

Response to Editor Gabriele Messori

Thank you for having addressed the previous round of Reviewer comments. Please address the additional minor comments provided by the Reviewer before I make a final decision on your submission.

Authors' response:

We thank the Editor for the opportunity to address the additional comments from Referee #3. In the new manuscript we have clarified the reasons behind our choice of the analysis regions, and added four additional references (Dong and Kelly, 2004; Parfitt and Czaja, 2016; Vries et al., 2019; Comunian et al., 2025) to previous works that have chosen very similar locations for their analysis of the Gulf Stream. We have also corrected the errors in the labels of Figs. B15 and B16.

We hope that this version of the manuscript will be considered suitable for publication.

Sincerely yours,

Juan Gancio on behalf of all the authors

Response to Anonymous Referee #3

The authors have satisfactorily addressed most of the referees' questions and comments; however, a few minor issues remain, as outlined. The first issue concerned the choices of regions. Firstly, limiting the domain to a given latitude-longitude box is subjective, and may incur the risk of the box boundaries cutting through important teleconnection pathways potentially useful to the classification of 1) events and their impacts and 2) where real process driven or spurious changes occur. Secondly and often without being explicitly stated, reducing the domain is tantamount to infer a priori that the geophysical processes under consideration within it are the most important drivers of interactions with or center of actions for the rest of the climate system outside the initially chosen domain. These choices are at time problematic. Clearly, the authors choices were driven by convention for 1) the ENSO Nino-3.4 region, but 2) a less obvious justification for the Gulf stream region. In view of the previous comments, they authors should add a caveat to their work and justify their choices based on previous work which is plentiful for this part of the globe.

The subplots label of figure B15 top row and figure B16 bottom row needs to be changed to El Nino and Gulf Stream, respectively.

As a final comment, changing the location and extent of the selected regions could have added to the work and informed the community on the both the robustness of the method and results regarding the potentially spurious (methodologically or driven by the addition of new observational platforms) or real regime shifts detected.

Authors' response:

We thank the referee for the useful comments and suggestions. We selected the Niño 3.4 region because this region is used to define the ENSO events and captures the ocean-atmosphere interaction phenomena that characterize them. Regarding the Gulf Stream region, it was selected as a compromise to consider the Gulf Stream geographically, while also being the area with the strongest and relatively zonal currents. We have modified the manuscript to clarify these points. Additionally, we have included four new references to previous works that analyzed very similar areas in the Gulf Stream region.

We also thank the referee for pointing out the errors in the labels of Figs. B15 and B16. They have been corrected.

Regarding the final comment, indeed the studies suggested by the reviewer are of real interest, as there are many relevant areas to analyze, and it would be a natural continuation of the present work.

Moreover, we hope that our findings will motivate other research groups to use our method to characterise complex spatio-temporal climatological data.

We remark that our method is not only useful to uncover change points (that can be due to changes in the climate, or in the observation systems or in the modelling and data assimilation methodologies) but also, our method is useful to uncover long-term trends and it can be used to compare different climate datasets.