Earth Syst. Dynam. Discuss.,
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Earth System Dynamics
Discussions

Interactive comment on "Assessment of a full-field initialised decadal climate prediction system with the CMIP6 version of EC-Earth" *by* Roberto Bilbao et al.

Roberto Bilbao et al.

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Specific Comments

1. Line 5: It would be helpful to be admitted / clarified that the realistic initialization contains part of the externally forced trends as, for example, the oceans get warmer with global warming. Yes, there are also aerosols and CO2 which modify radiation and clouds during the simulations, but the warming signal is also contained in the initialized ocean state (progressively warmer).

Reply: We agree with the reviewer's comment. Certainly the initial conditions include

a response to the external forcings, and can even correct part of the forced response that is misrepresented by the models and/or the forcings. To be more precise we have rewritten the sentence to simply say that most of the skill comes from the external radiative forcings.

2. Line 6: "gets" → is

Reply: corrected.

3. Line 13: "in the surface" → at the surface..... the subsurface layer,

Reply: corrected.

4. Line 47-50: On this point, there is also another recent study using DCPP-A (Athanasiadis et al., 2020) that shows comparable (even higher) skill for the NAO using CESM-DPLE.

Reply: The paragraph has been adjusted and the reference included.

5. Line 61: "is initialisation" → is the realistic initialisation of the ocean state (or of the Earth system, if the authors prefer).

Reply: suggestion accepted.

6. Line 65: "especially in" → especially in the deep ocean and before modern instruments (such as ARGO floats) were introduced.

Reply: suggestion accepted.

7. Line 66: What is the meaning of the word "exclusively" in this sentence? Initial states are built from observations.

Reply: The term "exclusively" has been removed.

8. Line 95: "that take" → which take

Reply: corrected.

9. Line 115: “10 member” → 10-member

Reply: corrected.

10. Line 154: Has the word “cmorisation” been defined earlier? Perhaps it would be best to keep the “CMOR” part in capital letters.

Reply: corrected.

11. Line 155: “data was...” → data were systematically checked for their quality with...

Reply: suggestion accepted.

12. Line 174: I expect that the drift cannot affect equally all predictions (initialized in different years with different states, closer to or further from the model climatology). The drift is defined as the average tendency over many years, is not that so?

Reply: The ‘mean drift correction’ that we apply assumes that drift is the same in all the forecasts, which may be a suitable approximation for certain variables. However, we agree with the reviewer’s comment that drift is unlikely equal in all predictions, in fact, in section 3.3 we highlight how this is not the case for the AMOC and SPGSI. An inefficient drift removal may compromise the skill evaluation. In literature several drift correction methods have been proposed, but to date there is no clear advantage to using a particular method. We have rephrased the sentence to acknowledge that the underlying assumption (i.e. the insensitivity of the drift to the initial state) might not always hold.

13. Line 199: “persisting it” → making it persist

Reply: corrected.

14. Line 219: “Equator-60” → EquatorâĂŠ60 (not hyphen but en dash).

Reply: corrected.

15. Line 248: What do you mean by “phases”? The Reviewer guesses what the au-

thors might mean. Please take into account the common use of “phase” as a verb (https://www.merriamwebster. com/dictionary/phase) and expand this sentence accordingly.

Reply: The verb has been changed to ‘puts in phase’.

16. Line 249: “equivalent” → comparable / similar

Reply: corrected.

17. Line 259: “influence of” → influence of the unpredictable part of

Reply: corrected.

18. Line 261: Here and elsewhere (where a similar expression is used as an adjective) use “lowfrequency”.

Reply: corrected.

19. Line 295: “is for the some” → is for some

Reply: corrected.

20. Line 319: “5f” is a reference to “Fig. 5f”? Please follow the instructions for authors of this journal – in any case, all references to figures should follow a standard way (same throughout the text).

Reply: corrected.

21. Line 344: “ranges(Figure” (add space)

Reply: corrected.

22. Line 351: “to aid” → so as to aid

Reply: corrected.

23. Line 356: “feature” → behaviour / relationship

Reply: corrected.

24. Line 359: “evolve” → evolves (singular)

Reply: corrected.

25. Line 363: Why should that be? Same model => same attractor.

Reply: What we mean to say is that the model might have more than 1 attractor, which seems to be the case given the existence of two different states of Labrador Convection. We have rephrased for clarity.

26. Line 389: The Reviewer questions the idea that PRED can reach (or come in the neighborhood of) the model’s AMOC attractor in just 10 years.

Reply: We agree with the reviewer that ten years may be insufficient time to reach the model attractor(s), in particular for the AMOC. We have rephrased the sentence taking it into account.

27. Line 392: But could not it be that a surface-wind bias (likely associated with a bias in Greenland blocking frequency) favors the formation of sea ice in the Lab. sea, which subsequently blocks heat and moisture surface fluxes? If the authors agree that this is a plausible explanation, at least in part, the Reviewer would suggest to take a look at surface wind biases in that area.

Reply: To answer the reviewers comment we have looked at the surface wind stress over the Labrador Sea (See Supporting Figure 1). The plot shows that the drift in PRED is too small in comparison with the one in other variables and therefore seems unlikely that the wind is responsible for the very rapid sea ice growth.

Supporting Figure 1. Evolution of the FMA Windstress in the Labrador Sea in PRED for a) the meridional direction and b) zonal direction. Ensemble mean forecasts (10 members) of PRED are shown from blue to red every 3 startdates. Panels b) and d) are the climatological values as a function of forecast time.

28. Line 414: What does “their” refer to?

Reply: corrected.

29. Line 421: Here and elsewhere, please make “3” a superscript (exponent). Also, add some small spaces between values/numbers and units.

Reply: corrected.

30. Line 428: “simulation” → simulations

Reply: corrected.

31. Line 486: “varibility” → variability

Reply: corrected.

32. Line 491: Speaking of an “effect”, is this positive, or negative? What kind of effect?

Reply: We refer to a negative effect on its regional skill. It’s been rephrased to clarify it.

33. Line 498: Speaking of different members exhibiting different mean states, it is likely that the AMOC has a degree of non-stationarity and not necessarily a uni-modal distribution. If that is so, then the multi-member time average may not correspond to any real attractor (preferred state).

Reply: We agree with the reviewer’s assessment. The fact that the historical ensemble mean might not represent a preferred state is now mentioned in the sentence.

34. Line 501: “brings the predictions apart from” → carries the predictions away from

Reply: suggestion accepted.

35. Line 517: “prone” → likely A method is prone to errors, instead, the errors themselves are not “prone” to occur.

Reply: corrected.

FIGURE 2: In the caption please change the sentence referring to the hatching – what are significant are the ACC values, not the areas themselves. Also write: “Points with missing values...” as the masking is applied to an area. From a scientific view point: the lack of predictive skill in the subpolar gyre (south of Greenland) is an indication of likely poor NAO skill (see Athanasiadis et al., 2020). Have the authors assessed the NAO skill for this set of hindcasts? If the NAO skill is indeed poor, perhaps it would be fair and worth mentioning this possible connection.

Reply: The caption of Figure 2 has been updated as suggested. We have looked at the NAO and we have low insignificant skill. The possible link between the low NAO skill and that of the SPNA OHC is now mentioned at the end of section 3.3.

FIGURE 5: This, but also other figures, should be expanded so as to best use the available space. The overall figure width should, however, remain a bit narrower than the width of the main text (plenty of space until there). From a scientific view point: Why does HIST ensemble mean exhibit such a weak ENSO variability, in contrast to PRED, for the 1st year of the predictions? Arguably, because ENSO events are mainly out of phase across the HIST ensemble (as expected). The authors may want to mention this rather trivial explanation.

Reply: The figures have been changed as suggested. The reviewer is correct, we have added a comment in the text.

FIGURE 11: “Scatterplot diagram” → Scatter plot.

Reply: corrected.

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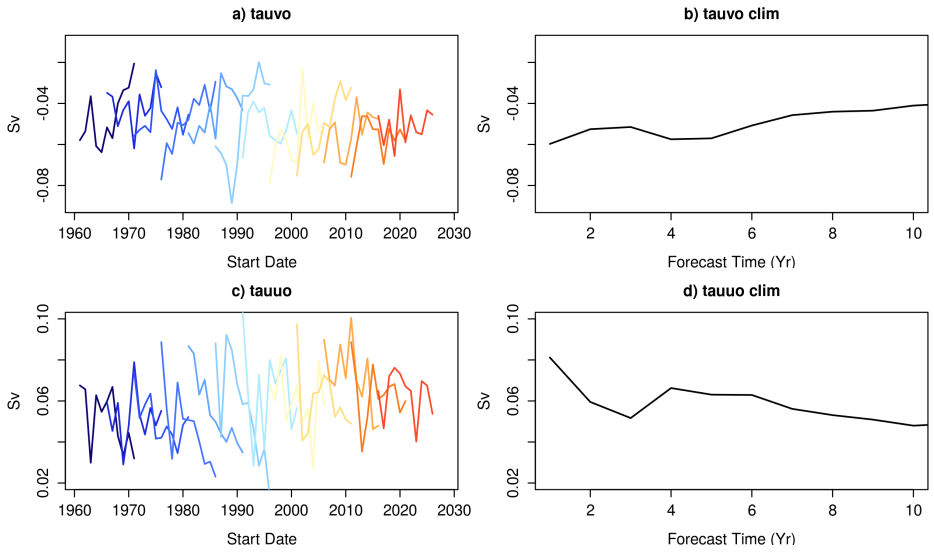

Fig. 1. Evolution of the FMA Windstress in the Labrador Sea in PRED for a) the meridional direction and b) zonal direction.