Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2021-1

Anonymous Referee #2

Referee comment on "Decadal climate predictions with the Canadian Earth System Model version 5 (CanESM5)" by Reinel Sospedra-Alfonso et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-1-RC2, 2021

General Comments

Sospedra-Alfonso et al have written a very good paper on the CanESM5 decadal prediction runs with some tantalizing new results on predicting components of the carbon cycle. I have no specific comments, the paper is ready to be published after they have addressed some technical issues detailed below.

Technical Issues

Abstract L4: sounds like the hindcasts were started in 1961 and then run continuously until present.

P2 L31: "at the end" maybe be more specific?

P5 L5: "augmented" replace with more specific phrase, please.

P5 L16-18: I don't understand what initialization through response means. Are the carbon cycle components running during the assimilation phase and the initial state for each hindcast corresponds to their states at that point in the assimilation? Please clarify in the manuscript.

P6 L9: Suddenly a subscript "e" appears in some equations, what is that? Not defining this makes it hard to follow the rest of the derivations.

P8 L9: "secular" is a strange timescale (is it an astronomy term?), do you mean centennial?

P9 L5: Why are you excluding the Arctic? The skill seems to come from initialization, but you'd think that it doesn't vary much under the ice, so that's a contradiction.

P9 L7: What is the relevance of mentioning the strong linear trends? What is the impact of them?

P9 L33: How can the errors be fully attributed to initialization and then in the same sentence also attributed to the response to external forcing?

P10 L35: "can potentially" - I feel you should have a little more certainty than this about the impacts of the Atlantic SST problem. Perhaps if sections 6 & 7 were swapped, you could discuss here what has been shown for skill over land.

P11 L32: Perhaps it is worth having a note here that there are several papers link the Sahel precip to the AMV and that this is discussed at the end of Section 8 in the paper.

P12 L13: I think the description of the volcanic experiments needs to have a few more details and be placed in the methodology section of the paper.

P12 L16: "volcanic forcing seems to be" I think the evidence presented is only strong enough to say "volcanic forcing could be". Initialisation seems to be quite important too!

P15 L14: "time pan"

P17 L11: "Strong warming" Where does the climate sensitivity of CanESM5 lie compared to CMIP5/6 estimates of the real world probable range?

Figure 1: This color scale looks problematic for color blind people (https://www.color-blindness.com/coblis-color-blindness-simulator/). Additionally, if the color scale for Fig 2 was used here, it would be easy to flick between the figures to see how much of the potential predictability has been realised (this applies to the other Figures showing the same thing for other variables).

Figure 10: (b) Year 1 and (d) Year 2 look very similar. Year 1 is not shown in Fig 9, so perhaps use (b) Year 2 and (d) Years 2-5? This would help with backing up the conclusions in the text too by making the trends later in the forecast clearer.

Figure 14: Why is this years 2-4 and not years 2-5 like in other figures in the paper?

Figure 16: This is similar to Fig 15, would years 6-9 be more interesting?