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Supplement of

Flow dependence of wintertime subseasonal prediction skill over Europe

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Discussion on weather regime persistence and recurrence conditioned to their initial intensity

We have computed the mean duration (in days) of weather regime sequences of at least 3 days in the forecasts and the observations (Table S1). The NAO- regime results to be the most persistent, followed by NAO+, and persistence times for each weather regime are on average correctly captured by models.

	CNRM	ECMWF	ERA5
NAO+	6.1	6.1	6.1
BLO	5.5	5.7	5.7
NAO-	7.5	7.4	7.3
AR	4.9	4.9	4.9

Table S1: mean persistence time (in days) for weather regime sequences of 3 days minimum

Figure S1 reproduces the figure 6 of the manuscript after subsampling the forecasts with the top 25% of strong NAO+ (top row) or NAO- (bottom row) initializations

We do find that these forecasts show an increased proportion of NAO- (NAO+ to a lesser extent) at week 3, which may indicate that the persistence of these regimes is related to their initial intensity. However, it could also be that a strong positive (negative) NAO in initial conditions lead to more frequent occurrences of positive (negative) NAO sequences during the forecast.

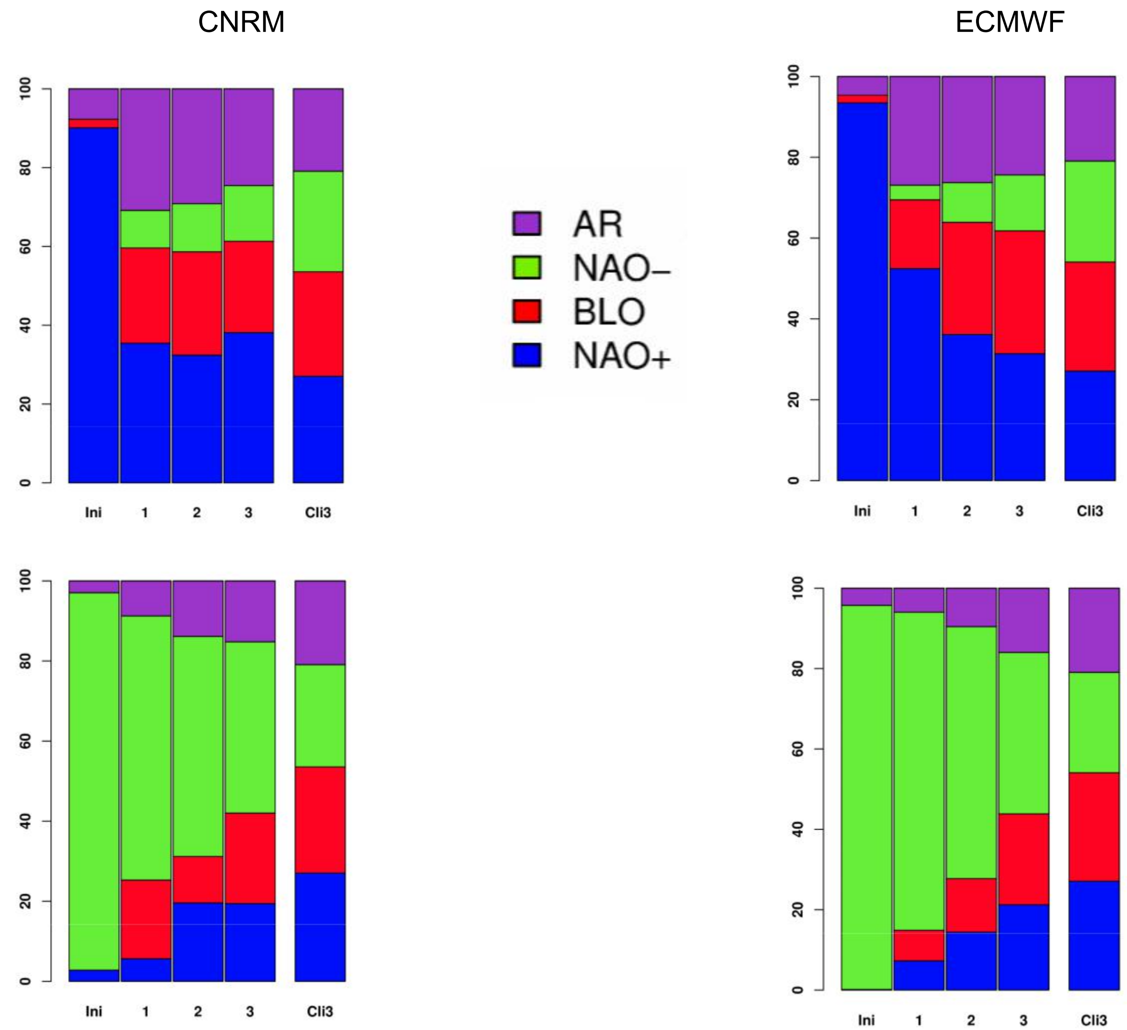

Figure S1: same as figure 6 after subsampling forecasts with the top 25% of strong NAO+ (top row) or NAO- (bottom row) initializations.

In order to verify this, we have analyzed for each model the relationship between this number of occurrences and the mean persistence among the forecasts initiated in NAO conditions

The scatterplots of figure S2 show for each forecast initiated in NAO- (NAO+) the number of occurrences of NAO- (NAO+) sequences of at least 3 consecutive days, as a function of the mean duration of these sequences. The red dots correspond to the 25% of these forecasts with the highest initial NAO intensity.

For both models, the NAO- probability density function has a more elongated shape than the NAO+ counterpart, which is consistent with the overall higher persistence of the NAO- regime. It appears that forecasts with intense NAO- initial conditions (red dots) are overrepresented in the rightmost part of the distribution, thereby confirming to some extent the link between initial intensity and persistence of the NAO- weather regime. It is not the case for NAO+, although, for ECMWF, many red dots are located on the upper part of the probability density function, meaning that intense initial NAO+ could translate into more frequent occurrences of NAO+ sequences during subsequent weeks. There is no strong evidence for this conclusion given that it does not show in CNRM.

Finally, these additional analyses elucidate only marginally the link between NAO intensity and persistence or recurrence of the NAO weather regimes. An intense NAO- can lead to increased persistence of this weather regime, which probably depends on the interaction with other drivers, such as the stratosphere, or tropical teleconnections. On the other hand, the NAO+ case is still unclear, potentially due to the lack of specificity of this weather regime when defined by k-means clustering with k=4 (see discussion in the Conclusion section).

CNRM ECMWF

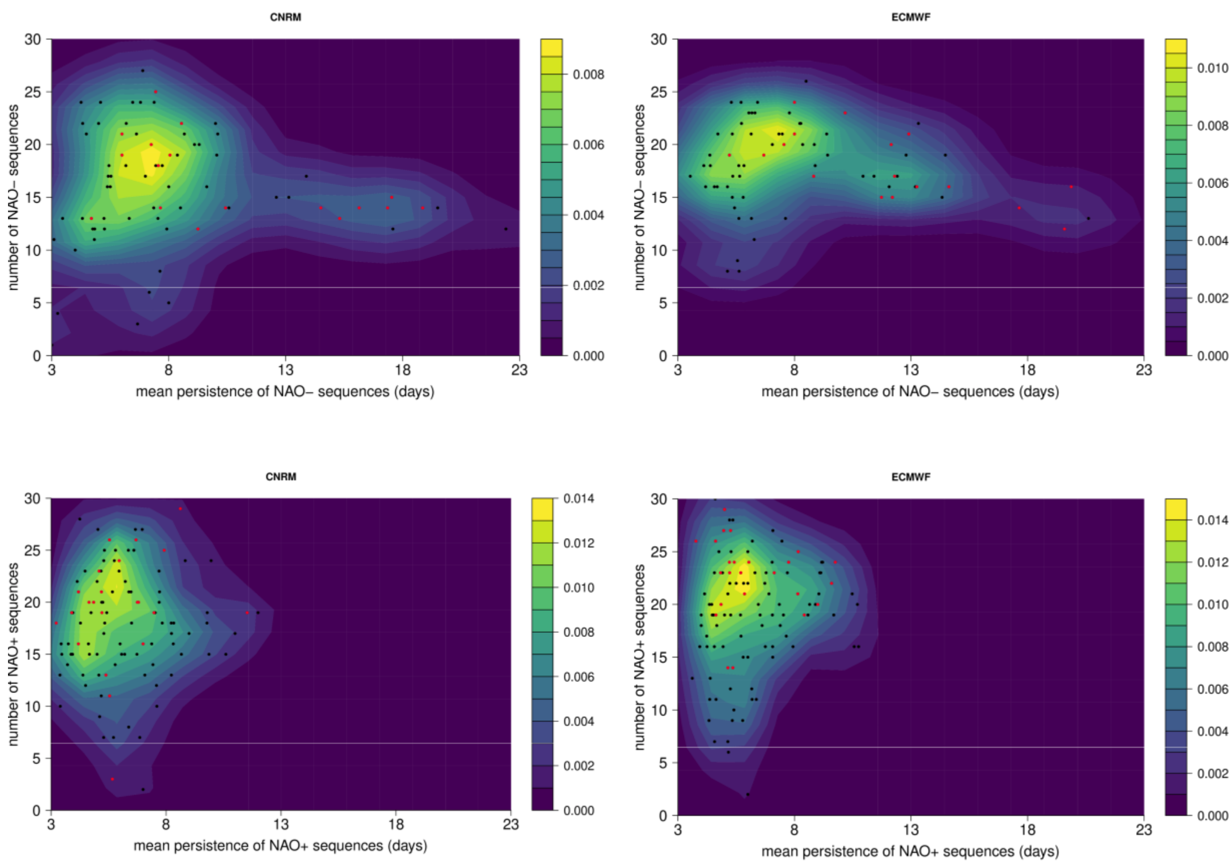

Figure S2: Scatter plot (dots) and associated probability density function (shading) of forecasts initiated in NAO- (top row) and NAO+ (bottom row). The y-axis indicates the number of 3-day or more NAO- (resp. NAO+) sequences in all the ensemble members and the x-axis the mean persistence of these sequences, in days. Red dots mark those forecasts initiated in strong NAO- (resp. NAO+) conditions.