

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2022-152

Anonymous Referee #2

Referee comment on "The emergence of the Gulf Stream and interior western boundary as key regions to constrain the future North Atlantic carbon uptake" by Nadine Goris et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-152-RC2>, 2022

I'm surprised to see this paper in review for GMD as it does not obviously meet any of the journal's manuscript types. It seems like the direct utility of this work is thinking about how to guide observational strategies to constrain N. Atlantic carbon uptake. This is however a call for the editor.

Major comments.

I find the manuscript comes across a bit as a dump of all the work the authors have done in this area, and as such, I feel it would benefit from some curating. The manuscript seems to be doing all of the following:

1. Identifying specific regions where people should be making observations to constrain future N. Atlantic CO₂ uptake (and in doing so they refine existing published emergent constraints slightly).
2. Exploring how a genetic algorithm can be used to select the optimum area of observational sampling to constrain models.
3. Expanding on the mechanisms behind the emergent constraints that the authors have previously put forward.
4. Better understand which key processes are leading to uncertainty in projections of future N. Atlantic CO₂ uptake (which links quite closely to 3).

As it is written it is doing 1, suggesting that it is doing 2, and doing a bit of 3 and 4 around the edges. The editor will be able to provide guidance on which of these a GMD paper should be doing, but I would argue that 2, 3 or 4 done fully would make the most useful papers, while 1 is useful for a very specific audience. As it stands 2, 3 and 4 are the less developed parts of this manuscript. Perhaps it is OK to do all of these things, but if that is what is done, a much clearer structure needs to be imposed on the manuscript and introduction of what is being done and why, so that the reader knows what information they should be getting from each section, and can efficiently take what they need from it. My preference would be to be clear about what the manuscript is trying to achieve and focus the manuscript on that, bringing in the other bits perhaps only as part of the discussion.

Fundamentally I can't see any mistakes beyond that raised by the other reviewer. I would echo the other reviewer's comments about it being difficult to interpret some of the figures, and would add that the manuscript would benefit from some careful editing for readability.

Minor comments:

- Just a comment - I'm pleased to see the desire for mechanisms in emergent constraints!
- The title does not make sense. "Gulf Stream and interior western boundary volume transport as key regions to constrain the future North Atlantic Carbon Uptake" Should it perhaps read "Gulf Stream and interior western boundary as key regions to constrain the future North Atlantic Carbon Uptake"?
- It seems to me that the 'competition' described in section 2 might benefit from a more detailed diagram than Fig 2.
- Line 27 refer --> referred
- Line 37 "Despite many progresses" --> "Despite much progress"
- Line 37: 'have not necessarily' – be specific have they or haven't they, or in what areas have they.
- 72: "could highly gain from" --> "could gain from"
- Line 214: "we advice against" --> "we advise against"
- Line 487 aver should be over