Nonlinear Processes
in Geophysics
Discussions

[NPGD]

Interactive
comment

Interactive comment on "Seasonal statistical-dynamical prediction of the North Atlantic Oscillation by probabilistic post-processing" *by* André Düsterhus

Anonymous Referee #2

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1 General Comments

In the study 'Seasonal statistical-dynamical prediction of the North Atlantic Oscillation by probabilistic post-processing' André Düsterhus proposes an approach for seasonal NAO prediction. This approach combines seasonal predictions of the MPI-ESM model with a statistical model based on meteorological fields as predictors. Here, for each ensemble member of the dynamical model a pdf is generated via bootstrapping. These single pdfs are merged to one pdf for all ensemble members via mixture modeling. The same procedure was applied to the statistical model, where each predictor of the statistical model was treated as one ensemble member. Subsequently the combined

model was constructed by multiplying the derived pdfs of the dynamical and the statistical model. In this study the author investigates the predictive performance of the combined model also w.r.t. to its single components, the dynamical model and the statistical model. For this purpose the anomaly correlation coefficient (ACC) and the Earth Mover's Distance (EMD) were applied. It can be shown that the performance of the combined model is superior to the dynamical model. On the other hand, an improvement w.r.t. the statistical model is not that clear. An analysis of the surface temperature, precipitation and geopotential height field shows significant skill of the combined model w.r.t. to ACC for many regions over Europa and North Atlantic. Moreover the combined model again outperforms the dynamical model but not the statistical model.

The general idea of the paper is interesting and the given approach is straight forward and certainly viable. This paper is well structured and written in a comprehensible language. The conlusions regarding the performance of the proposed statistical-dynamical prediction are justified by the results shown.

2 Specific Comments

2.1 Title

I would encourage you to reconsider the title, since I have the impression that a major part of the study is also about EMD-score and its benefits over the ACC.

2.2 Introduction

lines 36-38: In my opinion a short motivation is missing why you are also investigating other meteorological variables. For me, a link to the NAO-prediction and its evaluation

is missing within the introduction.

For a reader, who is not that familiar with subsampling it is hard to distinguish your work from the work of Dobrynin et al. (2018). So, I think that your introduction would benefit from a few sentences where you emphasize this aspect.

2.3 Data and Model

Maybe, one sentence about the used observational/reanalysis data would be helpful.

2.4 Methodology

lines 70-71: Please add some more details how the statistical model for the WNAO was constructed. Did you applied a linear regression model?
Moreover, please clarify whether you have applied a cross-validation. This is a very important aspect in the discussion about the prediction skill of the statistical model.
line 79: How is the pdf of the observations in Fig. 4 generated? Did you also applied a bootstrapping. Please clarify.
Eq. 3: What is N? I assume the number of time steps? Please use an other running index to avoid confusion with the ensemble number.
lines 107-108: What is the motivation for showing the relative positioning of the EMD-score? Isn't it also possible to show the relative positioning of the CRPS(S)? Did you calculate the EMD-score over every year as implied in Eqs. 3-4 or did you calculate the score for every year individually and derive the relative positioning afterwards? I assume the latter is valid but a more detailed description would prevent misunderstandings.

2.5   Results

lines 125-127: I don't understand that sentence. Do you mean that for years, where the combined prediction is not the best performing the model prediction performs best?
Figure 5 shows rather that the predictor predictions superior for such years...

2.6   Discussion and Conclusion

lines 182-184: Do you have any idea, why, on the one hand, the combined model is at first place almost as often as the statistical Model, but on the other hand is much more often at the second place? Is it possible, that the statistical model may not capture certain special cases, which are then taken into account by the dynamical model? Maybe an investigation of the corresponding years would certainly be very revealing.

3   Technical Corrections

line 17: the NAO describe → the NAO describes
line 19: (Hurrell (1995)) → (Hurrell, 1995)
line 21: (Folland et al. (2019)) → (Folland et al., 2019)
line 22: (Butler et al. (2016)) → (Butler et al., 2016)
line 32: sub-sampling → subsampling
line 85: (Rubner et al. (2001)) → (Rubner et al., 2001)
line 86: (Düsterhus and Hense (2012)) → (Düsterhus and Hense, 2012)
line 123: both other prediction → both other predictions

line 150: inflence → influence
line 170: three prediction → three predictions
line 200: (Thorarinsdottir et al. (2003)) → (Thorarinsdottir et al., 2003)
line 201: the approach allow → the approach allows
line 206: disadvantage ist → disadvantage is

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