps as it is very hard to see the differences when the maps are so small. Rather than one column of four maps, try two columns of two maps. Also, why are these KG maps called anomaly plots?

We find that four larger maps make it more difficult to compare the plots. The page width limitations also mean that two columns of figure 3 show a negligible improvement. Therefore to improve legibility, larger versions of these maps have instead been added to the appendix.

For clarity, we now refer to these maps as "anomaly-corrected maps".

Figure 5a & 5b: the right column of numbers next to the colour bar is labelled "% Land-area 4K" in both 5a and 5b. I think this should be "% Land-area 1.5K" for 5a and "% Land-area 2K" for 5b.

Indeed, that you for finding this typo, which has now been corrected.

Line 142: You refer to Figure 5a, but don't you mean Figure 5c? Figure 5a shows the 1.5K results, whereas Figure 5c shows the 4K results. Hence the comment about Arctic Tundra should be updated to 75% less land-area.

Thanks again. This has now been fixed to refer to Figure 5c.

Equation 1: you provide an equation, but no measure of how well this model fits the data. I realise there are only nine data points supporting this model fit, but a metric like R^2 would be useful to indicate how well the model fits the data.

As suggested, the r^2 values of the fits are now included.