Answer to Editor

Answer to Referee #3, Review #1

We thank the reviewer for the positive and thoughtful review. Detailed point by point responses are given below, with reviewers´ comments in black and answers of the authors in blue. Line numbers refer to the article document with tracked changes

Review #1:

In this article, the authors build on their previous work to identify of predictors for constraining future anthropogenic carbon uptake in the North Atlantic ocean in CIMP6 models. They propose and evaluate a novel application of a genetic method to regionally-optimize two previously identified "emergent constraints": the winter pCO_2 anomaly and the fraction of anthropogenic carbon stored below 1000 m. The genetic algorithm pointed out to a region of higher sensitivity of the future carbon uptake to the two predictors around the Gulf Stream, suggesting a dynamic control of the low-latitude AMOC on carbon uptake. The article is both of methodological and scientific value and, similar to the other reviewers, I could not identify any significant flaw in the science. The authors also re-worked the manuscript thoroughly following the advice of the previous reviewers. My only criticism is that the manuscript is a bit densely written (such that the focus is a bit lost sometimes – although the authors have made a significant effort to guide the reader in the revised version) and there are some repetitive bits, e.g. sections 3.2.1 and 3.3.1. I leave to the discretion of the authors whether they want to consider some re-structuring/simplification, which may improve the reading, but I don't see this as a real obstacle for accepting the article. Other than that, I came across some potential minor issues (note that line numbers refer to the Tracked Changes article document).

Answer 1: We would like to thank the reviewer for his/her thoughtful and positive evaluation of our revised manuscript. Based on her/his comments, we have tried to remove repetitive bits and to simplify or extend our text when fitting (especially in Lines 103-105, Lines 109-111, Lines 117-120, Lines 128-133, Lines 416-426, Lines 485-494, Lines 566-573).

- Line 150: "defined as an average over years 2090-2090s". Don't think this is correct.
  Answer 2: Indeed, this has been a mistake. We corrected this to "defined as an average over the years 2090 to 2099" (Line 136).

- Line 159. Not sure about the meaning of "partly" here
  Answer 3: We have removed the word "partly" to not confuse the reader (Line 146).

- Line 168. "… and biological production ARE not in phase"
  Answer 4: We have corrected this accordingly (Line 155).

- Line 384. I would use spuriously instead of randomly here.
  Answer 5: We have corrected this (Line 353-354).

- Similarly, I am not convinced of the used of phrase "by chance" (L. 395 and 533). I don't think such high and consistent correlations can emerge purely by chance, instead they could emerge from misrepresentations of processes in the model, as you mention elsewhere.
  Answer 6: We have corrected this (Lines 361 and 500).

- Lines 643-645. Something wrong with the brackets in this sentence?
  Answer 7: Our "tracked changes"-document did use a line-break at the incorrect place such that line 643 cut the words "linearity assumption)" off, including the closing bracket. This is corrected now (Lines 489-490).

- Line 700. Should it be "better-performing" instead of "well-performing"?
  Answer 8: We have corrected this to "better-performing" (Line 640).