

Earth Syst. Dynam. Discuss., referee comment RC2
<https://doi.org/10.5194/esd-2021-53-RC2>, 2021
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Comment on esd-2021-53

Anonymous Referee #2

Referee comment on "Extreme metrics from large ensembles: investigating the effects of ensemble size on their estimates" by Claudia Tebaldi et al., Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2021-53-RC2>, 2021

The paper 'Extreme Metrics and Large Ensembles' considers the problem of ensemble size applied to 6 widely used extreme metrics. It asks whether we can estimate the ensemble size needed using a smaller 5-member ensemble, then validates the answer using two large ensembles. This manuscript provides additional information to the field and presents novel results. However, there are a few issues that need to be addressed prior to publication.

Major comments:

1. Milinski et al 2020 discuss the problem of bootstrapping and how the errors increase as you approach the ensemble size. This is discussed in the manuscript on lines 108 onwards, however it is then largely ignored for the rest of the manuscript. This is a major issue as some of the results approaching the size of the ensemble may be biased due to this problem. Additionally this manuscript determines that the ensemble size needed is 20-25members, which is about half the ensemble size and where this problem starts affecting the results. This needs to be addressed before this manuscript is published.
2. All Figures are too small, on a printout it is impossible to see what the Figures are. On the screen one needs to magnify the pdf to be able to see anything.
3. Details of the statistics used and results are missing, sometimes the text is vague or non-specific. See comments below for details.

Minor issues:

The title could be more descriptive as currently one has no idea the paper is about ensemble size from the title.

line 20 'like' should be replaced with 'such as'

line 40 I think your citation of CanESM2 large ensemble is wrong:
<https://open.canada.ca/data/en/dataset/aa7b6823-fd1e-49ff-a6fb-68076a4a477c>

lines 59-62 there are only citations for CESM not CanESM here

line 63 - I don't think this is the correct initialisation procedure for CanESM2 see
<https://open.canada.ca/data/en/dataset/aa7b6823-fd1e-49ff-a6fb-68076a4a477c>

line 65 - you could cite Marotzke, 2019 here:
<https://wires.onlinelibrary.wiley.com/doi/full/10.1002/wcc.563>

Line 70 - would it make sense to show the results for the larger ensemble in the main paper?

Equations on page 4 - you need to define what each term in the equation is

line 126 - please define X

Section 3.2 what tests do you use to detect changes in variance?

Figure 1 - titles on the subplots could be more descriptive

Figure 2 - of the should be of the

Figure 2 - I don't fully understand what the diagonal line is. Is it the actual time evolution of the expected error?

Line 211 - do you have a hypothesis why the error exceeds the expected error in these regions?

Line 215 - be specific, for which variables are you talking about?

Figure 5 - how do you calculate 95% confidence

Line 252 - more detail please

Line 275 - this is really an odd sentence can you rephrase?

Line 281 - more detail please

Figure 9 - could you zoom in on the Arctic as this is the only place there are colours, it is otherwise small, and seems to have limited information in the plot

Line 294 - how do you detect changes?

Line 300 - missing specific details here

Line 307 - it is not clear how you calculate significance

Section 4.4 - this is short and has limited detail in it. S/N really is dependent on the quantity due to the size of each term. I feel like very little is actually said in this section. Maybe think about what the point you want to make here is?

5. Conclusions - perhaps mention recent regional large ensembles here such as:
<https://www.climex-project.org/>

Line 358 - Marotzke et al, 2019 and Hawkins et al, 2016
<https://link.springer.com/article/10.1007/s00382-015-2806-8>