

Reply on RC2

The article “Seamless climate information for the next months to multiple years: merging of seasonal and decadal predictions, and their comparison to multi-annual predictions” by Delgado-Torres and co-authors presents a new approach to combining different climate datasets in an efficient yet scientifically sound way. The topic itself is not new, but the way the authors describe it is quite convincing to me and could provide a good opportunity for climate services. I mainly have minor technical comments.

We sincerely thank the reviewer for the constructive feedback and valuable suggestions. We address each comment in detail below, providing point-by-point responses.

Title: I have no particular concerns about the title. However, the term “merging” is only used in the title, introduction, and conclusion, while elsewhere the key term is “constrained method/dataset.” It might be worth considering a rephrasing for consistency.

Thank you for the comment. This issue was also raised by the other reviewer, and we agree that using consistent terminology improves clarity. We will therefore change the title to:

“Seamless climate information from months to multiple years: constraining decadal predictions with seasonal predictions and past observations, and their comparison to multi-annual predictions.”

For consistency, we will also review the rest of the manuscript where “temporal merging” is mentioned, replacing it with “constraining”.

Data: For seasonal prediction, only one forecast system has been used. Since seasonal predictions play an important role in the constraining, it should be discussed whether the results still hold when using a multi-model system or a different forecast system.

We thank the reviewer for the comment. Indeed, our (seasonal-based) constraining approach is based on the ECMWF SEAS5 system, chosen for its relatively long hindcast period (with retrospective predictions available from 1981) and its well-documented skill in ENSO prediction (e.g. Johnson et al., 2019, <https://doi.org/10.5194/gmd-12-1087-2019>). Other C3S seasonal systems have often shorter hindcast periods in common archives (e.g. predictions available from 1993 in the Copernicus Climate Data Store), which would considerably reduce the evaluation period and, consequently, the robustness of the validation. Nevertheless, since the constraining methodology is model-independent, similar results are expected when using other skilful seasonal prediction systems or multi-model ensembles that adequately capture ENSO variability. Future studies could further assess the robustness of the methodology by applying it based on other seasonal forecast systems or multi-model ensembles. Therefore, we will add the following paragraph to the last section of the manuscript (Summary and Conclusions):

“This study used seasonal predictions from the SEAS5 system due to its relatively long hindcast period (with retrospective predictions from 1981 onwards) and its strong performance in ENSO forecasts (Johnson et al., 2019). Nevertheless, similar results would be expected when using other skilful seasonal systems or multi-model ensembles to perform the member selection. Therefore, future work could explore constraining methods that incorporate additional seasonal systems, as well as consider multiple variables simultaneously, potentially further improving the quality of seamless predictions.”

Method section: This section is somewhat difficult to read due to the large number of numerical values and coordinates given in the text. As not everything should be moved to the supplements would it be possible to summarize it in a table (e.g., listing the regions) within the text?

Thank you for the comment. We agree that the clarity of the section can be improved. We will summarise the constraining options in a new Table 1 (please find it below), to be added in the Method section. In addition, we will remove the coordinates of the constraining region boxes from the main text and point to Figure S2, where these regions and their coordinates are displayed and described.

Table 1. Summary of constraints applied in this study. The definition of the constraining regions can be found in Figure S2.

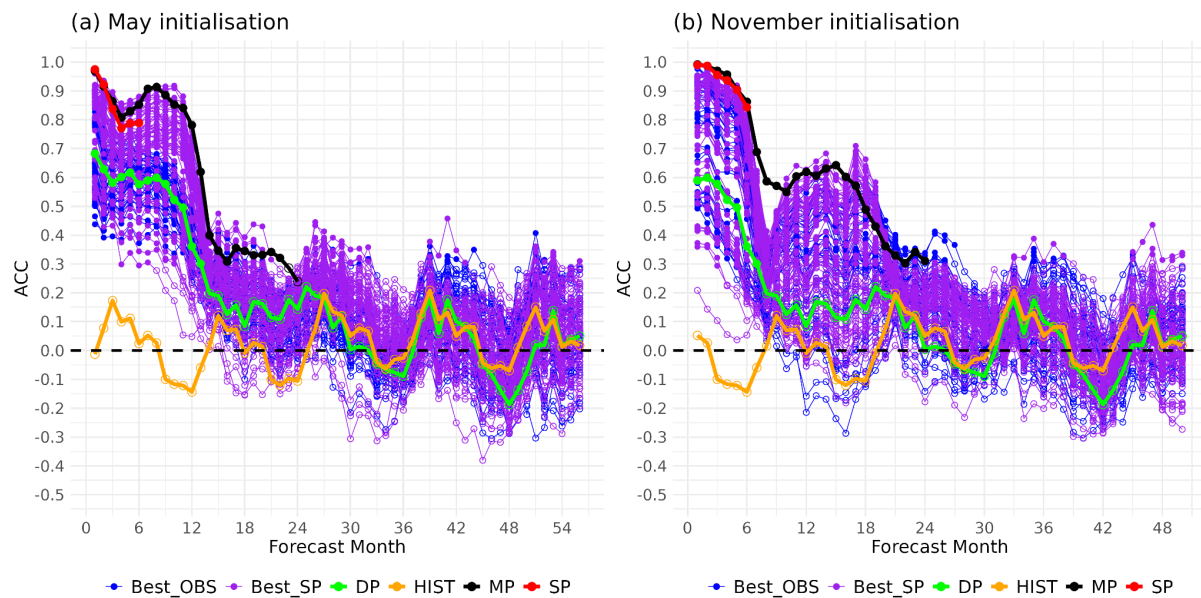
Parameter	Options
Constraining variable	TAS, PR
Constraining indices	Niño3.4, NAO
Constraining regions	Global, Global without the poles, Atlantic and Pacific Oceans, Pacific Ocean, North Atlantic Ocean (definition in Figure S2).
Constraining metric (variable-based)	Spatial correlation, center-RMSE, uncenter-RMSE
Constraining metric (index-based)	Mean absolute error
Constraining period (OBS-based)	Previous 1, 1-2, 1-3, 1-4 months
Constraining period (SP-based)	Forecast month 1, 1-2, 1-3, 1-4, 1-5, 1-6
Selection type	OBS-based, SP-based
Selectable ensemble	DCPP, HIST, DCPP+HIST

Results and Discussion: The main focus here is on Figures 1 and S4. The blue, purple, and even the red lines are hard to distinguish. Please consider choosing a better color scale, especially for the purple lines—perhaps grey? Figure 7 seems to have been prepared with a

different graphic tool, which gives it a clearer look, although the bright green line is again suboptimal.

Thank you very much for your suggestions to improve the clarity of the figures. Reviewer 1 also noted visibility issues (for example, the brown HIST line) which we will change to orange for better contrast.

We tested changing the purple lines to grey, but they were not very visible, and if made darker, they became too similar to the black MP line. After testing different options, we propose the following adjustments to enhance visibility: (1) increase the linewidth of the unconstrained SP, MP, DP, and HIST lines, and (2) decrease the linewidth of the constrained Best_OBS and Best_SP lines. The revised Figure 1 reflecting these changes is included below. We remain happy to further adjust the figures if the reviewers find them still unclear.



Regarding the figure preparation, all figures were produced using the ggplot2 R package, except for the maps, which were prepared using the s2dv R package.