

## New approaches for skillful prediction of winter North Atlantic Oscillation based on the coupled dynamical climate models

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The winter North Atlantic oscillation (NAO), is a crucial part of our understanding of Eurasian and Atlantic climate variability and predictability. In this study, we developed effective prediction schemes based on the interannual increment prediction method and verified their performance based on the climate hindcasts of the coupled ocean-atmosphere climate models (DEMENTER, ENSEMBLES, CFSV2). This approach utilizes the year-to-year increment of a variable (i.e. a difference in a variable between the current year and the previous year, e.g. DY of a variable) as the predictand rather than the anomaly of the variable. The results demonstrate that the new schemes can generally improve prediction skill of the winter NAO compared to the raw coupled model's output. Also, the new schemes show higher skill in prediction of abnormal NAO cases than the climatological prediction. Scheme-I uses just the NAO in the form of year-to-year increments as a predictor that is derived from the direct outputs of the models. Scheme-II is a hybrid prediction model that contains two predictors: the NAO derived from the coupled models, and the observed preceding autumn Atlantic sea surface temperature in the form of year-to-year increments. Scheme-II shows an even better prediction skill of the winter NAO than Scheme-I.

Key words: winter North Atlantic Oscillation prediction, coupled dynamic model, year-to-year increment

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